“Code Biology Database – A List of Biological Codes”

Compiled and updated by

Robert Prinz

Rechenkraft.net e.V., Marburg, Germany

rp@rechenkraft.net

https://www.codebiology.org

Number	Code Name	Descriptive Name(s)	Full Citation(s), Hyperlinked to Source
1	14-3-3 code	The 14-3-3 Protein (Phosphorylation Code) **SEE also Phosphorylation Code**	Winter, S., Simboeck, E., Fischle, W., Zupkovitz, G., Dohnal, I., Mechtler, K., . . . Seiser, C. (2008). 14-3-3 Proteins recognize a histone code at histone H3 and are required for transcriptional activation. Embo j, 27(1), 88-99.
2	Acoustic code	The Acoustic Codes	Farina, A. and N. Pieretti (2014). "Acoustic Codes in Action in a Soundscape Context." Biosemiotics 7(2): 321-328. Malavasi, R., K. Kull and A. Farina (2014). "The Acoustic Codes: How Animal Sign Processes Create Sound-Topes and Consortia via Conflict Avoidance." Biosemiotics 7(1): 89-95. Curé, C., N. Mathevon and T. Aubin (2016). "Mate vocal recognition in the Scopoli's shearwater Calonectris diomedea: do females and males share the same acoustic code?" Behav Processes 128: 96-102. Farina, A. (2018). "Ecoacoustic codes and ecological complexity." Biosystems 164: 147-154. Farina, A. (2019). "Acoustic codes from a rural sanctuary: How ecoacoustic events operate across a landscape scale." Biosystems 183: 103986. Farina, A., & Villa, A. E. P. (2023). On the semantics of ecoacoustic codes. Biosystems, 232, 105002.
3	Actin code	The Actin Code **SEE also Cytoskeleton Code**	Vedula, P. and A. Kashina (2018). "The makings of the 'actin code': regulation of actin's biological function at the amino acid and nucleotide level." J Cell Sci 131(9). A, M., Latario, C. J., Pickrell, L. E., & Higgs, H. N. (2020). Lysine acetylation of cytoskeletal proteins: Emergence of an actin code. Journal of Cell Biology, 219(12).
4	Adenylation code	The Adenylation Code	Stachelhaus, T., H. D. Mootz and M. A. Marahiel (1999). "The specificity-conferring code of adenylation domains in nonribosomal peptide synthetases." Chem Biol 6(8): 493-505. Davis, R. and Y. Shi (2014). "The polyadenylation code: a unified model for the regulation of mRNA alternative polyadenylation." J Zhejiang UnivSci B 15(5): 429-437. Zhang, F., Y. Wang, Q. Jiang, Q. Chen, L. Karthik, Y.-L. Zhao and Z. Li (2018). "Substrate selection of adenylation domains for nonribosomal peptide synthetase (NRPS) in bacillamide C biosynthesis by marine Bacillus atrophaeus C89." Journal of Industrial Microbiology & Biotechnology 45(5): 335-344.

5	Adhesion code	The Adhesion Code **SEE also Synaptic code(s)** **SEE also Cadherin code(s)**	Bedzhov, I., Alotaibi, H., Basilicata, M. F., Ahlborn, K., Liszewska, E., Brabletz, T., & Stemmler, M. P. (2013). Adhesion, but not a specific cadherin code, is indispensable for ES cell and induced pluripotency. Stem Cell Research, 11(3), 1250-1263. Faria, M. (2018). "Aggregating, polarizing, networking – The evolution of cell adhesion codes." Biosystems 164: 60-67. Tsai, T. Y., M. Sikora, P. Xia, T. Colak-Champollion, H. Knaut, C. P. Heisenberg and S. G. Megason (2020). "An adhesion code ensures robust pattern formation during tissue morphogenesis." Science 370(6512): 113-116. Ferreira-Pinto, M., Aguilar-Aragón, M., Rhiner, C., & Moreno, E. (2026). Hbs and Rst adhesion molecules provide a regional code that regulates cell elimination during epithelial remodeling. iScience, 29(3). Ko, J. (2026). A decade of discovery: Deciphering the synaptic adhesion code. Mol Cells, 49(5), 100341.
6	Allosteric code -A (hemoglobin)	The Allosteric Code Hemoglobin	Ackers, G. K., Doyle, M. L., Myers, D., & Daugherty, M. A. (1992). Molecular Code for Cooperativity in Hemoglobin. Science, 255(5040), 54-63. Edelstein, S. J. (1996). "An allosteric theory for hemoglobin incorporating asymmetric states to test the putative molecular code for cooperativity." J Mol Biol 257(4): 737-744. Ackers, G. K. (1998). Deciphering the Molecular Code of Hemoglobin Allostery. In E. Di Cera (Ed.), Advances in Protein Chemistry (Vol. 51, pp. 185-253). Academic Press. Daugherty, M. A., M. A. Shea, J. A. Johnson, V. J. LiCata, G. J. Turner and G. K. Ackers (1991). "Identification of the intermediate allosteric species in human hemoglobin reveals a molecular code for cooperative switching." Proc Natl Acad Sci U S A 88(4): 1110-1114. Goldbeck, R. A., Esquerra, R. M., Holt, J. M., Ackers, G. K., & Kliger, D. S. (2004). The molecular code for hemoglobin allostery revealed by linking the thermodynamics and kinetics of quaternary structural change. 1. Microstate linear free energy relations. Biochemistry, 43(38), 12048-12064. Goldbeck, R. A., R. M. Esquerra, D. S. Kliger, J. M. Holt and G. K. Ackers (2004). "The molecular code for hemoglobin allostery revealed by linking the thermodynamics and kinetics of quaternary structural change. 2. Cooperative free energies of (alphaFeCObetaFe)2 and (alphaFebetaFeCO)2 T-state tetramers." Biochemistry 43(38): 12065-12080.

7	Allosteric code -B (miscellaneous)	The Allosteric Code Miscellaneous	Armour-Garb, I., I. S. M. Han, B. S. Cowan and K. M. Thayer (2022). "Variable Regions of p53 Isoforms Allosterically Hard Code DNA Interaction." J Phys Chem B.
8	Alzheimer´s code	The Alzheimer´s Disease Code	Fan, F., Zhao, N., & Guo, M. (2026). Lymphatic–venous anastomosis: Cracking the code of Alzheimer's disease treatment? Neural Regen Res, 21(6).
9	Angiotensin code	The Angiotensin Receptor Code	Sadybekov, A. and V. Katritch (2020). "Breaking the Enigma Code of Angiotensin II Type 2 Receptor Signaling." Structure 28(4): 390-392.
10	Annexin code	The Annexin Codes	Kietselaer, B. L., Narula, J., & Hofstra, L. (2007). The Annexin code: revealing endocarditis. Eur Heart J, 28(8), 948. Ganesan, T., Sinniah, A., Ramasamy, T. S., & Alshawsh, M. A. (2024). Cracking the code of Annexin A1-mediated chemoresistance. Biochem Biophys Res Commun, 725, 150202.
11	Antibiotic resistance code	The Antibiotic Resistance Codes	Lo, S. W., N. Kumar and N. E. Wheeler (2018). "Breaking the code of antibiotic resistance." Nat Rev Microbiol 16(5): 262. Al Fadhli, A. H., Mouftah, S. F., Jamal, W. Y., Rotimi, V. O., & Ghazawi, A. (2023). Cracking the Code: Unveiling the Diversity of Carbapenem-Resistant Klebsiella pneumoniae Clones in the Arabian Peninsula through Genomic Surveillance. Antibiotics, 12(7), 1081.
12	Anticancer code	The Anticancer Codes	Pei, Z., Zhou, W., Zhong, M., Xi, R., Li, F., & Li, H. (2025). Unlocking the anticancer code of gambogic acid: Multidimensional strategies to overcome tumor treatment challenges. Computers in Biology and Medicine, 197, 111044.
13	Antigen code	The Antigen Codes **SEE also Immune code**	Krasilnikov, I., Lehnherr-Ilyina, T., Djonovic, M., Artamonova, I., Nikitin, M., & Kislichkin, N. (2024). Cracking the antigenic code of mycobacteria: CFP-10/ESAT-6 tuberculosis skin test and misleading results. Journal of Clinical Tuberculosis and Other Mycobacterial Diseases, 36, 100436.
14	Apoptosis code	The Apoptosis Code	Basañez, G. and J. M. Hardwick (2008). "Unravelling the bcl-2 apoptosis code with a simple model system." PLoSBiol 6(6): e154. Füllgrabe, J., N. Hajji and B. Joseph (2010). "Cracking the death code: apoptosis-related histone modifications." Cell Death Differ 17(8): 1238-1243. Biermann, M., C. Maueröder, J. M. Brauner, R. Chaurio, C. Janko, M. Herrmann and L. E. Muñoz (2013). "Surface code--biophysical signals for apoptotic cell clearance." Phys Biol 10(6): 065007.

			Shih, H. C., M. El-Shazly, Y. S. Juan, C. Y. Chang, J. H. Su, Y. C. Chen, S. P. Shih, H. M. Chen, Y. C. Wu and M. C. Lu (2014). "Cracking the cytotoxicity code: apoptotic induction of 10-acetylirciformonin B is mediated through ROS generation and mitochondrial dysfunction." Mar Drugs 12(5): 3072-3090. Wook Choi, D. and C. Yong Choi (2014). "HIPK2 modification code for cell death and survival." Mol Cell Oncol 1(2): e955999. Cavallaro, S. (2015). Cracking the code of neuronal apoptosis and survival. Cell Death Dis, 6(11), e1963-e1963. Jiang, S., Y. Liu, B. Xu, Y. Zhang and M. Yang (2020). "Noncoding RNAs: New regulatory code in chondrocyte apoptosis and autophagy." Wiley Interdiscip Rev RNA 11(4): e1584. Rothlin, C. V. and S. Ghosh (2020). "Cracking the Cell Death Code." Cold Spring Harb Perspect Biol 12(5).
15	Archetype codes	The Archetype Codes	Bemowski, Karen (1995) Codes, cultural archetypes, and the collective cultural unconscious. Quality Progress; Milwaukee Vol 28, Issue 1, p33. Major, J. C. (2021). "Archetypes and code biology." Biosystems 208: 104501. Major, J. C. (2025). From code to archetype: Toward a unified theory of biological, neural, and artificial artifacts. Biosystems, 254, 105516. Major, João Carlos, (2025) Jung 4.0 - The Code Architecture of the Archetype: Reframing Analytical Psychology through Code Biology. Available at SSRN. Major, João Carlos, From Archetype-as-Code to the Code-Mediator-Artifact Framework: Empirical Extensions Across Biological, Neural, and Symbolic Systems (October 22, 2025). Available at SSRN. Sacco, Rob G., Marks-Tarlow, T., & Beitman, Bernard D. (2026). Archetypes as Codes: Jungian Psychology, Biological Organization, and the Fractal Logic of Synchronicity. International Journal of Jungian Studies, 1-21.
16	Area code	The Area / Cell Recognition Code	Hood, L., H. V. Huang and W. J. Dreyer (1977). "The area-code hypothesis: The immune system provides clues to understanding the genetic and molecular basis of cell recognition during development." Journal of Supramolecular Structure 7(3-4): 531-559. Springer, T. A. (1993). "Signals on endothelium for lymphocyte recirculation and leukocyte emigration: the area code paradigm." Harvey Lect 89: 53-103.

			Yoshihara, Y., & Mori, K. (1994). Telencephalin: a neuronal area code molecule? Neuroscience Research, 21(2), 119-124. Dreyer, W. J. (1998). "The area code hypothesis revisited: olfactory receptors and other related transmembrane receptors may function as the last digits in a cell surface code for assembling embryos." Proc Natl Acad Sci U S A 95(16): 9072-9077. Liu, C. Y. (2020). "β7 Gives Tregs a Gut Area Code." Cell Mol Gastroenterol Hepatol 9(3): 543-544.
17	Arrestin code	The Arrestin Receptor Code	Draper-Joyce, C. J. and A. Christopoulos (2018). "Strength in numbers-an arrestin interaction code." Nat Struct Mol Biol 25(6): 437-439.
18	Assembly code	The Assembly Code	Shelton, C. L., D. G. Conrady and A. B. Herr (2017). "Functional consequences of B-repeat sequence variation in the staphylococcal biofilm protein Aap: deciphering the assembly code." Biochem J 474(3): 427-443.
19	ATG8 code	The ATG8 Paralog Code	Choi, H., Lee, S. M., & Lee, J. A. (2026). Decoding the brain's ATG8 paralog code: LC3-GABARAP specialization at synapses and the astrocyte-neuron interface. Front Cell Dev Biol, 14, 1762891.
20	Auditory Code	The Auditory Codes	Middlebrooks, J. C. and E. I. Knudsen (1984). "A neural code for auditory space in the cat's superior colliculus." J Neurosci 4(10): 2621-2634. Schwarz, D. W. and R. W. Tomlinson (1987). "A complex tone code in the auditory cortex." J Otolaryngol 16(5): 316-321. Sterbing, S. J., U. Schmidt and R. Rübsamen (1994). "The postnatal development of frequency-place code and tuning characteristics in the auditory midbrain of the phyllostomid bat, Carollia perspicillata." Hear Res 76(1-2): 133-146. Thompson, V. A., & Paivio, A. (1994). Memory for pictures and sounds: independence of auditory and visual codes. Can J Exp Psychol, 48(3), 380-398. Schwarz, D. W., F. Tennigkeit, T. Adam, P. Finlayson and E. Puil (1998). "Membrane properties that shape the auditory code in three nuclei of the central nervous system." J Otolaryngol 27(6): 311-317. Lalwani, A. K. and C. M. Castelein (1999). "Cracking the auditory genetic code: nonsyndromic hereditary hearing impairment." Am J Otol 20(1): 115-132. March, L., A. Cienfuegos, L. Goldbloom, W. Ritter, N. Cowan and D. C. Javitt (1999). "Normal time course of auditory recognition in schizophrenia, despite impaired precision of the auditory sensory ("echoic") memory code." J Abnorm Psychol 108(1): 69-75.

			Kozloski, J. and J. D. Crawford (2000). "Transformations of an auditory temporal code in the medulla of a sound-producing fish." J Neurosci 20(6): 2400-2408. Tseng, C. J. and A. K. Lalwani (2000). "Cracking the auditory genetic code: part II. Syndromic hereditary hearing impairment." Am J Otol 21(3): 437-451. Bodnar, D. A., A. D. Holub, B. R. Land, J. Skovira and A. H. Bass (2001). "Temporal population code of concurrent vocal signals in the auditory midbrain." J Comp Physiol A Neuroethol Sens Neural Behav Physiol 187(11): 865-873. Juslin, P. N. and P. Laukka (2003). "Communication of emotions in vocal expression and music performance: different channels, same code?" Psychol Bull 129(5): 770-814. Polley, D. B., M. A. Heiser, D. T. Blake, C. E. Schreiner and M. M. Merzenich (2004). "Associative learning shapes the neural code for stimulus magnitude in primary auditory cortex." Proc Natl Acad Sci U S A 101(46): 16351-16356. Guttman, S. E., Gilroy, L. A., & Blake, R. (2005). Hearing What the Eyes See: Auditory Encoding of Visual Temporal Sequences. Psychological Science, 16(3), 228-235. Weisz, N., S. Müller, W. Schlee, K. Dohrmann, T. Hartmann and T. Elbert (2007). "The neural code of auditory phantom perception." J Neurosci 27(6): 1479-1484. Eyherabide, H. G., A. Rokem, A. V. Herz and I. Samengo (2008). "Burst firing is a neural code in an insect auditory system." Front Comput Neurosci 2: 3. Werner-Reiss, U. and J. M. Groh (2008). "A rate code for sound azimuth in monkey auditory cortex: implications for human neuroimaging studies." J Neurosci 28(14): 3747-3758. Salminen, N. H., P. J. May, P. Alku and H. Tiitinen (2009). "A population rate code of auditory space in the human cortex." PLoS One 4(10): e7600. Salminen, N. H., H. Tiitinen, S. Yrttiaho and P. J. May (2010). "The neural code for interaural time difference in human auditory cortex." J Acoust Soc Am 127(2): El60-65. Clemens, J., O. Kutzki, B. Ronacher, S. Schreiber and S. Wohlgemuth (2011). "Efficient transformation of an auditory population code in a small sensory system." Proc Natl Acad Sci U S A 108(33): 13812-13817. Chen, C., H. L. Read and M. A. Escabí (2012). "Precise feature based time scales and frequency decorrelation lead to a sparse auditory code." J Neurosci 32(25): 8454-8468.

			Escoffier, N., J. Zhong, A. Schirmer and A. Qiu (2013). "Emotional expressions in voice and music: same code, same effect?" Hum Brain Mapp 34(8): 1796-1810. Filippopoulos, P. C., P. Hallworth, S. Lee and J. H. Wearden (2013). "Interference between auditory and visual duration judgements suggests a common code for time." Psychol Res 77(6): 708-715. Henry, K. S. and M. G. Heinz (2013). "Effects of sensorineural hearing loss on temporal coding of narrowband and broadband signals in the auditory periphery." Hear Res 303: 39-47. Micheyl, C., P. R. Schrater and A. J. Oxenham (2013). "Auditory frequency and intensity discrimination explained using a cortical population rate code." PLoS Comput Biol 9(11): e1003336. Plakke, B., M. D. Diltz and L. M. Romanski (2013). "Coding of vocalizations by single neurons in ventrolateral prefrontal cortex." Hear Res 305: 135-143. Yovel, G. and P. Belin (2013). "A unified coding strategy for processing faces and voices." Trends Cogn Sci 17(6): 263-271. Dimitrov, A. G., G. I. Cummins, Z. M. Mayko and C. V. Portfors (2014). "Inhibition does not affect the timing code for vocalizations in the mouse auditory midbrain." Front Physiol 5: 140. Harper, N. S., B. H. Scott, M. N. Semple and D. McAlpine (2014). "The neural code for auditory space depends on sound frequency and head size in an optimal manner." PLoS One 9(11): e108154. Lee, J. and J. M. Groh (2014). "Different stimuli, different spatial codes: a visual map and an auditory rate code for oculomotor space in the primate superior colliculus." PLoS One 9(1): e85017. Mizrahi, A., A. Shalev and I. Nelken (2014). "Single neuron and population coding of natural sounds in auditory cortex." Curr Opin Neurobiol 24(1): 103-110. Plack, C. J., D. Barker and D. A. Hall (2014). "Pitch coding and pitch processing in the human brain." Hear Res 307: 53-64. Wang, Y., Y. Gutfreund and J. L. Peña (2014). "Coding space-time stimulus dynamics in auditory brain maps." Front Physiol 5: 135. Arnal, L. H., D. Poeppel and A. L. Giraud (2015). "Temporal coding in the auditory cortex." Handb Clin Neurol 129: 85-98. Hochmair, I., E. Hochmair, P. Nopp, M. Waller and C. Jolly (2015). "Deep electrode insertion and sound coding in cochlear implants." Hear Res 322: 14-23.

			Laback, B., K. Egger and P. Majdak (2015). "Perception and coding of interaural time differences with bilateral cochlear implants." Hear Res 322: 138-150. Malmierca, M. S., L. A. Anderson and F. M. Antunes (2015). "The cortical modulation of stimulus-specific adaptation in the auditory midbrain and thalamus: a potential neuronal correlate for predictive coding." Front Syst Neurosci 9: 19. Rudnicki, M., O. Schoppe, M. Isik, F. Völk and W. Hemmert (2015). "Modeling auditory coding: from sound to spikes." Cell Tissue Res 361(1): 159-175. Behroozmand, R., S. Sangtian, O. Korzyukov and C. R. Larson (2016). "A temporal predictive code for voice motor control: Evidence from ERP and behavioral responses to pitch-shifted auditory feedback." Brain Res 1636: 1-12. Vyssotski, A. L., A. E. Stepien, G. B. Keller and R. H. Hahnloser (2016). "A Neural Code That Is Isometric to Vocal Output and Correlates with Its Sensory Consequences." PLoS Biol 14(10): e2000317. Woolgar, A., J. Jackson and J. Duncan (2016). "Coding of Visual, Auditory, Rule, and Response Information in the Brain: 10 Years of Multivoxel Pattern Analysis." J Cogn Neurosci 28(10): 1433-1454. Beckert, M. V., R. Pavão and J. L. Peña (2017). "Distinct Correlation Structure Supporting a Rate-Code for Sound Localization in the Owl's Auditory Forebrain." eNeuro 4(3). Carbajal, G. V. and M. S. Malmierca (2018). "The Neuronal Basis of Predictive Coding Along the Auditory Pathway: From the Subcortical Roots to Cortical Deviance Detection." Trends Hear 22: 2331216518784822. Heilbron, M. and M. Chait (2018). "Great Expectations: Is there Evidence for Predictive Coding in Auditory Cortex?" Neuroscience 389: 54-73. Kuchibhotla, K. and B. Bathellier (2018). "Neural encoding of sensory and behavioral complexity in the auditory cortex." Curr Opin Neurobiol 52: 65-71. Navntoft, C. A. and V. Adenis (2018). "Does Auditory Cortex Code Temporal Information from Acoustic and Cochlear Implant Stimulation in a Similar Way?" J Neurosci 38(2): 260-262. Oxenham, A. J. (2018). "How We Hear: The Perception and Neural Coding of Sound." Annu Rev Psychol 69: 27-50.

			Wang, X. (2018). "Cortical Coding of Auditory Features." Annu Rev Neurosci 41: 527-552. Bouse, J., V. Vencovský, F. Rund and P. Marsalek (2019). "Functional rate-code models of the auditory brainstem for predicting lateralization and discrimination data of human binaural perception." J Acoust Soc Am 145(1): 1. Huet, A., C. Batrel, J. Wang, G. Desmadryl, R. Nouvian, J. L. Puel and J. Bourien (2019). "Sound Coding in the Auditory Nerve: From Single Fiber Activity to Cochlear Mass Potentials in Gerbils." Neuroscience 407: 83-92. Denham, S. L. and I. Winkler (2020). "Predictive coding in auditory perception: challenges and unresolved questions." Eur J Neurosci 51(5): 1151-1160. Fong, C. Y., W. H. C. Law, T. Uka and S. Koike (2020). "Auditory Mismatch Negativity Under Predictive Coding Framework and Its Role in Psychotic Disorders." Front Psychiatry 11: 557932. Fox, N. P., M. Leonard, M. J. Sjerps and E. F. Chang (2020). "Transformation of a temporal speech cue to a spatial neural code in human auditory cortex." Elife 9. Paquette, S., S. Rigoulot, K. Grunewald and A. Lehmann (2020). "Temporal decoding of vocal and musical emotions: Same code, different timecourse?" Brain Res 1741: 146887. Downer, J. D., J. R. Verhein, B. C. Rapone, K. N. O'Connor and M. L. Sutter (2021). "An Emergent Population Code in Primary Auditory Cortex Supports Selective Attention to Spectral and Temporal Sound Features." J Neurosci 41(36): 7561-7577. Gründemann, J. (2021). "Distributed coding in auditory thalamus and basolateral amygdala upon associative fear learning." Curr Opin Neurobiol 67: 183-189. Jalewa, J., J. Todd, P. T. Michie, D. M. Hodgson and L. Harms (2021). "Do rat auditory event related potentials exhibit human mismatch negativity attributes related to predictive coding?" Hear Res 399: 107992. Robotka, H., L. Thomas, K. Yu, W. Wood, J. E. Elie, M. Gahr and F. E. Theunissen (2023). "Sparse ensemble neural code for a complete vocal repertoire." Cell Rep 42(2): 112034. López Espejo, M., & David, S. V. (2024). A sparse code for natural sound context in auditory cortex. Current Research in Neurobiology, 6, 100118. Zhang, H., Nelken, I., & Sharpee, T. (2025). Parsing auditory neural code into maximum-entropy packets. bioRxiv.

21	Autophagic code	The Autophagic Code	Dong, N., & Yue, H. (2025). Decoding the autophagic code in obstructive sleep apnea: a multi-organ mechanistic dissection. Biochem Biophys Res Commun, 777, 152324.
22	Auxin code	The Auxin Metabolism Code	Campos, M. L. (2021). "Breaking the code of auxin metabolism: an additional role for DIOXYGENASE FOR AUXIN OXIDATION 1." Plant Physiol 187(1): 7-8. Martin-Arevalillo, R., & Vernoux, T. (2023). Decoding the Auxin Matrix: Auxin Biology Through the Eye of the Computer. Annu Rev Plant Biol, 74(Volume 74, 2023), 387-413. Martin-Arevalillo, R., Guillotin, B., Schön, J., Hugues, A., Gerentes, M.-F., Tang, K., . . . Vernoux, T. (2025). Synthetic deconvolution of an auxin-dependent transcriptional code. Cell, 188(11), 2872-2889.e2824.
23	Axon guidance code	The Axon Guidance Codes	Goodhill, G. J. (2003). "A theoretical model of axon guidance by the Robo code." Neural Comput 15(3): 549-564. Kinrade, E. F. and A. Hidalgo (2004). "Lateral neuron--glia interactions steer the response of axons to the Robo code." Neuron Glia Biol 1(2): 101-112. Shirasaki, R., J. W. Lewcock, K. Lettieri and S. L. Pfaff (2006). "FGF as a target-derived chemoattractant for developing motor axons genetically programmed by the LIM code." Neuron 50(6): 841-853. Chatterjee, M., Li, K., Chen, L., Maisano, X., Guo, Q., Gan, L., & Li, J. Y. H. (2012). Gbx2 regulates thalamocortical axon guidance by modifying the LIM and Robo codes. Development, 139(24), 4633-4643. Zarin, A. A., A. C. Daly, J. Hülsmeier, J. Asadzadeh and J. P. Labrador (2012). "A GATA/homeodomain transcriptional code regulates axon guidance through the Unc-5 receptor." Development 139(10): 1798-1805. Kohl, A., T. Marquardt, A. Klar and D. Sela-Donenfeld (2015). “Control of axon guidance and neurotransmitter phenotype of dB1 hindbrain interneurons by Lim-HD code.” J Neurosci 35(6): 2596-2611.
24	BAF code	The BRG1/BRM-associated factor (BAF) Code	de Rojas, I., Miera, M., Molero, A., Jinménez, C., Pérez, M. J., Moreno, L., & Segura, M. F. (2026). Cracking the BAF code: a new therapeutic strategy in neuroblastoma (was selected for Fire-session). EJC Paediatric Oncology, 7.
25	BAFF code	The B cell activating factor (BAFF) Immune Code	Mackay, F. and P. Schneider (2009). “Cracking the BAFF code.” Nat Rev Immunol 9(7): 491-502.

26	Bile code	The Bile Acid Code	Vuong, B., Tejirian, T., Chen, G. L., & Collins, J. C. (2015). Cracking the Code: The Unexpected Challenge of Identifying Major Bile Duct Injuries. Am Surg, 81(10), 1088-1092. Gadaleta, R. M., M. Cariello, L. Crudele and A. Moschetta (2022). "Bile Salt Hydrolase-Competent Probiotics in the Management of IBD: Unlocking the "Bile Acid Code"." Nutrients 14(15).
27	Binaural code	The Binaural Code	Harnischfeger, G. (1980). Brainstem units of echolocating bats code binaural time differences in the microsecond range. Naturwissenschaften, 67(6), 314-316. Młynarski, W. (2015). The Opponent Channel Population Code of Sound Location Is an Efficient Representation of Natural Binaural Sounds. PLOS Computational Biology, 11(5), e1004294. Bouse, J., Vencovský, V., Rund, F., & Marsalek, P. (2019). Functional rate-code models of the auditory brainstem for predicting lateralization and discrimination data of human binaural perception. J Acoust Soc Am, 145(1), 1. Encke, J. and M. Dietz (2022). "A hemispheric two-channel code accounts for binaural unmasking in humans." CommunBiol 5(1): 1122.
28	Biodiversity code	The Biodiversity Codes	Ab'Sáber, A. (2010). Evolving from a Forest Code to a Biodiversity Code [Do código florestal para o código da biodiversidade.]. Biota Neotropica, 10(4), 331–336. Nogués-Bravo, D., Rodríguez-Sánchez, F., Orsini, L., de Boer, E., Jansson, R., Morlon, H., . . . Jackson, S. T. (2018). Cracking the Code of Biodiversity Responses to Past Climate Change. Trends in Ecology & Evolution, 33(10), 765-776.
29	Bioelectric code	The Bioelectric Code	Tseng, A. and M. Levin (2013). "Cracking the bioelectric code: Probing endogenous ionic controls of pattern formation." Commun Integr Biol 6(1): e22595. Levin, M. and C. J. Martyniuk (2018). "The bioelectric code: An ancient computational medium for dynamic control of growth and form." Biosystems 164: 76-93. Silver, B. B. and C. M. Nelson (2018). "The Bioelectric Code: Reprogramming Cancer and Aging From the Interface of Mechanical and Chemical Microenvironments." Front Cell Dev Biol 6: 21.
30	Bioremediation code	The Bioremediation Codes	Fu, Y., Zhou, X., Shi, J., & Zhuang, H. (2026). Bacterial-algae biofilm formation deciphering phenolic wastewater degradation code: Revealing microbial community succession and tripartite synergistic networks. Journal of Water Process Engineering, 86, 109967.
31	Biosysnthetic code	The Biosynthetic Code	Xu, Z., M. Baunach, L. Ding, H. Peng, J. Franke and C. Hertweck (2014). "Biosynthetic code for divergolide assembly in a bacterial mangrove endophyte." Chembiochem 15(9): 1274-1279.

32	bHLH code	The bHLH Codes	Conway, S. J., Firulli, B., & Firulli, A. B. (2010). A bHLH Code for Cardiac Morphogenesis. Pediatric Cardiology, 31(3), 318-324. Sallee, M. D., H. E. Littleford and I. Greenwald (2017). "A bHLH Code for Sexually Dimorphic Form and Function of the C. elegans Somatic Gonad." Curr Biol 27(12): 1853-1860.e1855. Borba, A. R., Serra, T. S., Górska, A., Gouveia, P., Cordeiro, A. M., Reyna-Llorens, I., . . . Saibo, N. J. M. (2018). Synergistic Binding of bHLH Transcription Factors to the Promoter of the Maize NADP-ME Gene Used in C4 Photosynthesis Is Based on an Ancient Code Found in the Ancestral C3 State. Mol Biol Evol, 35(7), 1690-1705. Puig-Barbe, A., Dettmann, S., Nirello, V. D., Moor, H., Azami, S., Edgar, B. A., . . . de Navascués, J. (2025). A bHLH interaction code controls bipotential differentiation and self-renewal in the Drosophila gut. Cell Rep, 44(3).
33	Blood-Brain Barrier code	The Blood-Brain Barrier Code	Nájera-Maldonado, L., Parra-González, M., Peralta-Cuevas, E., Gutierrez-Onofre, A. J., Garcia-Atutxa, I., & Villanueva-Flores, F. (2025). Cracking the Blood–Brain Barrier Code: Rational Nanomaterial Design for Next-Generation Neurological Therapies. Pharmaceutics, 17(9), 1169.
34	Body plan code	The (Epigenetic) Body Plan Code	Elder D (1979) An epigenetic code. Differentiation, 14, 119-122.
35	Brain code	The Universal Brain Code	Rosenberg, R. N. (2021). "The universal brain code a genetic mechanism for memory." J Neurol Sci 429: 118073.
36	Brain immune code	The Brain Immune Code	Kim, M. W., & Kipnis, J. (2025). Glymphatics and meningeal lymphatics unlock the brain-immune code. Immunity, 58(5), 1040-1051.
37	Cadherin code	The Cadherin Neuronal Code **SEE also The Synaptic / Adhesive Code**	Ranscht, B. (2000). Cadherins: molecular codes for axon guidance and synapse formation. International Journal of Developmental Neuroscience, 18(7), 643-651. Hertel, N., Krishna, K., Nuernberger, M., & Redies, C. (2008). A cadherin-based code for the divisions of the mouse basal ganglia. Journal of Comparative Neurology, 508(4), 511-528. Krishna, K. K., Hertel, N., & Redies, C. (2011). Cadherin expression in the somatosensory cortex: evidence for a combinatorial molecular code at the single-cell level. Neuroscience, 175, 37-48. Pearson, Caroline A., Samantha J. Butler and Bennett G. Novitch (2014). "Neuronal Organization: Unsticking the Cadherin Code." Current Biology 24(23): R1127-R1129.

			Canzio, D. and T. Maniatis (2019). "The generation of a protocadherin cell-surface recognition code for neural circuit assembly." Curr Opin Neurobiol 59: 213-220. Bao, M., J. Cornwall-Scoones, E. Sanchez-Vasquez, D. Y. Chen, J. De Jonghe, S. Shadkhoo, F. Hollfelder, M. Thomson, D. M. Glover and M. Zernicka-Goetz (2022). "Stem cell-derived synthetic embryos self-assemble by exploiting cadherin codes and cortical tension." Nat Cell Biol 24(9): 1341-1349. Genuth, M. A., Jülich, D., Ton, A. T., Smith, S. J., Guillon, E., Shattuck, M. D., . . . Holley, S. A. (2025). A cadherin-integrin–ECM code for presomitic mesoderm fluidity. Development, 152(21). Gray, M. T., & Lefebvre, J. L. (2025). Cracking the cadherin codes that wire the nervous system. Current Opinion in Neurobiology, 93, 103086.
38	Calcium code	The Calcium Code	Teruel, M. N., Chen, W., Persechini, A., & Meyer, T. (2000). Differential codes for free Ca2+ calmodulin signals in nucleus and cytosol. Current Biology, 10(2), 86-94. Thomine, S. (2001). "Cracking the calcium code." Trends Plant Sci 6(11): 501. Allen, G. J. and J. I. Schroeder (2001). "Combining genetics and cell biology to crack the code of plant cell calcium signaling." Sci STKE 2001(102): re13. Mauro, T. (2003). "'The discovery channel': CRAC'king the code of calcium influx." J Invest Dermatol 121(1): lx-x. Parekh, A. B. (2006). "Cell biology: cracking the calcium entry code." Nature 441(7090): 163-165. DeFalco, T. A., K. W. Bender and W. A. Snedden (2009). "Breaking the code: Ca2+ sensors in plant signalling." Biochem J 425(1): 27-40. Haiech, J. and M. Moreau (2011). "The calcium signal: a universal carrier to code, decode and transduce information." Biochimie 93(12): v. Covelo, A., A. Badoual and A. Denizot (2022). "Reinforcing Interdisciplinary Collaborations to Unravel the Astrocyte "Calcium Code"." J Mol Neurosci 72(7): 1443-1455. Moccia, F., Brunetti, V., Soda, T., Berra-Romani, R., & Scarpellino, G. (2023). Cracking the Endothelial Calcium (Ca2+) Code: A Matter of Timing and Spacing. Int J Mol Sci, 24(23), 16765. Paudel, S., Yue, M., Nalamalapu, R., & Saha, M. S. (2024). Deciphering the Calcium Code: A Review of Calcium Activity Analysis Methods Employed to Identify Meaningful Activity in Early Neural Development. Biomolecules, 14(1), 138.

39	Cancer code	The (Epigenetic) Cancer Code	Altarac, S. (1993). “Numerical quadruplet code of human cervical carcinoma tissue proteins.” Acta Med Croatica 47(2): 85-87. Smith, L. T., G. A. Otterson and C. Plass (2007). “Unraveling the epigenetic code of cancer for therapy.” Trends Genet 23(9): 449-456. Brower, V. (2011). "Epigenetics: Unravelling the cancer code." Nature 471(7339): S12-13. New, M., H. Olzscha and N. B. La Thangue (2012). "HDAC inhibitor-based therapies: can we interpret the code?" Mol Oncol 6(6): 637-656. Blancafort, P., J. Jin and S. Frye (2013). "Writing and rewriting the epigenetic code of cancer cells: from engineered proteins to small molecules." Mol Pharmacol 83(3): 563-576. Karpathakis, A., H. Dibra and C. Thirlwell (2013). "Neuroendocrine tumours: cracking the epigenetic code." Endocr Relat Cancer 20(3): R65-82. Sato, K., T. Hara and M. Ohya (2013). “The code structure of the p53 DNA-binding domain and the prognosis of breast cancer patients.” Bioinformatics 29(22): 2822-2825. Kulkarni, R. A. and J. L. Meier (2014). "Chemical cryptology of cancer's histone code." Chem Biol 21(11): 1419-1421. Lomberk, G. A. and R. Urrutia (2015). "The Triple-Code Model for Pancreatic Cancer: Cross Talk Among Genetics, Epigenetics, and Nuclear Structure." Surg Clin North Am 95(5): 935-952. Roschewski, M. and W. H. Wilson (2015). "Cracking the diverse biologic code of diffuse large B-cell lymphoma." Semin Hematol 52(2): 55-56 Bonci, D., V. Coppola, M. Patrizii, A. Addario, A. Cannistraci, F. Francescangeli, R. Pecci, G. Muto, D. Collura, R. Bedini, A. Zeuner, M. Valtieri, S. Sentinelli, M. S. Benassi, M. Gallucci, P. Carlini, S. Piccolo and R. De Maria (2016). "A microRNA code for prostate cancer metastasis." Oncogene 35(9): 1180-1192. Søreide, K., M. M. Watson and H. R. Hagland (2016). "Deciphering the Molecular Code to Colorectal Liver Metastasis Biology Through Microsatellite Alterations and Allelic Loss: The Good, the Bad, and the Ugly." Gastroenterology 150(4): 811-814. Lucas, C. (2017). “Cracking the cancer code: a personalised genomic approach.” Lancet Oncol 18(6): 717.

			Yotsukura, S., M. Karasuyama, I. Takigawa and H. Mamitsuka (2017). "Exploring phenotype patterns of breast cancer within somatic mutations: a modicum in the intrinsic code." Brief Bioinform 18(4): 619-633. Rodríguez, E., S. T. T. Schetters and Y. van Kooyk (2018). "The tumour glyco-code as a novel immune checkpoint for immunotherapy." Nat Rev Immunol 18(3): 204-211. Lopes, N., V. G. Correia, A. S. Palma and C. Brito (2021). "Cracking the Breast Cancer Glyco-Code through Glycan-Lectin Interactions: Targeting Immunosuppressive Macrophages." Int J Mol Sci 22(4). Dushanan, R., Weerasinghe, S., Dissanayake, D. P., & Senthilinithy, R. (2022). Cracking a cancer code histone deacetylation in epigenetic: the implication from molecular dynamics simulations on efficacy assessment of histone deacetylase inhibitors. Journal of Biomolecular Structure and Dynamics, 40(5), 2352-2368. Gu, L., Pan, X., Wang, C., & Wang, L. (2022). The benefits of propofol on cancer treatment: Decipher its modulation code to immunocytes [Review]. Front Pharmacol, Volume 13 - 2022. Patel, A., Mendiratta, V., & Acharya, C. (2023). S3702 Cracking the Code: Molecular Analysis of Hepatic Adenomas. Official journal of the American College of Gastroenterology | ACG, 118(10S). Asare, A., Fleming, N., Bateman, N., Westin, S., Jazaeri, A., Yao, J., . . . Sood, A. (2024). Cracking the code: Understanding molecular signatures in ovarian cancer subgroups undergoing primary treatment. Gynecologic Oncology, 190, S225. Dushanan, R., Weerasinghe, S., Dissanayake, D.P., & Senthilnithy, R. (2025). Cracking a cancer code DNA methylation in epigenetic modification: an in-silico approach on efficacy assessment of Sri Lanka-oriented nutraceuticals. Journal of Biomolecular Structure and Dynamics, 43(16), 9192-9212. Goel, N., Hernandez, A. E., Antoni, M. H., Kesmodel, S., Pinheiro, P. S., Kobetz, E., . . . Cole, S. W. (2024). ZIP Code to Genomic Code: Neighborhood Disadvantage, Aggressive Breast Cancer Biology, and Breast Cancer Outcomes. Annals of Surgery, 280(1). Mundhara, N., & Sadhukhan, P. (2024). Cracking the Codes behind Cancer Cells' Immune Evasion. Int J Mol Sci, 25(16), 8899. Assi, T., & Le Cesne, A. (2025). Cracking the code: the emerging role of immune checkpoint inhibitors in PEComas. Immunotherapy, 17(12), 835-837. Coburn, F., Nsereko, Y., Armstrong, A., & Al Musaimi, O. (2025). Peptide inhibitors: Breaking cancer code. Eur J Med Chem, 297, 117961.

			Debie, Y., Garcia-Fogeda, I., Willem, L., Roelant, E., Verbruggen, L., Vanhoutte, G., . . . Vandamme, T. (2025). Cracking the code of a correlate of protection against SARS-CoV-2 breakthrough infection in cancer patients. Scientific Reports, 15(1), 7858. Ricco, J.-B., & Hostalrich, A. (2025). When the Neck Speaks Genes: Carotid Paragangliomas and the Hidden Code behind a Tumour; A Genetic Compass for Vascular Surgeons. European Journal of Vascular and Endovascular Surgery, 70(6), 734. Scherer, F. (2025). Cracking the POD24 code in follicular lymphoma. Blood, 146(8), 899-900. Vasilescu, A.-G., Vasilescu, A.-M., Sima, L. E., Baran, N., & Szedlacsek, Ş.-E. (2025). Breaking the cancer code: a novel DNA minicircle to disable STAT3 in ovarian cancer cells SKOV3 [Original Research]. Front Pharmacol, Volume 16. Zhu, C., Guo, J., Xu, Q., Shi, C., Xu, C., & Mei, C. (2026). CD44: The key target unlocking the new code of tumor and inflammation treatment. Journal of Drug Delivery Science and Technology, 120, 108257.
40	Cancer resistance code	The Cancer Treatment Resistance Codes	Qiao, H. and C. M. Lovly (2016). "Cracking the Code of Resistance across Multiple Lines of ALK Inhibitor Therapy in Lung Cancer." Cancer Discov 6(10): 1084-1086. Musiu, C., Lupo, F., Agostini, A., Lionetto, G., Bevere, M., Paiella, S., . . . De Sanctis, F. (2024). Cellular collusion: cracking the code of immunosuppression and chemo resistance in PDAC [Review]. Front Immunol, Volume 15 - 2024. Lei, K., Chen, J., Deng, Y., Peng, Y., Zhai, X., Ren, X., . . . Jiang, C. (2025). Cracking the code of cancer immunotherapy resistance: emerging roles of pyroptosis and necroptosis. Journal of Experimental & Clinical Cancer Research, 44(1), 308. Nikanjam, M., & Kurzrock, R. (2025). Cracking the resistance code: The molecular reclassification of cancer and precision therapy strategies. Semin Cancer Biol, 117, 57-68. Zhang, R., Li, M., Lu, S., Wang, A., & Zhang, S. (2025). Exploring exosomal lncRNAs: unlocking the molecular code of tumor metastasis and drug resistance. Cancer Cell International, 25(1), 447. Papavassiliou, K. A., Stravopodis, D. J., Gogou, V. A., & Papavassiliou, A. G. (2026). Cracking the Code of Immunotherapy Resistance in SCLC: Molecular Insights and Emerging Solutions. Am J Respir Crit Care Med.

41	Capsid code	The (Viral) Capsid Codes	Zajac, J. W. P., Tohidian, I., Muralikrishnan, P., Perry, S. L., Heldt, C. L., & Sarupria, S. (2026). Cracking the Capsid Code: A Computationally Feasible Approach for Investigating Virus–Excipient Interactions in Biologics Design. Journal of Chemical Theory and Computation, 22(5), 2635-2651.
42	Cardiac code	The Cardia Codes	Rabolli, C. P., & Accornero, F. (2024). Cardiac cryptographers: cracking the code of the epitranscriptome. European Heart Journal, 45(23), 2034-2036. Ha, C.-M., & Wende Adam, R. (2025). Cracking the Code of a Preclinical Rodent Model of HFpEF. JACC: Basic to Translational Science, 10(9), 101357. Qian, Li and Liu, Smin L. (2026), Heartbeats and Hidden Codes: Decoding Cardiac Aging with Multi-Omics and AI. Available at SSRN.
43	Cascade code	The Subcellular Cascade Code	Sahar, S., Sun, S., Zeb, A., Jin, L., Gao, Y., Tian, L., . . . Mao, Z. (2023). Multi-enzyme mimics – cracking the code of subcellular cascade reactions and their potential biological applications. Materials Chemistry Frontiers, 7(15), 3037-3072.
44	CD code	The (Cluster of Differentiation) Code	Pruszak, J., Ludwig, W., Blak, A., Alavian, K., & Isacson, O. (2009). CD15, CD24, and CD29 Define a Surface Biomarker Code for Neural Lineage Differentiation of Stem Cells. Stem Cells, 27(12), 2928-2940. Zhu, C., Guo, J., Xu, Q., Shi, C., Xu, C., & Mei, C. (2026). CD44: The key target unlocking the new code of tumor and inflammation treatment. Journal of Drug Delivery Science and Technology, 120, 108257.
45	Cell access code	The Cell Access Code	Zengel, J. and J. E. Carette (2020). “Cracking the cell access code for the deadly virus VEEV.” Nature 588(7837): 223-224.
46	Cell surface code	The Cell Surface Recognition Code	Mountoufaris, G., D. Canzio, C. L. Nwakeze, W. V. Chen and T. Maniatis (2018). “Writing, Reading, and Translating the Clustered Protocadherin Cell Surface Recognition Code for Neural Circuit Assembly.” Annu Rev Cell Dev Biol 34: 471-493. Dong, H., Li, J., Wu, Q., & Jin, Y. (2023). Confluence and convergence of Dscam and Pcdh cell-recognition codes. Trends Biochem Sci, 48(12), 1044-1057. Fischer, F., Ernst, L., Frey, A., Holstein, K., Prasad, D., Weichselberger, V., . . . Classen, A.-K. (2023). A cell surface code mediates tissue-intrinsic defense against aberrant cells in epithelia. bioRxiv, 2023.2002.2016.528665.
47	Cell wall code	The Plant Cell Wall Code	Tavares, E. Q. and M. S. Buckeridge (2015). “Do plant cell walls have a code?” Plant Sci 241: 286-294.

			Vukašinović, N., Serif, M., & Bacete, L. (2023). Cracking the green wall code: insights into cell wall integrity across organisms [Mini Review]. Frontiers in Plant Physiology, Volume 1 - 2023.
48	Centromere code	The Centromere Code	Koch, J. (2000). Neocentromeres and alpha satellite: a proposed structural code for functional human centromere DNA. Hum Mol Genet, 9(2), 149-154. Bergmann, J. H., Martins, N. M., Larionov, V., Masumoto, H., & Earnshaw, W. C. (2012). HACking the centromere chromatin code: insights from human artificial chromosomes. Chromosome Res, 20(5), 505-519.
49	Cerebral resistance code	The Cerebral Resistance Code	Sharma, A. and R. Goyal (2016). “Cross tolerance: a tread to decipher the code of endogenous global cerebral resistance.” Neural Regen Res 11(5): 719-720.
50	Chaperone code	The Chaperone Code	Cloutier, P. and B. Coulombe (2013). "Regulation of molecular chaperones through post-translational modifications: decrypting the chaperone code." Biochim Biophys Acta 1829(5): 443-454. Nitika and A. W. Truman (2017). “Cracking the Chaperone Code: Cellular Roles for Hsp70 Phosphorylation.” Trends Biochem Sci 42(12): 932-935. Backe, S. J., R. A. Sager, M. R. Woodford, A. M. Makedon and M. Mollapour (2020). "Post-translational modifications of Hsp90 and translating the chaperone code." J Biol Chem 295(32): 11099-11117. Nitika, C. M. Porter, A. W. Truman and M. C. Truttmann (2020). "Post-translational modifications of Hsp70 family proteins: Expanding the chaperone code." J Biol Chem 295(31): 10689-10708. Truman, A. W., D. Bourboulia and M. Mollapour (2021). "Decrypting the chaperone code." J Biol Chem 296: 100293. Woodford, M. R., S. J. Backe, L. A. Wengert, D. M. Dunn, D. Bourboulia and M. Mollapour (2021). "Hsp90 chaperone code and the tumor suppressor VHL cooperatively regulate the mitotic checkpoint." Cell Stress Chaperones 26(6): 965-971. Omkar, S., Rysbayeva, A., & Truman, A. W. (2023). Understanding chaperone specificity: evidence for a ‘client code&#x2019. Trends Biochem Sci, 48(8), 662-664. Backe, S. J., Heritz, J. A., & Mollapour, M. (2024). The HSP90 chaperone code regulates the crosstalk between proteostasis and autophagy. Autophagy, 20(7), 1689-1691.

			Buchner, J., Alasady, M. J., Backe, S. J., Blagg, B. S. J., Carpenter, R. L., Colombo, G., . . . Woodford, M. R. (2024). Second international symposium on the chaperone code, 2023. Cell Stress Chaperones, 29(1), 88-96. Felipe Perez, R., Mochi, G., Khan, A., & Woodford, M. (2024). Mitochondrial Chaperone Code: Just warming up. Cell Stress and Chaperones, 29(3), 483-496. Guarra, F., Sciva, C., Bonollo, G., Pasala, C., Chiosis, G., Moroni, E., & Colombo, G. (2024). Cracking the chaperone code through the computational microscope. Cell Stress and Chaperones, 29(5), 626-640. Rani, K., Gotmare, A., Maier, A., Menghal, R., Akhtar, N., Fangaria, N., . . . Bhattacharyya, S. (2024). Identification of a chaperone-code responsible for Rad51-mediated genome repair. Journal of Biological Chemistry, 300(6). Backe, S. J., Heritz, J. A., & Mollapour, M. (2025). Hsp70 and Hsp90 post-translational modifications and translating the chaperone code. Cell Stress and Chaperones, 30(6), 100118. Gajsek, O., Becker, C. F. W., & Conibear, A. C. (2025). Site-specifically Phosphorylated Hsp90C-terminal Domain Variants Provide Access to Deciphering the Chaperone Code. Chemistry – A European Journal, 31(6), e202403676. Mitchem, M. M., Choi, A., Mirikar, D. A., Deb, R., & Truman, A. W. (2025). Dissecting the Cdc37 cochaperone code: Functional roles in chaperone-mediated stress adaptation. Journal of Biological Chemistry, 301(10), 110672. Digwal, C. S., Wang, S., & Chiosis, G. (2026). Embracing diversity: Post-translational modifications, the chaperone code, and the emergence of new chaperone entities. Cell Stress and Chaperones, 31(2), 100148.
51	Checkpoint code	The Checkpoint Codes **SEE also Immune Code**	Zeng, P., J. Ma, R. Yang and Y. C. Liu (2017). "Immune Regulation by Ubiquitin Tagging as Checkpoint Code." Curr Top Microbiol Immunol 410: 215-248. Melosky, B., Chu, Q., Juergens, R. A., Leighl, N., Ionescu, D., Tsao, M. S., . . . Hirsh, V. (2018). Breaking the biomarker code: PD-L1 expression and checkpoint inhibition in advanced NSCLC. Cancer Treat Rev, 65, 65-77.
52	Chitin code	The Chitin (Defense) Code	Khokhani, D., C. Carrera Carriel, S. Vayla, T. B. Irving, C. Stonoha-Arther, N. P. Keller and J. M. Ané (2021). “Deciphering the Chitin Code in Plant Symbiosis, Defense, and Microbial Networks.” Annu Rev Microbiol 75: 583-607.

			Velandia, K., & Foo, E. (2025). Cracking the chitin code: how a single pair of LysM receptors deciphers symbiosis and immunity in Marchantia. Science China Life Sciences, 68(5), 1533-1535.
53	Chromatin code	The Chromatin Code **SEE also Histone Code** **SEE also Splicing Codes**	Gacek, A., & Strauss, J. (2012). The chromatin code of fungal secondary metabolite gene clusters. Appl Microbiol Biotechnol, 95(6), 1389-1404. Agirre, E., Bellora, N., Alló, M., Pagès, A., Bertucci, P., Kornblihtt, A. R., & Eyras, E. (2015). A chromatin code for alternative splicing involving a putative association between CTCF and HP1α proteins. BMC Biol, 13, 31.
54	Chromosome code	The Chromosome Codes	Artandi, S. E. and J. P. Cooper (2009). "Reverse transcribing the code for chromosome stability." Mol Cell 36(5): 715-719. Podgornaya, O., E. Gavrilova, V. Stephanova, S. Demin and A. Komissarov (2013). "Large tandem repeats make up the chromosome bar code: a hypothesis." Adv Protein Chem Struct Biol 90: 1-30.
55	Circadian codes	The Circadian Rhythm Codes	Arjona, A. and D. K. Sarkar (2008). "Are Circadian Rhythms the Code of Hypothalamic-Immune Communication? Insights from Natural Killer Cells." Neurochemical Research 33(4): 708-718. Brown, S. A. (2011). A New Histone Code for Clocks? Science, 333(6051), 1833-1834. He, W., K. Kraus, D. Druzd, A. de Juan, L. Ince, C.-S. Chen and C. Scheiermann (2017). "A circadian zip code determines rhythmic leukocyte trafficking to tissues." The FASEB Journal 31(S1): 55.54-55.54. Wang, B., A. N. Kettenbach, X. Zhou, J. J. Loros and J. C. Dunlap (2019). "The Phospho-Code Determining Circadian Feedback Loop Closure and Output in Neurospora." Molecular Cell 74(4): 771-784.e773. Warsi, J., Noor, N., Ansari, S., & Uddin, S. F. (2024). The Circadian Code: Deciphering the Role of Blood Groups in Sleep Pattern. ADVANCES IN BASIC MEDICAL SCIENCES, 8(1), 39-43. Nisoli, E., Ragni, M., Ruocco, C., & Valerio, A. Reprogramming the mitochondrial-circadian energy code with incretins. Trends in Endocrinology & Metabolism.
56	Circular ribosome code	The Circular Motif (Ribosome) Code	Pirillo, G. and M. A. Pirillo (2005). "Growth function of self-complementary circular codes." Rivista di biologia 98(1): 97-110. El Soufi, K. and C. J. Michel (2014). "Circular code motifs in the ribosome decoding center." ComputBiol Chem 52: 9-17. Dila, G., R. Ripp, C. Mayer, O. Poch, C. J. Michel and J. D. Thompson (2019). "Circular code motifs in the ribosome: a missing link in the evolution of translation?" Rna 25(12): 1714-1730.

			Thompson, J. D., R. Ripp, C. Mayer, O. Poch and C. J. Michel (2021). "Potential role of the X circular code in the regulation of gene expression." Biosystems 203: 104368. Michel, C. J., & Sereni, J.-S. (2023). Reading Frame Retrieval of Genes: A New Parameter of Codon Usage Based on the Circular Code Theory. Bulletin of Mathematical Biology, 85(4), 24.
57	Cis-regulatory transcription code	The Transcriptional Cis-Regulatory Code	Istrail, S. and E. H. Davidson (2005). "Logic functions of the genomic cis-regulatory code." Proceedings of the National Academy of Sciences 102(14): 4954-4959. Ochoa-Espinosa, A. and S. Small (2006). "Developmental mechanisms and cis-regulatory codes." Current Opinion in Genetics & Development 16(2): 165-170. Conte, I. and P. Bovolenta (2007). "Comprehensive characterization of the cis-regulatory code responsible for the spatio-temporal expression of olSix3.2 in the developing medaka forebrain." Genome Biol 8(7): R137. Zou, C., K. Sun, J. D. Mackaluso, A. E. Seddon, R. Jin, M. F. Thomashow and S. H. Shiu (2011). "Cis-regulatory code of stress-responsive transcription in Arabidopsis thaliana." Proc Natl Acad Sci U S A 108(36): 14992-14997. Sorge, S., N. Ha, M. Polychronidou, J. Friedrich, D. Bezdan, P. Kaspar, M. H. Schaefer, S. Ossowski, S. R. Henz, J. Mundorf, J. Rätzer, F. Papagiannouli and I. Lohmann (2012). "The cis-regulatory code of Hox function in Drosophila." Embo j 31(15): 3323-3333. Doglio, L., D. K. Goode, M. C. Pelleri, S. Pauls, F. Frabetti, S. M. Shimeld, T. Vavouri and G. Elgar (2013). "Parallel evolution of chordate cis-regulatory code for development." PLoS Genet 9(11): e1003904. Yáñez-Cuna, J. O., E. Z. Kvon and A. Stark (2013). "Deciphering the transcriptional cis-regulatory code." Trends Genet 29(1): 11-22. Dresch, J. M. and D. N. Arnosti (2015). "The Wisdom of Crowds: Can Mathematical Models Crack the cis Regulatory Code?" Cell Syst 1(6): 379-380. Mancino, A., A. Termanini, I. Barozzi, S. Ghisletti, R. Ostuni, E. Prosperini, K. Ozato and G. Natoli (2015). "A dual cis-regulatory code links IRF8 to constitutive and inducible gene expression in macrophages." Genes Dev 29(4): 394-408. Uygun, S., C. B. Azodi and S. H. Shiu (2019). "Cis-Regulatory Code for Predicting Plant Cell-Type Transcriptional Response to High Salinity." Plant Physiol 181(4): 1739-1751.

			Coppola, U., A. K. Kamal, A. Stolfi and F. Ristoratore (2020). "The Cis-Regulatory Code for Kelch-like 21/30 Specific Expression in Ciona robusta Sensory Organs." Front Cell Dev Biol 8: 569601. Novikova, D. D., P. A. Cherenkov, Y. G. Sizentsova and V. V. Mironova (2020). "metaRE R Package for Meta-Analysis of Transcriptome Data to Identify the cis-Regulatory Code behind the Transcriptional Reprogramming." Genes (Basel) 11(6). Zeitlinger, J. (2020). "Seven myths of how transcription factors read the cis-regulatory code." Curr Opin Syst Biol 23: 22-31. Chatterjee, S., K. M. Karasaki, L. E. Fries, A. Kapoor and A. Chakravarti (2021). "A multi-enhancer RET regulatory code is disrupted in Hirschsprung disease." Genome Res 31(12): 2199-2208. Tokuhiro, S. and Y. Satou (2021). "Cis-regulatory code for determining the action of Foxd as both an activator and a repressor in ascidian embryos." Dev Biol 476: 11-17. Zemlyanskaya, E. V., V. A. Dolgikh, V. G. Levitsky and V. Mironova (2021). "Transcriptional regulation in plants: Using omics data to crack the cis-regulatory code." Curr Opin Plant Biol 63: 102058. Benoit, M. (2022). "Hot 'n cold: Applying the cis-regulatory code to predict heat and cold stress response in maize." Plant Cell 34(1): 497-498. Kim, S., & Wysocka, J. (2023). Deciphering the multi-scale, quantitative cis-regulatory code. Molecular Cell, 83(3), 373-392. de Boer, C. G., & Taipale, J. (2024). Hold out the genome: a roadmap to solving the cis-regulatory code. Nature, 625(7993), 41-50. Peleke, F. F., Zumkeller, S. M., Gültas, M., Schmitt, A., & Szymański, J. (2024). Deep learning the cis-regulatory code for gene expression in selected model plants. Nat Commun, 15(1), 3488. Ogawa, Y., Liu, Y., Myers, C. A., Morshedian, A., Fain, G. L., Sampath, A. P., & Corbo, J. C. (2025). Conservation of cis-regulatory codes over half a billion years of evolution. Sci Adv, 11(50), eadw7681. Buitrago, N., Vidal, J. A., & Lim, B. (2026). Configuring the Code: Enhancer-Promoter Arrangement and Transcriptional Regulation. J Mol Biol, 438(1), 169417. Nurov U., Djalilova, N….Xudayqulov, B. (2026) Deep Learning of Plant CIS Regulatory Code to Predict Expression and Trait Associated Variants. Genetics and Molecular Research, 25(1).

58	Citrullination code	The Protein Citrullination Code	Harada, K., Carr, S. M., Shrestha, A., & La Thangue, N. B. (2023). Citrullination and the protein code: crosstalk between post-translational modifications in cancer. Philosophical Transactions of the Royal Society B: Biological Sciences, 378(1890).
59	CKD code	The Chronic Kidney Disease Code	O'Toole, J. F. and J. R. Sedor (2018). "CKD, Genetic Variation, and the Epigenome: Decrypting the Code." Am J Kidney Dis 72(2): 164-167.
60	Clean-up code	The Cellular Clean-Up Code	Li, B., & Sun, Q. (2025). Organelle-ly speaking: Cracking the code of cellular clean-up. Cell Chem Biol, 32(10), 1202-1204.
61	Coactivator code	The Coactivator/Corepressor/ Epigenetic Code	Gamble, M. J., & Freedman, L. P. (2002). A coactivator code for transcription. Trends Biochem Sci, 27(4), 165-167. Rosenfeld, M. G., V. V. Lunyak and C. K. Glass (2006). “Sensors and signals: a coactivator/corepressor/epigenetic code for integrating signal-dependent programs of transcriptional response.” Genes Dev 20(11): 1405-1428.
62	Cocain code	The Cocain Addiction Code	Ahmed, S. H., & Kenny, P. J. (2011). Cracking the Molecular Code of Cocaine Addiction. ILAR Journal, 52(3), 309-320. LaPlant, Q., & Nestler, E. J. (2011). CRACKing the histone code: Cocaine's effects on chromatin structure and function. Horm Behav, 59(3), 321-330.
63	Cohesin code	The Cohesin-Dockerin Code	Vera, A. M., A. Galera-Prat, M. Wojciechowski, B. Różycki, D. V. Laurents, M. Carrión-Vázquez, M. Cieplak and P. Tinnefeld (2021). “Cohesin-dockerin code in cellulosomal dual binding modes and its allosteric regulation by proline isomerization.” Structure 29(6): 587-597.e588.
64	Coincidence-detection code	The Coincidence-Detection Code **SEE also Cell Polarity Code**	Ren, C., Yuan, Q., Jian, X., Randazzo, P. A., Tang, W., & Wu, D. (2020). Small GTPase ARF6 Is a Coincidence-Detection Code for RPH3A Polarization in Neutrophil Polarization. J Immunol, 204(4), 1012-1021.
65	Collagen code	The Collagen Code	Holmgren, S. K., Taylor, K. M., Bretscher, L. E., & Raines, R. T. (1998). Code for collagen's stability deciphered. Nature, 392(6677), 666-667. DiChiara, A. S., Li, R. C., Suen, P. H., Hosseini, A. S., Taylor, R. J., Weickhardt, A. F., . . . Shoulders, M. D. (2018). A cysteine-based molecular code informs collagen C-propeptide assembly. Nat Commun, 9(1), 4206. Gupta, A. A., Kheur, S., Palaskar, S. J., & Narang, B. R. (2021). Deciphering the “Collagen code” in tumor progression. Journal of Cancer Research and Therapeutics, 17(1), 29-32.

			Zhang, Q., An, Z.-Y., Jiang, W., Jin, W.-L., & He, X.-Y. (2023). Collagen code in tumor microenvironment: Functions, molecular mechanisms, and therapeutic implications. Biomedicine & Pharmacotherapy, 166, 115390. Malcor, J.-D., Ferruz, N., Romero-Romero, S., Dhingra, S., Sagar, V., & Jalan, A. A. (2025). Deciphering the folding code of collagens. Nat Commun, 16(1), 2702.
66	Colour Code	The (Retinal) Colour Code	Maturana, H. R., Uribe, G., & Frenk, S. (1968). A biological theory of relativistic colour coding in the primate retina. Archivos de biologia y medicina experimentales, 1(0), 1-30. Reuter, T. O. M., & Virtanen, K. A. J. (1972). Border and Colour Coding in the Retina of the Frog. Nature, 239(5370), 260-263. Zeki, S. M. (1973). Colour coding in rhesus monkey prestriate cortex. Brain Res, 53(2), 422-427. Regan, D. (1975). Colour coding of pattern responses in man investigated by evoked potential feedback and direct plot techniques. Vision Res, 15(2), 175-183. Tolhurst, D. J. (1977). Colour-coding properties of sustained and transient channels in human vision. Nature, 266(5599), 266-268. Zeki, S. M. (1977). Colour coding in the superior temporal sulcus of rhesus monkey visual cortex. Proceedings of the Royal Society of London. B. Biological Sciences, 197(1127), 195-223. Caelli, T., & Finlay, D. (1979). Frequency, Phase, and Colour Coding in Apparent Motion. Perception, 8(1), 59-68. Buchsbaum, G., & Gottschalk, A. (1983). Trichromacy, opponent colours coding and optimum colour information transmission in the retina. Proceedings of the Royal Society of London. B. Biological Sciences, 220(1218), 89-113. Paulus, W., & KrÖger-Paulus, A. (1983). A new concept of retinal colour coding. Vision Res, 23(5), 529-540. Paulus, W. M., Hömberg, V., Cunningham, K., & Halliday, A. M. (1986). Colour and brightness coding in the central nervous system: theoretical aspects and visual evoked potentials to homogeneous red and green stimuli. Proceedings of the Royal Society of London. B. Biological Sciences, 227(1246), 53-66. Hurlbert, A. (1991). "Visual perception. Deciphering the colour code." Nature 349(6306): 191-193.

			Atick, J. J., Li, Z., & Redlich, A. N. (1992). Understanding Retinal Color Coding from First Principles. Neural Comput, 4(4), 559-572. Chittka, L., Beier, W., Hertel, H., Steinmann, E., & Menzel, R. (1992). Opponent colour coding is a universal strategy to evaluate the photoreceptor inputs in Hymenoptera. Journal of Comparative Physiology A, 170(5), 545-563. Dacey, D. M. (1996). Circuitry for color coding in the primate retina. Proceedings of the National Academy of Sciences, 93(2), 582-588. Dacey, D. M. (2000). Parallel Pathways for Spectral Coding in Primate Retina. Annu Rev Neurosci, 23, 743-775. Twer, T. v. d., & MacLeod, D. I. A. (2001). Optimal nonlinear codes for the perception of natural colours. Network: Computation in Neural Systems, 12(3), 395. Dacey, D. M., & Packer, O. S. (2003). Colour coding in the primate retina: diverse cell types and cone-specific circuitry. Current Opinion in Neurobiology, 13(4), 421-427. Friedman, H. S., Zhou, H., & von der Heydt, R. (2003). The coding of uniform colour figures in monkey visual cortex. J Physiol, 548(2), 593-613. Macleod, D. I. A., & Von Der Twer, T. (2003). The Pleistochrome: Optimal Opponent Codes For Natural Colours. In Colour Perception: Mind and the physical world (pp. 0). Oxford University Press. Lennie, P., & Movshon, J. A. (2005). Coding of color and form in the geniculostriate visual pathway (invited review). Journal of the Optical Society of America A, 22(10), 2013-2033. Conway, B. R. (2009). Color Vision, Cones, and Color-Coding in the Cortex. The Neuroscientist, 15(3), 274-290. Setiawan, A. W., Suksmono, A. B., & Mengko, T. L. R. (2009). A comparative study of colour retinal image coding using vector quantization: K-Means & Fuzzy C-Means. International Conference on Electrical Engineering and Informatics Chen, S., & Li, W. (2012). A color-coding amacrine cell may provide a blue-Off signal in a mammalian retina. Nat Neurosci, 15(7), 954-956. Chang, L., Breuninger, T., & Euler, T. (2013). Chromatic Coding from Cone-type Unselective Circuits in the Mouse Retina. Neuron, 77(3), 559-571.

			Troscianko, J., & Osorio, D. (2023). A model of colour appearance based on efficient coding of natural images. PLOS Computational Biology, 19(6), e1011117.
67	Communication code – A (cellular)	The Cellular Communication Codes	Salmond, G. P., B. W. Bycroft, G. S. Stewart and P. Williams (1995). "The bacterial 'enigma': cracking the code of cell-cell communication." Mol Microbiol 16(4): 615-624. Fontanari, J. F. and L. I. Perlovsky (2008). "A game theoretical approach to the evolution of structured communication codes." Theory in Biosciences 127(3): 205-214. Li, P. and M. B. Elowitz (2019). "Communication codes in developmental signaling pathways." Development 146(12). Meyer, K., Lammers, N. C., Bugaj, L. J., Garcia, H. G., & Weiner, O. D. (2023). Optogenetic control of YAP reveals a dynamic communication code for stem cell fate and proliferation. Nat Commun, 14(1), 6929.
68	Communication code – B (interorganellar)	Interorganellar Communication Code	de Souza, A. J., Svozil, J., Wang, J.-Z., Ke, H., Xiao, Y., Gruissem, W., & Dehesh, K. (2017). Cracking the Interorganellar Communication Codes. The FASEB Journal, 31(S1), 617.612-617.612.
69	Communication code – C (insects)	The Insect Communication Codes	Leonhardt, B. A. (1985). Insect Communication Codes. Analytical chemistry, 57(12), 1240A-1249A.
70	Communication code – D (plants)	The Plant Communication Codes	Bonato, B., F. Peressotti, S. Guerra, Q. Wang and U. Castiello (2021). "Cracking the code: a comparative approach to plant communication." Communicative & Integrative Biology 14(1): 176-185.
71	Compartment code	The Compartment Code	Barbieri, M. (2003). The organic codes. An introduction to semantic biology., Cambridge University Press. Artmann, S. (2009). "Basic Semiosis as Code-Based Control." Biosemiotics 2(1): 31-38. Ozawa, M. G., Cardó-Vila, M., Mintz, P. J., Arap, W., & Pasqualini, R. (2010). Cracking the code for compartment-specific dual functionality proteins in cancer: The case for CRKL. Cell Cycle, 9(1), 8-9. Maza, N. A., W. E. Schiesser and P. D. Calvert (2019). "An intrinsic compartmentalization code for peripheral membrane proteins in photoreceptor neurons." Journal of Cell Biology 218(11): 3753-3772. Kilgore, H. R., Chinn, I., Mikhael, P. G., Mitnikov, I., Van Dongen, C., Zylberberg, G., . . . Young, R. A. (2025). Protein codes promote selective subcellular compartmentalization. Science, 387(6738), 1095-1101.

			Ye, S., So, C. L., & Cai, D. (2025). Cracking the protein compartmentalization code with ProtGPS. Trends Biochem Sci, 50(5), 369-371.
72	Connexin code	The Connexin Code	Kelsell, D. P., J. Dunlop and M. B. Hodgins (2001). "Human diseases: clues to cracking the connexin code?" Trends Cell Biol 11(1): 2-6.
73	Cooperation codes	The Moral Cooperation Code	Proverbio, A. M., F. Riva, L. Paganelli, S. F. Cappa, N. Canessa, D. Perani and A. Zani (2011). "Neural coding of cooperative vs. affective human interactions: 150 ms to code the action's purpose." PLoS One 6(7): e22026. Efferson, C. and E. Fehr (2018). "Simple moral code supports cooperation." Nature 555(7695): 169-170.
74	Coregulator code	The Transcriptional Coregulator Code **SEE also Transcription Codes**	Rosenfeld, M. G., & Glass, C. K. (2001). Coregulator Codes of Transcriptional Regulation by Nuclear Receptors*. Journal of Biological Chemistry, 276(40), 36865-36868. Stallcup, M. R. and C. Poulard (2020). "Gene-Specific Actions of Transcriptional Coregulators Facilitate Physiological Plasticity: Evidence for a Physiological Coregulator Code." Trends Biochem Sci 45(6): 497-510.
75	Cryptic code	The Cryptic Amyotrophic Sclerosis Code	Akiyama, T., Y. Koike, L. Petrucelli and A. D. Gitler (2022). "Cracking the cryptic code in amyotrophic lateral sclerosis and frontotemporal dementia: Towards therapeutic targets and biomarkers." Clin Transl Med 12(5): e818.
76	CTCF code	The CTCF DNA Binding Code	Nakahashi, H., K. R. Kieffer Kwon, W. Resch, L. Vian, M. Dose, D. Stavreva, O. Hakim, N. Pruett, S. Nelson, A. Yamane, J. Qian, W. Dubois, S. Welsh, R. D. Phair, B. F. Pugh, V. Lobanenkov, G. L. Hager and R. Casellas (2013). "A genome-wide map of CTCF multivalency redefines the CTCF code." Cell Rep 3(5): 1678-1689. Nichols, M. H., & Corces, V. G. (2015). A CTCF Code for 3D Genome Architecture. Cell, 162(4), 703-705. Lobanenkov, V. V., & Zentner, G. E. (2018). Discovering a binary CTCF code with a little help from BORIS. Nucleus, 9(1), 33-41.
77	CTD code	The C-Terminal Domain Code **SEE also Phosphorylation Code**	Buratowski, S. (2003). "The CTD code." Nat Struct Biol 10(9): 679-680. Egloff, S., & Murphy, S. (2008). Cracking the RNA polymerase II CTD code. Trends in Genetics, 24(6), 280-288.

			Tietjen, J. R., D. W. Zhang, J. B. Rodríguez-Molina, B. E. White, M. S. Akhtar, M. Heidemann, X. Li, R. D. Chapman, K. Shokat, S. Keles, D. Eick and A. Z. Ansari (2010). "Chemical-genomic dissection of the CTD code." Nat Struct Mol Biol 17(9): 1154-1161. Schwer, B., & Shuman, S. (2011). Deciphering the RNA polymerase II CTD code in fission yeast. Mol Cell, 43(2), 311-318. Heidemann, M. and D. Eick (2012). "Tyrosine-1 and threonine-4 phosphorylation marks complete the RNA polymerase II CTD phospho-code." RNA Biol 9(9): 1144-1146. Meyer, P. A. and J. Fu (2012). "Mutual remodeling and conformation grid: a mediator code?" Structure 20(5): 755-757. Schwer, B., Sanchez, A. M., & Shuman, S. (2012). Punctuation and syntax of the RNA polymerase II CTD code in fission yeast. Proc Natl Acad Sci U S A, 109(44), 18024-18029. Eick, D. and M. Geyer (2013). "The RNA polymerase II carboxy-terminal domain (CTD) code." Chem Rev 113(11): 8456-8490. Jeronimo, C., A. R. Bataille and F. Robert (2013). "The writers, readers, and functions of the RNA polymerase II C-terminal domain code." Chem Rev 113(11): 8491-8522. Schwer, B., Bitton, D. A., Sanchez, A. M., Bähler, J., & Shuman, S. (2014). Individual letters of the RNA polymerase II CTD code govern distinct gene expression programs in fission yeast. Proc Natl Acad Sci U S A, 111(11), 4185-4190. Doamekpor, S. K., Schwer, B., Sanchez, A. M., Shuman, S., & Lima, C. D. (2015). Fission yeast RNA triphosphatase reads an Spt5 CTD code. Rna, 21(1), 113-123. Materne, P., J. Anandhakumar, V. Migeot, I. Soriano, C. Yague-Sanz, E. Hidalgo, C. Mignion, L. Quintales, F. Antequera and D. Hermand (2015). "Promoter nucleosome dynamics regulated by signalling through the CTD code." Elife 4: e09008. Corden, J. L. (2016). "Pol II CTD Code Light." Mol Cell 61(2): 183-184. Zhang, B., X. Zhong, M. Sauane, Y. Zhao and Z. L. Zheng (2020). "Modulation of the Pol II CTD Phosphorylation Code by Rac1 and Cdc42 Small GTPases in Cultured Human Cancer Cells and Its Implication for Developing a Synthetic-Lethal Cancer Therapy." Cells 9(3). Dieci, G. (2021). "Removing quote marks from the RNA polymerase II CTD 'code'." Biosystems 207: 104468.

			Zhang, Q., Hardtke, H. A., Zheng, Y., Gerber, A., Kumar Venkat Ramani, M., Escobar, E., . . . Zhang, Y. J. (2026). "Zipper" Grammar of CTD Governs the Spatial Programing of the Transcription Cycle of RNA Polymerase II. bioRxiv, 2026.2001.2002.697396.
78	Cryptic code	The Cryptic ALS code	Akiyama, T., Koike, Y., Petrucelli, L., & Gitler, A. D. (2022). Cracking the cryptic code in amyotrophic lateral sclerosis and frontotemporal dementia: Towards therapeutic targets and biomarkers. Clin Transl Med, 12(5), e818.
79	Culture code	The Culture Codes	Lloyd, B. (1976). Culture and Colour Coding. Royal Institute of Philosophy Lectures, 10, 140-161. Molnar, D. (2013). Cracking the colour code: A case study of red. Jezikoslovlje, 14 (2-3), 363-383. Preuzeto s
80	Curvature code	The (Membrane) Curvature Code **SEE also Apoptosis Code**	Santulli, G. (2025). The curvature code: BCL-w dimers rewire BAX-BCL-2 control of mitochondrial fate and apoptosis. Cell Cycle, 24(21-24), 403-408.
81	Cybernetic code	The Cybernetic (Cognition) Code	Wells, A. (2019). "Breaking the Cybernetic Code: Understanding and Treating the Human Metacognitive Control System to Enhance Mental Health." Front Psychol 10: 2621.
82	Cytokine code	The Cytokine Codes	Ulloa, L. and K. J. Tracey (2005). "The "cytokine profile": a code for sepsis." Trends Mol Med 11(2): 56-63. Nickoloff, B. J. (2007). "Cracking the cytokine code in psoriasis." Nat Med 13(3): 242-244. Hartmann, B. M., N. Marjanovic, G. Nudelman, T. M. Moran and S. C. Sealfon (2014). "Combinatorial cytokine code generates anti-viral state in dendritic cells." Front Immunol 5: 73. Nickoloff, B. J. (2023). Cracking the cytokine code in atopic dermatitis reveals IL-13 as dominant driver of disease activity. J Dermatol Sci, 111(3), 128-129. Takahama, M., Patil, A., Richey, G., Cipurko, D., Johnson, K., Carbonetto, P., . . . Chevrier, N. (2024). A pairwise cytokine code explains the organism-wide response to sepsis. Nat Immunol, 25(2), 226-239. Yu, Y., Liu, X., Liu, W., Yuan, H., Han, Q., Shi, J., . . . Li, Y. (2025). Decoding the cytokine code for heart failure based on bioinformatics, machine learning and Bayesian networks. Biochim Biophys Acta Mol Basis Dis, 1871(3), 167701. Florence Vallelian, Dominik Schaer, Nadja Schulthess-Lutz et al. (2025) A CSF-cytokine code predicts macrophage response polarity and tumor outcomes, PREPRINT (Version 1) available at Research Square

			Schaer, D. J., Schulthess-Lutz, N., Peterhans, M. J., Baselgia, L., Eschment, M., Humar, R., & Vallelian, F. (2026). An ontogeny-cytokine code determines macrophage response polarity and tumor outcomes. Commun Biol.
83	Cytoskeleton code	The Cytoskeleton Code	Barbieri, M. (2003). The organic codes. An introduction to semantic biology., Cambridge University Press. Gimona, M. (2008). Protein Linguistics and the Modular Code of the Cytoskeleton. The Codes of Life: The Rules of Macroevolution. M. Barbieri and J. Hoffmeyer. Dordrecht, Springer Netherlands: 189-206. Garhewal, A., Angres, G. J., & Muroyama, A. (2025). The polar code for patterning: how polarity and the cytoskeleton orchestrate asymmetric cell division during plant development [Review]. Front Cell Dev Biol, Volume 13 - 2025. Peris, Leticia (2025). Microtubule-actin crosstalk in dendritic spines: a cytoskeletal code for synaptic stability and neuroprotection. Life Sciences [q-bio]. UGA (Université Grenoble Alpes)
84	Dance code (animal)	The Honey Bee Dance Code	Rohrseitz, K. and J. Tautz (1999). "Honey bee dance communication: waggle run direction coded in antennal contacts?" Journal of Comparative Physiology A 184(4): 463-470.
85	Dance code (human)	The Human Dance Code	Françoise, J., Alaoui, S. F., & Candau, Y. (2022). CO/DA: Live-Coding Movement-Sound Interactions for Dance Improvisation Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems, New Orleans, LA, USA. Ursyn, A. (2025). Dance Code: Dance Steps As A Code (1st ed.). Chapman and Hall/CRC.
86	Decisional Codes	The Neural Decisional Codes	Aller, M., Mihalik, A., & Noppeney, U. (2022). Audiovisual adaptation is expressed in spatial and decisional codes. Nat Commun, 13(1), 3924. Buetfering, C., Zhang, Z., Pitsiani, M., Smallridge, J., Boven, E., McElligott, S., & Häusser, M. (2022). Behaviorally relevant decision coding in primary somatosensory cortex neurons. Nat Neurosci, 25(9), 1225-1236. Kutter, E. F., Viswanathan, P., & Nieder, A. (2026). Dopamine D1 and D2 receptors differentially control strength and dynamics of abstract decision codes in the primate prefrontal cortex. Proceedings of the National Academy of Sciences, 123(15), e2600210123.
87	Defence Code	The Host Defence Code	Medzhitov, R. (2001). "CpG DNA: security code for host defense." Nat Immunol 2(1): 15-16.

88	Dendritic code	The Dendritic Cell Code	Pomeranz, B., & Chung, S. H. (1970). Dendritic-Tree Anatomy Codes Form-Vision Physiology in Tadpole Retina. Science, 170(3961), 983-984. Woolf, N. J. (1999). Dendritic Encoding: An Alternative to Temporal Synaptic Coding of Conscious Experience. Conscious Cogn, 8(4), 447-454. Baba, N., Samson, S., Bourdet-Sicard, R., Rubio, M., & Sarfati, M. (2009). Selected commensal-related bacteria and Toll-like receptor 3 agonist combinatorial codes synergistically induce interleukin-12 production by dendritic cells to trigger a T helper type 1 polarizing programme. Immunology, 128(1pt2), e523-e531. Papoutsi, A., Kastellakis, G., Psarrou, M., Anastasakis, S., & Poirazi, P. (2014). Coding and decoding with dendrites. Journal of Physiology-Paris, 108(1), 18-27. Rashid, S. K., Pedrosa, V., Dufour, M. A., Moore, J. J., Chavlis, S., Delatorre, R. G., . . . Basu, J. (2020). The dendritic spatial code: branch-specific place tuning and its experience-dependent decoupling. bioRxiv, 2020.2001.2024.916643. Stürner, T., Ferreira Castro, A., Philipps, M., Cuntz, H., & Tavosanis, G. (2022). The branching code: A model of actin-driven dendrite arborization. Cell Rep, 39(4). Silva Barcelos, E. C., Ricciuti, D., Mondanelli, G., & Gargaro, M. (2025). Rewriting the dendritic cell code in cancer-from subset identity to immunotherapeutic design. FEBS Lett, 599(14), 2060-2083.
89	Density code	The (Surface Antigen) Density Code	Cheng, W. (2016). The Density Code for the Development of a Vaccine? Journal of Pharmaceutical Sciences, 105(11), 3223-3232.
90	Depression code	The Depression (Neuroinflammatory) Code	Schroeder, M., Hillemacher, T., Bleich, S., & Frieling, H. (2012). The Epigenetic Code in Depression: Implications for Treatment. Clinical Pharmacology & Therapeutics, 91(2), 310-314. Gałecka, M., Bliźniewska-Kowalska, K., Maes, M., Su, K. P., & Gałecki, P. (2021). Update on the neurodevelopmental theory of depression: is there any 'unconscious code'? Pharmacol Rep, 73(2), 346-356. Yuan, Z., Qi, Z., Wang, R., Cui, Y., An, S., Wu, G., . . . Luo, M. (2023). A corticoamygdalar pathway controls reward devaluation and depression using dynamic inhibition code. Neuron, 111(23), 3837-3853.e3835. Comai, S., De Martin, S., Mattarei, A., Guidetti, C., Pappagallo, M., Folli, F., . . . Manfredi, P. L. (2024). N-methyl-D-aspartate Receptors and Depression: Linking Psychopharmacology, Pathology and

			Physiology in a Unifying Hypothesis for the Epigenetic Code of Neural Plasticity. Pharmaceuticals, 17(12), 1618. Li, Y., Ng, S., Kong, K., Jin, M., Fan, W., Zhou, W., . . . Li, H. (2026). Brain–bone axis dysregulation: Biological code underlying the bidirectional association between depression and musculoskeletal disorders. Journal of Orthopaedic Translation, 56, 101044.
91	Developmental code	The Developmental Codes	Zhao, H., Li, B., Liu, L., Wang, X., Zhu, Z., & Liu, Y. (2025). Deciphering the "Developmental Code": A Comprehensive Review of Regulatory Mechanisms in Tomato Trichomes. Journal of Agricultural and Food Chemistry, 73(28), 17358-17373.
92	Diabetes code	The Diabetes Codes	Yau, C., & Danska, J. S. (2024). Cracking the type 1 diabetes code: Genes, microbes, immunity, and the early life environment. Immunological Reviews, 325(1), 23-45.
93	Differentiation code	The Differentiation Code	Gu, X. and N. C. Spitzer (1997). "Breaking the code: regulation of neuronal differentiation by spontaneous calcium transients." Dev Neurosci 19(1): 33-41. Spitzer, N. C. (2009). Neuroscience: A bar code for differentiation. Nature, 458(7240), 843-844. Kondoh, H. and Y. Kamachi (2010). "SOX-partner code for cell specification: Regulatory target selection and underlying molecular mechanisms." Int J Biochem Cell Biol 42(3): 391-399. Gordon, R. and N. K. Gordon (2019). "The differentiation code." Biosystems 184: 104013. Ni, P., & Su, Z. (2019). Deciphering epigenomic code for cell differentiation using deep learning. BMC Genomics, 20(1), 709. Wang, N., X. Ji, Y. Wu, S. Zhou, H. Peng, J. Wang, S. Yu and J. Zhang (2021). "The Different Molecular Code in Generation of Dopaminergic Neurons from Astrocytes and Mesenchymal Stem Cells." Int J Mol Sci 22(22). Metzl-Raz, E., Zhao, R., Deshpande, S., Powell, J., Porter, E. G., Zouaghi, Y., . . . Gifford, C. A. (2025). Deep learning the dynamic regulatory sequence code of cardiac organoid differentiation. bioRxiv.
94	Discriminator code	The Discriminator Codes	Kuncha, S. K., K. Suma, K. I. Pawar, J. Gogoi, S. B. Routh, S. Pottabathini, S. P. Kruparani and R. Sankaranarayanan (2018). "A discriminator code-based DTD surveillance ensures faithful glycine delivery for protein biosynthesis in bacteria." Elife 7.
95	DNA codes	The DNA Codes	Sternberg, R. V. (2008). "DNA codes and information: formal structures and relational causes." Acta Biotheor 56(3): 205-232.

96	DNA-binding code	The DNA-Binding Code **SEE also Zinc finger code**	Gursky, A. V., V. G. Tumanyan, A. S. Zasedatelev, A. L. Zhuze, S. L. Grokhovsky and B. P. Gottikh (1976). "A code controlling specific binding of regulatory proteins to DNA." Mol Biol Rep 2(5): 413-425. Rein, R., R. Garduno, J. T. Egan and S. Columbano (1977). "Elements of a DNA-polypeptide recognition code: electrostatic potential around the double helix, and a stereospecific model for purine recognition." Biosystems 9(2-3): 131-137. Davis, R. L., P. F. Cheng, A. B. Lassar and H. Weintraub (1990). "The MyoD DNA binding domain contains a recognition code for muscle-specific gene activation." Cell 60(5): 733-746. Suzuki, M. (1994). "A framework for the DNA-protein recognition code of the probe helix in transcription factors: the chemical and stereochemical rules." Structure 2(4): 317-326. Suzuki, M. and N. Yagi (1994). "DNA recognition code of transcription factors in the helix-turn-helix, probe helix, hormone receptor, and zinc finger families." Proc Natl Acad Sci U S A 91(26): 12357-12361. Choo, Y., & Klug, A. (1997). Physical basis of a protein-DNA recognition code. Curr Opin Struct Biol, 7(1), 117-125. Dave, V., Zhao, C., Yang, F., Tung, C.-S., & Ma, J. (2000). Reprogrammable Recognition Codes in Bicoid Homeodomain-DNA Interaction. Mol Cell Biol, 20(20), 7673-7684. Boch, J., H. Scholze, S. Schornack, A. Landgraf, S. Hahn, S. Kay, T. Lahaye, A. Nickstadt and U. Bonas (2009). "Breaking the code of DNA binding specificity of TAL-type III effectors." Science 326(5959): 1509-1512. Camas, F. M., E. J. Alm and J. F. Poyatos (2010). "Local gene regulation details a recognition code within the LacI transcriptional factor family." PLoS Comput Biol 6(11): e1000989. Puppin, C., D. Fabbro, L. Pellizzari and G. Damante (2011). "Using the recognition code to swap homeodomain target specificity in cell culture." Mol Biol Rep 38(8): 5349-5354. de Lange, O., T. Schreiber, N. Schandry, J. Radeck, K. H. Braun, J. Koszinowski, H. Heuer, A. Strauß and T. Lahaye (2013). "Breaking the DNA-binding code of Ralstonia solanacearum TAL effectors provides new possibilities to generate plant resistance genes against bacterial wilt disease." New Phytol 199(3): 773-786. Hortschansky, P., E. Ando, K. Tuppatsch, H. Arikawa, T. Kobayashi, M. Kato, H. Haas and A. A. Brakhage (2015). "Deciphering the combinatorial DNA-binding code of the CCAAT-binding complex

			and the iron-regulatory basic region leucine zipper (bZIP) transcription factor HapX." J Biol Chem 290(10): 6058-6070. Joerger, A. C. (2018). "Extending the Code of Sequence Readout by Gene Regulatory Proteins: The Role of Hoogsteen Base Pairing in p53-DNA Recognition." Structure 26(9): 1163-1165. Yao, Y. M., Miodownik, I., O'Hagan, M. P., Jbara, M., & Afek, A. (2024). Deciphering the dynamic code: DNA recognition by transcription factors in the ever-changing genome. Transcription, 15(3-5), 114-138. Riera Aroche, R., Ortiz García, Y. M., Riera Leal, L., Machado Sulbarán, A. C., & Riera Leal, A. (2026). Understanding the underlying language code that governs the π–π non-covalent interactions between proteins and DNA. Scientific Reports.
97	DNA damage code	The DNA Damage Code **SEE also Recombination Codes**	Chen, H., Yang, H., Zhu, X., Yadav, T., Ouyang, J., Truesdell, S. S., . . . Lan, L. (2020). m(5)C modification of mRNA serves a DNA damage code to promote homologous recombination. Nat Commun, 11(1), 2834.
98	DNA replication code	DNA Replication Code	Marmolejo, C. O., Sanchez, C., Lee, J., Werner, M., Roberts, P., Hamperl, S., & Saldivar, J. C. (2024). A phosphorylation code coordinating transcription condensate dynamics with DNA replication. bioRxiv, 2024.2005.2010.593572.
99	Domain code	The Domain (Specificity) Codes	Koide, A., R. N. Gilbreth, K. Esaki, V. Tereshko and S. Koide (2007). "High-affinity single-domain binding proteins with a binary-code interface." Proc Natl Acad Sci U S A 104(16): 6632-6637. Throckmorton, K., V. Vinnik, R. Chowdhury, T. Cook, M. G. Chevrette, C. Maranas, B. Pfleger and M. G. Thomas (2019). "Directed Evolution Reveals the Functional Sequence Space of an Adenylation Domain Specificity Code." ACS Chem Biol 14(9): 2044-2054.
100	Dormancy code	The Dormancy Codes **SEE also Seed Germination Code**	Kumar, V., Jaiswal, D. K., Ansari, W. A., Sahu, P. K., & Kumar Baranwal, V. (2026). Unveiling Nature's Dormancy Code: The Pivotal Role of Brassinosteroids in Seed Germination. Journal of Plant Growth Regulation.
101	Dream code	The Dream (Language) Code	Aragno, A. (2025). The Dream Codes Lectures. IPBooks. Ereiras Vedor, J. (2025). Dreams as a Code Language. Biosystems, 105586.
102	Dress code	The Molecular Dress Codes	Fingleton, B. and C. C. Lynch (2010). "A new dress code for MMPs: cleavage optional." Dev Cell 18(1): 3-4.

			Belkaid, Y. and J. Grainger (2013). "Immunology. Mucus coat, a dress code for tolerance." Science 342(6157): 432-433. Lamaze, C., N. Tardif, M. Dewulf, S. Vassilopoulos and C. M. Blouin (2017). "The caveolae dress code: structure and signaling." Curr Opin Cell Biol 47: 117-125.
103	Ecdysone code	The Ecdysone Codes	Ono, H., K. F. Rewitz, T. Shinoda, K. Itoyama, A. Petryk, R. Rybczynski, M. Jarcho, J. T. Warren, G. Marqués, M. J. Shimell, L. I. Gilbert and M. B. O'Connor (2006). "Spook and Spookier code for stage-specific components of the ecdysone biosynthetic pathway in Diptera." Dev Biol 298(2): 555-570.
104	Ecological codes	The Ecological Codes	Kull, K. (2010). "Ecosystems are Made of Semiosic Bonds: Consortia, Umwelten, Biophony and Ecological Codes." Biosemiotics 3(3): 347-357
105	Endocrine codes	The Endocrine Signalling Codes	Leong, D. A. and M. O. Thorner (1991). "A potential code of luteinizing hormone-releasing hormone-induced calcium ion responses in the regulation of luteinizing hormone secretion among individual gonadotropes." J Biol Chem 266(14): 9016-9022. Dygalo, N. N. (2010). "[Evolution of endocrine glands and neuroendocrine systems: the "humoral code"]." Ross Fiziol Zh Im I M Sechenova 96(7): 675-685. Burnstock, G. (2014). "Purinergic signalling in endocrine organs." Purinergic Signalling 10(1): 189-231. Gribble, F. M. and F. Reimann (2017). "Signalling in the gut endocrine axis." Physiology & Behavior 176: 183-188. Lee, S., J. Choi, J. Mohanty, L. P. Sousa, F. Tome, E. Pardon, J. Steyaert, M. A. Lemmon, I. Lax and J. Schlessinger (2018). "Structures of β-klotho reveal a 'zip code'-like mechanism for endocrine FGF signalling." Nature 553(7689): 501-505. Kuang, H. and J. D. Lin (2019). "GPNMB: expanding the code for liver–fat communication." Nature Metabolism 1(5): 507-508. Hah, Y.-S., Hwang, J., Lee, S.-J., & Kwag, S.-J. (2026). Decoding the Endocrine Code of Skeletal Muscle: Myokines, Exerkines, and Inter-Organ Crosstalk in Metabolic Health and Disease. Cells, 15(4), 318.
106	Endocytic code	The Endocytic Code	Chang, C. P., Lazar, C. S., Walsh, B. J., Komuro, M., Collawn, J. F., Kuhn, L. A., . . . Rosenfeld, M. G. (1993). Ligand-induced internalization of the epidermal growth factor receptor is mediated by multiple endocytic codes analogous to the tyrosine motif found in constitutively internalized receptors. Journal of Biological Chemistry, 268(26), 19312-19320.

			Vleurick, L., Pezet, A., Kühn, E. R., Decuypere, E., & Edery, M. (1999). A β-Turn Endocytic Code Is Required for Optimal Internalization of the Growth Hormone Receptor but Not for α-Adaptin Association. Molecular Endocrinology, 13(11), 1823-1831. Qualmann, B., Koch, D., & Kessels, M. M. (2011). Let's go bananas: revisiting the endocytic BAR code. Embo j, 30(17), 3501-3515. Wang, Q., Chen, X., & Wang, Z. (2015). Dimerization drives EGFR endocytosis through two sets of compatible endocytic codes. J Cell Sci, 128(5), 935-950.
107	Endothelial code	The Endothelial (Iron) Code	Pantopoulos, K. (2025). Foxo1 unlocks the liver endothelial code to iron sensing. Blood, 146(14), 1639-1641.
108	Epigenetic code – A (general)	The Epigenetic (Chromatin) Code **SEE also Histone Code**	Kauffman, S. (1975). Control circuits for determination and transdetermination: interpreting positional information in a binary epigenetic code. Ciba Found Symp, 0(29), 201-221. Imhof, A., & Becker, P. B. (2001). Modifications of the histone N-terminal domains - Evidence for an "epigenetic code"? Molecular Biotechnology, 17(1), 1-13. Benecke, A. (2006). "Chromatin code, local non-equilibrium dynamics, and the emergence of transcription regulatory programs." Eur Phys J E Soft Matter 19(3): 353-366. Fatemi, M. and P. A. Wade (2006). "MBD family proteins: reading the epigenetic code." J Cell Sci 119(Pt 15): 3033-3037. Lesne, A. (2006). "The chromatin regulatory code: beyond a histone code." Eur Phys J E Soft Matter 19(3): 375-377. Nightingale, K. P., L. P. O'Neill and B. M. Turner (2006). "Histone modifications: signalling receptors and potential elements of a heritable epigenetic code." Curr Opin Genet Dev 16(2): 125-136. Turner, B. M. (2007). "Defining an epigenetic code." Nature Cell Biology 9(1): 2-6. Lennartsson, A. and K. Ekwall (2009). "Histone modification patterns and epigenetic codes." Biochim Biophys Acta 1790(9): 863-868. Dhanak, D. (2012). Cracking the Code: The Promise of Epigenetics. ACS Medicinal Chemistry Letters, 3(7), 521-523. Marx, V. (2012). "Epigenetics: Reading the second genomic code." Nature 491(7422): 143-147.

			The EPIC Planning Committee (2012). “Reading the second code: mapping epigenomes to understand plant growth, development, and adaptation to the environment.” Plant Cell 24(6): 2257-2261. Karpathakis, A., Dibra, H., & Thirlwell, C. (2013). Neuroendocrine tumours: cracking the epigenetic code. Endocr Relat Cancer, 20(3), R65-82. Gao, Q., J. Tang, J. Chen, L. Jiang, X. Zhu and Z. Xu (2014). "Epigenetic code and potential epigenetic-based therapies against chronic diseases in developmental origins." Drug Discov Today 19(11): 1744-1750. Bensaddek, D. and A. I. Lamond (2016). "Unlocking the chromatin code by deciphering protein-DNA interactions." Mol Syst Biol 12(11): 887. Nilendu, P., & Sharma, N. K. (2017). Epigenomic Hard Drive Imprinting: A Hidden Code Beyond the Biological Death of Cancer Patients. Journal of Cancer Prevention, 22(4), 211-218. Di Pietro, A. and K. L. Good-Jacobson (2018). "Disrupting the Code: Epigenetic Dysregulation of Lymphocyte Function during Infectious Disease and Lymphoma Development." J Immunol 201(4): 1109-1118. Tchasovnikarova, I. A. and R. E. Kingston (2018). "Beyond the Histone Code: A Physical Map of Chromatin States." Mol Cell 69(1): 5-7. Wang, M., V. Ngo and W. Wang (2021). "Deciphering the genetic code of DNA methylation." Brief Bioinform 22(5). Kong, S., Y. Lu, S. Tan, R. Li, Y. Gao, K. Li and Y. Zhang (2022). “Nucleosome-Omics: A Perspective on the Epigenetic Code and 3D Genome Landscape.” Genes (Basel) 13(7). Xie, S.-S., & Duan, C.-G. (2023). Epigenetic regulation of plant immunity: from chromatin codes to plant disease resistance. aBIOTECH, 4(2), 124-139. Mahendran, G., Shangaradas, A. D., Romero-Moreno, R., Wickramarachchige Dona, N., Sarasija, S. H. G. S., Perera, S., & Silva, G. N. (2024). Unlocking the epigenetic code: new insights into triple-negative breast cancer [Review]. Frontiers in Oncology, Volume 14 - 2024. Talarico, E., Zambelli, A., Araniti, F., Greco, E., Chiappetta, A., & Bruno, L. (2024). Unravelling the Epigenetic Code: DNA Methylation in Plants and Its Role in Stress Response. Epigenomes, 8(3), 30.

			Niu, Q.-q., Xi, Y.-t., Guo, Y.-q., Piao, Z.-j., Zhang, C.-r., Li, T.-y., . . . Kamal, N. N. S. N. M. (2025). Lactylation and methylation: Dual epigenetic codes and potential therapeutic targets in myocardial aging. Ageing Research Reviews, 112, 102849.
109	Epigenetic code – B (stem cell)	The Epigenetic Stem Cell Codes	Yamada, Y., & Watanabe, A. (2010). 7 - Epigenetic Codes in Stem Cells and Cancer Stem Cells. In Z. Herceg & T. Ushijima (Eds.), Advances in Genetics (Vol. 70, pp. 177-199). Academic Press. Bayarsaihan, D. (2016). "Deciphering the Epigenetic Code in Embryonic and Dental Pulp Stem Cells." Yale J Biol Med 89(4): 539-563. Li, Y., Zhao, X., Sun, M., Pei, D., & Li, A. (2022). Deciphering the Epigenetic Code of Stem Cells Derived From Dental Tissues [Review]. Frontiers in Dental Medicine, Volume 2 - 2021.
110	Epigenetic code – C (behaviour)	The Epigenetic Behaviour Codes **SEE also Depression code**	Gräff, J. and I. M. Mansuy (2008). "Epigenetic codes in cognition and behaviour." Behav Brain Res 192(1): 70-87. Maleszka, R. (2016). "Epigenetic code and insect behavioural plasticity." Curr Opin Insect Sci 15: 45-52. Fustin, J. M., R. Kojima, K. Itoh, H. Y. Chang, S. Ye, B. Zhuang, A. Oji, S. Gibo, R. Narasimamurthy, D. Virshup, G. Kurosawa, M. Doi, I. Manabe, Y. Ishihama, M. Ikawa and H. Okamura (2018). "Two Ck1δ transcripts regulated by m6A methylation code for two antagonistic kinases in the control of the circadian clock." Proc Natl Acad Sci U S A 115(23): 5980-5985.
111	Epigenetic code – D (miscellaneous)	The Epigenetic Code Miscellaneous	Jiang, Y., & Hsieh, J. (2012). Harnessing Adult Neurogenesis By Cracking the Epigenetic Code. Future Neurology, 7(1), 65-79. Treas, J. N., T. Tyagi and K. P. Singh (2012). "Effects of chronic exposure to arsenic and estrogen on epigenetic regulatory genes expression and epigenetic code in human prostate epithelial cells." PLoS One 7(8): e43880. Bronner, C., M. Krifa and M. Mousli (2013). "Increasing role of UHRF1 in the reading and inheritance of the epigenetic code as well as in tumorogenesis." Biochem Pharmacol 86(12): 1643-1649. Santoni, F. A. (2013). "EMdeCODE: a novel algorithm capable of reading words of epigenetic code to predict enhancers and retroviral integration sites and to identify H3R2me1 as a distinctive mark of coding versus non-coding genes." Nucleic Acids Res 41(3): e48. Allan, R. S., & Nutt, S. L. (2014). Deciphering the epigenetic code of T lymphocytes. Immunological Reviews, 261(1), 50-61.

			Infante, T., F. P. Mancini, A. Lanza, A. Soricelli, F. de Nigris and C. Napoli (2015). “Polycomb YY1 is a critical interface between epigenetic code and miRNA machinery after exposure to hypoxia in malignancy.” Biochim Biophys Acta 1853(5): 975-986. Biot, M. and B. de Massy (2020). "Reading the epigenetic code for exchanging DNA." Elife 9. Kawaguchi, A., Wang, J., Knapp, D., Murawala, P., Nowoshilow, S., Masselink, W., . . . Tanaka, E. M. (2024). A chromatin code for limb segment identity in axolotl limb regeneration. Dev Cell, 59(16), 2239-2253.e2239. Yan, Y., Liu, H., Abedini, A., Sheng, X., Palmer, M., Li, H., & Susztak, K. (2024). Unraveling the epigenetic code: human kidney DNA methylation and chromatin dynamics in renal disease development. Nat Commun, 15(1), 873. Goldberg, D. C., Cloud, C., Lee, S. M., Barnes, B., Gruber, S., Kim, E., . . . Zhou, W. (2025). Scalable screening of ternary-code DNA methylation dynamics associated with human traits. Cell Genomics, 5(9). Lee, S. M., Goldberg, D. C., Cloud, C., Parker, J. B., Krapp, C., Loo, C. E., . . . Zhou, W. (2025). A ternary-code DNA methylome atlas of mouse tissues. Genome Biology, 26(1), 343. Lombò, M., Cobellis, G., & Manfrevola, F. (2025). Editorial: Sperm epigenetic code: implications in reproductive health and paternal contribution to embryo development. Front Cell Dev Biol, 13, 1666435.
112	Episode code	The episodic memory code	Sakabe, E. Y., Camargo, E., Simões, A., Colombini, E., Costa, P., & Gudwin, R. (2025). An episode encoding mechanism for cognitive architectures. Cognitive Systems Research, 101397.
113	Epitope code	The Epitope Codes	Konstantinou, G. N., Yin Wong, L. S., & Nowak-Wegrzyn, A. (2025). Reading the code of epitope-specific IgE: Predicting persistence and resolution in peanut allergy. Journal of Allergy and Clinical Immunology, 156(6), 1520-1522.
114	Epitranscriptomic code	The Epitranscriptomic Code	Berlivet, S., J. Scutenaire, J. M. Deragon and C. Bousquet-Antonelli (2019). "Readers of the m(6)A epitranscriptomic code." Biochim Biophys Acta Gene Regul Mech 1862(3): 329-342. Deng, L., J. Kumar, R. Rose, W. McIntyre and D. Fabris (2022). “Analyzing RNA posttranscriptional modifications to decipher the epitranscriptomic code.” Mass Spectrom Rev: e21798.
115	E-protein code	The Combinatorial E-Protein Code	BARNDT, R. J., & ZHUANG, Y. (1999). Controlling Lymphopoiesis with a Combinatorial E-protein Code. Cold Spring Harbor Symposia on Quantitative Biology, 64, 45-50.

116	Error correcting code	The Error Correcting Code	Štambuk, N., & Konjevoda, P. (2001). New computational algorithm for the prediction of protein folding types. International Journal of Quantum Chemistry, 84(1), 13-22. Battail, G. (2007). Information Theory and Error-Correcting Codes In Genetics and Biological Evolution. Introduction to Biosemiotics: The New Biological Synthesis. M. Barbieri. Dordrecht, Springer Netherlands: 299-345. Faria, L. C., A. S. Rocha, J. H. Kleinschmidt, M. C. Silva-Filho, E. Bim, R. H. Herai, M. E. Yamagishi and R. Palazzo, Jr. (2012). "Is a genome a codeword of an error-correcting code?" PloS One 7(5): e36644. Ashlock, D., S. K. Houghten, J. A. Brown and J. Orth (2012). "On the synthesis of DNA error correcting codes." Biosystems 110(1): 1-8. Battail, G. (2019). "Error-correcting codes and information in biology." Biosystems 184: 103987.
117	ER stress code	The Endoplasmatic Reticulum Stress Code	Varshney, V., Singh, J., & Mishra, V. (2024). Unlocking the plant ER stress code: IRE1-proteasome signaling cohort takes the lead. Trends Plant Sci, 29(6), 610-612.
118	Estrogen code	The Estrogen (Receptor) Code	Le Romancer, M., Poulard, C., Cohen, P., Sentis, S., Renoir, J.-M., & Corbo, L. (2011). Cracking the Estrogen Receptor's Posttranslational Code in Breast Tumors. Endocrine Reviews, 32(5), 597-622.
119	Eukaryogenesis codes	The Eukaryogenesis Codes	Igamberdiev, A. U. (2025). The development of code systems during eukaryogenesis and the rise of multicellularity. Biosystems, 255, 105546.
120	Event codes	Neural Event Tracking Code	Collin, S. H. P., Kempner, R. P., Srivatsan, S., & Norman, K. A. (2025). Neural codes track prior events in a narrative and predict subsequent memory for details. Communications Psychology, 3(1), 26.
121	Export / Exit code	The Export & Exit Codes	Nishimura, N., S. Bannykh, S. Slabough, J. Matteson, Y. Altschuler, K. Hahn and W. E. Balch (1999). "A di-acidic (DXE) code directs concentration of cargo during export from the endoplasmic reticulum." J Biol Chem 274(22): 15937-15946. Wang, X., J. Matteson, Y. An, B. Moyer, J. S. Yoo, S. Bannykh, I. A. Wilson, J. R. Riordan and W. E. Balch (2004). "COPII-dependent export of cystic fibrosis transmembrane conductance regulator from the ER uses a di-acidic exit code." J Cell Biol 167(1): 65-74. Roy, G., Chalfin, E. M., Saxena, A., & Wang, X. (2010). Interplay between ER Exit Code and Domain Conformation in CFTR Misprocessing and Rescue. Mol Biol Cell, 21(4), 597-609.
122	Extensin code	The (Plant) Extensin Codes	Kieliszewski, M. J., & Lamport, D. T. A. (1994). Extensin: repetitive motifs, functional sites, post-translational codes, and phylogeny. The Plant Journal, 5(2), 157-172.

123	Fear code	The Thalamic Fear Code	Tuna, T., Totty, M. S., Badarnee, M., Afonso Gonçalves Mourão, F., Peters, S., Milad, M. R., & Maren, S. (2025). Associative coding of conditioned fear in the thalamic nucleus reuniens in rodents and humans. bioRxiv, 2025.2003.2018.643915.
124	Feng-flavor baijiu code	The Feng-Flavor Baijiu Code	Zhang, Y., Liu, K., Ding, X., Feng, Y., Jing, C., Zhang, Y., & Bai, L. (2026). Unlocking the Feng-flavor baijiu code: Single-strain yeast inoculants outperform co-cultures in enhancing sweet honey-ester aroma. Food Res Int, 230, 118518.
125	Ferroptosis code	The Ferroptosis Code	Zhao, X., Hsu, C.-L., & Spruston, N. (2022). Rapid synaptic plasticity contributes to a learned conjunctive code of position and choice-related information in the hippocampus. Neuron, 110(1), 96-108.e104. Cai, X., Zhang, Y., Qin, W., & Li, X. (2026). Molecular code of ferroptosis: emerging multi-dimensional modifications and therapeutic targets in hepatic disorders. Metabolism, 175, 156457.
126	Fiber code	The Fiber Code	Dong, Y. (2026). The fiber code: AI predicts HCC in MASLD. Hepatology, 83(3).
127	Fibrogenic code	The Fibrogenic Code **SEE also Inflammation Codes**	Friedersdorf, M., & Diehl, A. M. (2021). Inflammation Writes the Fibrogenic Code. Cell Mol Gastroenterol Hepatol, 12(3), 1147-1148.
128	Flower code	The (Cancer) Flower Code **SEE also Cancer Code**	Rhiner, C., López-Gay, J. M., Soldini, D., Casas-Tinto, S., Martín, F. A., Lombardía, L., & Moreno, E. (2010). Flower Forms an Extracellular Code that Reveals the Fitness of a Cell to its Neighbors in Drosophila. Dev Cell, 18(6), 985-998. Casas-Tinto, S., Torres, M., & Moreno, E. (2011). The flower code and cancer development. Clinical and Translational Oncology, 13(1), 5-9.
129	Folding code	The Protein Folding Code	Alexander, P. A., Y. He, Y. Chen, J. Orban and P. N. Bryan (2009). "A minimal sequence code for switching protein structure and function." Proc Natl Acad Sci U S A 106(50): 21149-21154. Joo, H., A. G. Chavan, J. Phan, R. Day and J. Tsai (2012). "An amino acid packing code for α-helical structure and protein design." J Mol Biol 419(3-4): 234-254. Joo, H. and J. Tsai (2014). "An amino acid code for β-sheet packing structure." Proteins 82(9): 2128-2140. Carter, C. W., Jr. and R. Wolfenden (2015). "tRNA acceptor stem and anticodon bases form independent codes related to protein folding." Proc Natl Acad Sci U S A 112(24): 7489-7494.

			van der Linden, M. G., Ferreira, D. C., & Pereira de Araújo, A. F. (2022). Constrained Layer Assignment for the Protein Burial Folding Code Accounting for Chain Connectivity. The Journal of Physical Chemistry B, 126(33), 6159-6170.
130	FoxO code	The Forkhead Transcription Factor Code	Calnan, D. R. and A. Brunet (2008). "The FoxO code." Oncogene 27(16): 2276-2288.
131	GABA code	The GABA Receptor Code	Jang, H. J., Park, K., Lee, J., Kim, H., Han, K. H., & Kwag, J. (2015). GABAA receptor-mediated feedforward and feedback inhibition differentially modulate the gain and the neural code transformation in hippocampal CA1 pyramidal cells. Neuropharmacology, 99, 177-186. Iorio, M. T., F. D. Vogel, F. Koniuszewski, P. Scholze, S. Rehman, X. Simeone, M. Schnürch, M. D. Mihovilovic and M. Ernst (2020). "GABA(A) Receptor Ligands Often Interact with Binding Sites in the Transmembrane Domain and in the Extracellular Domain-Can the Promiscuity Code Be Cracked?" Int J Mol Sci 21(1).
132	Genetic code – A (historical)	The Historical Papers on the Genetic Code	Dounce, A. L. (1952). "[Duplicating mechanism for peptide chain and nucleic acid synthesis]." Enzymologia 15(5): 251-258. Dounce, A. L. (1953). "Nucleic Acid Template Hypotheses." Nature 172(4377): 541-541. Gamow, G. (1954). "Possible Relation between Deoxyribonucleic Acid and Protein Structures." Nature 173(4398): 318-318. Berg, P. and E. J. Offengand (1958). "An Enzymatic Mechanism for Linking Amino Acids to RNA." Proc Natl Acad Sci U S A 44(2): 78-86. Nirenberg, M. W. and J. H. Matthaei (1961). "The dependence of cell-free protein synthesis in E. coli upon naturally occurring or synthetic polyribonucleotides." Proceedings of the National Academy of Sciences 47(10): 1588-1602. Lengyel, P., J. F. Speyer and S. Ochoa (1961). "Synthetic polynucleotides and the amino acid code." Proc Natl Acad Sci U S A 47(12): 1936-1942. Speyer, J. F., P. Lengyel, C. Basilio, A. J. Wahba, R. S. Gardner and S. Ochoa (1963). "Synthetic Polynucleotides and the Amino Acid Code." Cold Spring Harbor Symposia on Quantitative Biology 28: 559-567. Nirenberg, M. and P. Leder (1964). "RNA Codewords and Protein Synthesis." Science 145(3639): 1399-1407.

			Nishimura, S., D. S. Jones and H. G. Khorana (1965). “Studies on polynucleotides. 48. The in vitro synthesis of a co-polypeptide containing two amino acids in alternating sequence dependent upon a DNA-like polymer containing two nucleotides in alternating sequence.” J Mol Biol 13(1): 302-324. Woese, C. R. (1965). “Order in the genetic code.” Proc Natl Acad Sci U S A 54(1): 71-75. Basilio, C., Bravo, M., & Allende, J. E. (1966). Ribonucleic acid code words in wheat germ. J Biol Chem, 241(8), 1917-1919. Nirenberg, M., T. Caskey, R. Marshall, R. Brimacombe, D. Kellogg, B. Doctor, D. Hatfield, J. Levin, F. Rottman, S. Pestka, M. Wilcox and F. Anderson (1966). “The RNA code and protein synthesis.” Cold Spring Harb Symp Quant Biol 31: 11-24. Khorana, H. G., H. Büuchi, H. Ghosh, N. Gupta, T. M. Jacob, H. Kössel, R. Morgan, S. A. Narang, E. Ohtsuka and R. D. Wells (1966). “Polynucleotide Synthesis and the Genetic Code.” Cold Spring Harbor Symposia on Quantitative Biology 31: 39-49.
133	Genetic code – B (research)	Research Papers on the Genetic Code	Taylor, F. J. R. and D. Coates (1989). "The code within the codons." Biosystems 22(3): 177-187. Jukes, T. H. and S. Osawa (1990). “The genetic code in mitochondria and chloroplasts.” Experientia 46(11-12): 1117-1126. Haig, D. and L. D. Hurst (1991). “A quantitative measure of error minimization in the genetic code.” J Mol Evol 33(5): 412-417. Arquès, D. G. and C. J. Michel (1997). "A code in the protein coding genes." Biosystems 44(2): 107-134. Cebrat, S., P. Mackiewicz and M. R. Dudek (1998). "The role of the genetic code in generating new coding sequences inside existing genes." Biosystems 45(2): 165-176. Freeland, S. J. and L. D. Hurst (1998). “The Genetic Code Is One in a Million.” Journal of Molecular Evolution 47(3): 238-248. Ronneberg, T. A., Landweber, L. F., & Freeland, S. J. (2000). Testing a biosynthetic theory of the genetic code: Fact or artifact? Proceedings of the National Academy of Sciences, 97(25), 13690-13695. Bollenbach, T., K. Vetsigian and R. Kishony (2007). “Evolution and multilevel optimization of the genetic code.” Genome Res 17(4): 401-404.

			Kun, Á., S. Pongor, F. Jordán and E. Szathmáry (2008). Catalytic Propensity of Amino Acids and the Origins of the Genetic Code and Proteins. The Codes of Life: The Rules of Macroevolution. M. Barbieri and J. Hoffmeyer. Dordrecht, Springer Netherlands: 39-58. Di Giulio, M. (2008). Why the Genetic Code Originated: Implications for the Origin of Protein Synthesis. The Codes of Life: The Rules of Macroevolution. M. Barbieri and J. Hoffmeyer. Dordrecht, Springer Netherlands: 59-67. Guimarães, R. C., C. H. C. Moreira and S. T. de Farias (2008). Self-Referential Formation of the Genetic System. The Codes of Life: The Rules of Macroevolution. M. Barbieri and J. Hoffmeyer. Dordrecht, Springer Netherlands: 69-110. Gonzalez, D. L. (2008). The Mathematical Structure of the Genetic Code. The Codes of Life: The Rules of Macroevolution. M. Barbieri and J. Hoffmeyer. Dordrecht, Springer Netherlands: 111-152. shCherbak, V. (2008). The Arithmetical Origin of the Genetic Code. The Codes of Life: The Rules of Macroevolution. M. Barbieri and J. Hoffmeyer. Dordrecht, Springer Netherlands: 153-185. Rodin, A. S., E. Szathmáry and S. N. Rodin (2011). “On origin of genetic code and tRNA before translation.” Biol Direct 6: 14. Seligmann, H. (2015). "Phylogeny of genetic codes and punctuation codes within genetic codes." Biosystems 129: 36-43. Barbieri, M. (2019). "Evolution of the genetic code: The ambiguity-reduction theory." Biosystems 185: 104024. Zolyan, S. (2021). "On the context-sensitive grammar of the genetic code." Biosystems 208: 104497. Michel, C. J. (2021). "Genes on the circular code alphabet." Biosystems 206: 104431. Karasev, V. A. (2022). "The Canonical Table of the Genetic Code as a periodic system of triplets." Biosystems 214: 104636. Rosandić, M. and V. Paar (2022). "Standard Genetic Code vs. Supersymmetry Genetic Code – Alphabetical table vs. physicochemical table." Biosystems 218: 104695. Samhita, L. (2022). “Re-reading the genetic code: The evolutionary potential of frameshifting in time.” J Biosci 47. Zürcher, J. F., Robertson, W. E., Kappes, T., Petris, G., Elliott, T. S., Salmond, G. P. C., & Chin, J. W. (2022). Refactored genetic codes enable bidirectional genetic isolation. Science, 378(6619), 516-523.

			Showbharnikhaa, S., Vijayalakshmi M.K., Akshaya T. (2024) Unlocking the Genetic Code: Pharmacogenomics and the Potential of Personalized Medicine: Review Article. Journal of Pharma Insights and Research, 2(1), 050–055. Worning, P., & Ibarra-Chávez, R. (2026). Gene sharing has stabilised the genetic code. Trends in Genetics, 42(4), 314-323.
134	Genetic Code – C (expanded)	The Expanded Genetic Code	Moore, B., B. C. Persson, C. C. Nelson, R. F. Gesteland and J. F. Atkins (2000). "Quadruplet codons: implications for code expansion and the specification of translation step size." J Mol Biol 298(2): 195-209. Budisa, N. (2004). "Prolegomena to Future Experimental Efforts on Genetic Code Engineering by Expanding Its Amino Acid Repertoire." Angewandte Chemie International Edition 43(47): 6426-6463. Wang, L. and P. G. Schultz (2005). "Expanding the Genetic Code." AngewandteChemie International Edition 44(1): 34-66. Cropp, T. A., J. C. Anderson and J. W. Chin (2007). "Reprogramming the amino-acid substrate specificity of orthogonal aminoacyl-tRNA synthetases to expand the genetic code of eukaryotic cells." Nat Protoc 2(10): 2590-2600. Liu, C. C., A. V. Mack, M. L. Tsao, J. H. Mills, H. S. Lee, H. Choe, M. Farzan, P. G. Schultz and V. V. Smider (2008). "Protein evolution with an expanded genetic code." Proc Natl Acad Sci U S A 105(46): 17688-17693. Bohlke, N. and N. Budisa (2014). "Sense codon emancipation for proteome-wide incorporation of noncanonical amino acids: rare isoleucine codon AUA as a target for genetic code expansion." FEMS Microbiol Lett 351(2): 133-144. Aerni, H. R., M. A. Shifman, S. Rogulina, P. O'Donoghue and J. Rinehart (2015). "Revealing the amino acid composition of proteins within an expanded genetic code." Nucleic Acids Res 43(2): e8. Oron-Gottesman, A., M. Sauert, I. Moll and H. Engelberg-Kulka (2016). "A Stress-Induced Bias in the Reading of the Genetic Code in Escherichia coli." mBio 7(6). Hoffman, K. S., A. Crnković and D. Söll (2018). "Versatility of Synthetic tRNAs in Genetic Code Expansion." Genes (Basel) 9(11). Su, H. J., T. J. Barkman, W. Hao, S. S. Jones, J. Naumann, E. Skippington, E. K. Wafula, J. M. Hu, J. D. Palmer and C. W. dePamphilis (2019). "Novel genetic code and record-setting AT-richness in the

			highly reduced plastid genome of the holoparasitic plant Balanophora." Proc Natl Acad Sci U S A 116(3): 934-943. Turmel, M., A. Lopes Dos Santos, C. Otis, R. Sergerie and C. Lemieux (2019). "Tracing the Evolution of the Plastome and Mitogenome in the Chloropicophyceae Uncovered Convergent tRNA Gene Losses and a Variant Plastid Genetic Code." Genome Biol Evol 11(4): 1275-1292. Kivenson, V. and S. J. Giovannoni (2020). "An Expanded Genetic Code Enables Trimethylamine Metabolism in Human Gut Bacteria." mSystems 5(5). Bag, S. S., I. Saraogi and J. Guo (2022). "Editorial: Expansion of the Genetic Code: Unnatural Amino Acids and their Applications." Front Chem 10: 958433. McFeely, C. A. L., Shakya, B., Makovsky, C. A., Haney, A. K., Ashton Cropp, T., & Hartman, M. C. T. (2023). Extensive breaking of genetic code degeneracy with non-canonical amino acids. Nat Commun, 14(1), 5008. Reinkemeier, C. D. and E. A. Lemke (2023). "Synthetic Organelles for Multiple mRNA Selective Genetic Code Expansions in Eukaryotes." Methods Mol Biol 2563: 341-369. Awawdeh, A., Radecki, A. A., & Vargas-Rodriguez, O. (2024). Suppressor tRNAs at the interface of genetic code expansion and medicine [Mini Review]. Front Genet, Volume 15. Kim, Y., Cho, S., Kim, J. C., & Park, H. S. (2024). tRNA engineering strategies for genetic code expansion. Front Genet, 15, 1373250. Natter Perdiguero, A., & Deliz Liang, A. (2024). Practical Approaches to Genetic Code Expansion with Aminoacyl-tRNA Synthetase/tRNA Pairs. Chimia (Aarau), 78(1-2), 22-31. Huang, Y., Zhang, P., Wang, H., Chen, Y., Liu, T., & Luo, X. (2025). Genetic Code Expansion: Recent Developments and Emerging Applications. Chemical Reviews, 125(2), 523-598. Mittal, S., Jena, M. K., & Pathak, B. (2025). Unlocking the 12-Letter Genetic Code: ML-Empowered Quantum Nanopore Base-Calling Even for DNA Isomers. ACS Applied Nano Materials, 8(23), 12065-12078. Zhang, J., Yu, K., Xu, Y., Zhao, W., Li, Y., Wang, Y., . . . Liao, C. (2025). A robust platform streamlining aromatic noncanonical amino acid biosynthesis and genetic code expansion in Escherichia coli. Nat Commun, 16(1), 8605.

			Zong, Z. (2025). Expanding the genetic code for site-specific lysine lactylation. Nature Reviews Molecular Cell Biology, 26(4), 252-252. Katoh, T., & Suga, H. (2026). A reprogrammed genetic code consisting of 32 distinct amino acids. Nucleic Acids Res, 54(4).
135	Genetic code – D (alternative)	The Alternative Genetic Codes	Doerfler, W. (1982). “In search of more complex genetic codes—can linguistics be a guide?” Med Hypotheses 9(6): 563-579. Parker, J. (1989). "Errors and alternatives in reading the universal genetic code." Microbiol Rev 53(3): 273-298. Osawa, S., D. Collins, T. Ohama, T. H. Jukes and K. Watanabe (1990). "Evolution of the mitochondrial genetic code. III. Reassignment of CUN codons from leucine to threonine during evolution of yeast mitochondria." J Mol Evol 30(4): 322-328. Suzuki, T., T. Ueda, T. Yokogawa, K. Nishikawa and K. Watanabe (1994). "Characterization of serine and leucine tRNAs in an asporogenic yeast Candida cylindracea and evolutionary implications of genes for tRNA(Ser)CAG responsible for translation of a non-universal genetic code." Nucleic Acids Res 22(2): 115-123. Keeling, P. J. and W. F. Doolittle (1996). "A non-canonical genetic code in an early diverging eukaryotic lineage." Embo j 15(9): 2285-2290. Lang-Unnasch, N. and D. P. Aiello (1999). “Sequence evidence for an altered genetic code in the Neospora caninum plastid.” Int J Parasitol 29(10): 1557-1562. Fellouse, F. A., Wiesmann, C., & Sidhu, S. S. (2004). Synthetic antibodies from a four-amino-acid code: A dominant role for tyrosine in antigen recognition. Proceedings of the National Academy of Sciences, 101(34), 12467-12472. Wang, K., H. Neumann, S. Y. Peak-Chew and J. W. Chin (2007). "Evolved orthogonal ribosomes enhance the efficiency of synthetic genetic code expansion." Nat Biotechnol 25(7): 770-777. McCutcheon, J. P., B. R. McDonald and N. A. Moran (2009). “Origin of an alternative genetic code in the extremely small and GC-rich genome of a bacterial symbiont.” PloS Genet 5(7): e1000565. Castro-Chavez, F. (2010). "The rules of variation: amino acid exchange according to the rotating circular genetic code." J Theor Biol 264(3): 711-721.

			Cocquyt, E., G. H. Gile, F. Leliaert, H. Verbruggen, P. J. Keeling and O. De Clerck (2010). "Complex phylogenetic distribution of a non-canonical genetic code in green algae." BMC Evol Biol 10: 327. Moura, G. R., Paredes, J. A., & Santos, M. A. (2010). Development of the genetic code: insights from a fungal codon reassignment. FEBS Lett, 584(2), 334-341. Matsumoto, T., S. A. Ishikawa, T. Hashimoto and Y. Inagaki (2011). “A deviant genetic code in the green alga-derived plastid in the dinoflagellate Lepidodinium chlorophorum.” Mol Phylogenet Evol 60(1): 68-72. Santos, M. A., Gomes, A. C., Santos, M. C., Carreto, L. C., & Moura, G. R. (2011). The genetic code of the fungal CTG clade. C R Biol, 334(8-9), 607-611. Sczepanski, J. T. and G. F. Joyce (2012). "Synthetic evolving systems that implement a user-specified genetic code of arbitrary design." Chem Biol 19(10): 1324-1332. Roukos, D. H. (2012). "Biotechnological, genomics and systems-synthetic biology revolution: redesigning genetic code for a pragmatic systems medicine." Expert Rev Med Devices 9(2): 97-101. Bezerra, A. R., Simões, J., Lee, W., Rung, J., Weil, T., Gut, I. G., . . . Santos, M. A. (2013). Reversion of a fungal genetic code alteration links proteome instability with genomic and phenotypic diversification. Proc Natl Acad Sci U S A, 110(27), 11079-11084. Hofer, U. (2013). Fungal genetics: Candida chooses its code. Nat Rev Microbiol, 11(8), 511. Mateus, D. D., Paredes, J. A., Español, Y., Ribas de Pouplana, L., Moura, G. R., & Santos, M. A. S. (2013). Molecular reconstruction of a fungal genetic code alteration. RNA Biol, 10(6), 968-980. Ling, J., O'Donoghue, P., & Söll, D. (2015). Genetic code flexibility in microorganisms: novel mechanisms and impact on physiology. Nature Reviews Microbiology, 13(11), 707-721. Nagao, A., Ohara, M., Miyauchi, K., Yokobori, S.-i., Yamagishi, A., Watanabe, K., & Suzuki, T. (2017). Hydroxylation of a conserved tRNA modification establishes non-universal genetic code in echinoderm mitochondria. Nature Structural & Molecular Biology, 24(9), 778-782. Ma, N. J., C. F. Hemez, K. W. Barber, J. Rinehart and F. J. Isaacs (2018). “Organisms with alternative genetic codes resolve unassigned codons via mistranslation and ribosomal rescue.” eLife 7: e34878. Fimmel, E. and L. Strüngmann (2019). "Linear codes and the mitochondrial genetic code." Biosystems 184: 103990.

			Meng, K., C. Z. Chung, D. Söll and N. Krahn (2022). "Unconventional genetic code systems in archaea." Front Microbiol 13: 1007832. Pfennig, A., Lomsadze, A., & Borodovsky, M. (2023). MgCod: Gene Prediction in Phage Genomes with Multiple Genetic Codes. J Mol Biol, 435(14), 168159.
136	Genetic code, second	The Second Genetic Code	Mohanty, Bijan B (2025) Does a Second Genetic Code Really Exist? Available at SSRN. Mohanty, B. B. (2025). Reassessing the Notion of a Second Genetic Code, A Historical Review and a Path Toward Clearer Genomic Classification. International Journal of Science and Research (IJSR), 14(11), 1470-1473. Mohanty, Bijan B (2025) Discovery of the Second Genetic Code. Available at SSRN. Mohanty, Bijan B (2026) Preliminary Evidence of Correlations between the Second Genetic Code & the Standard Genetic Code. Available at SSRN.
137	Genome regulatory code	The Genomic Regulatory Code	Rister, J. and C. Desplan (2010). "Deciphering the genome's regulatory code: the many languages of DNA." Bioessays 32(5): 381-384. Willis, N. A., E. Rass and R. Scully (2015). "Deciphering the Code of the Cancer Genome: Mechanisms of Chromosome Rearrangement." Trends Cancer 1(4): 217-230. Kelley, D. R., J. Snoek and J. L. Rinn (2016). "Basset: learning the regulatory code of the accessible genome with deep convolutional neural networks." Genome Res 26(7): 990-999. Istrail, S. (2019). "Eric Davidson's Regulatory Genome for Computer Science: Causality, Logic, and Proof Principles of the Genomic cis-Regulatory Code." J Comput Biol 26(7): 653-684. Mozziconacci, J., M. Merle and A. Lesne (2020). "The 3D Genome Shapes the Regulatory Code of Developmental Genes." J Mol Biol 432(3): 712-723. Basu, A., D. G. Bobrovnikov, B. Cieza, J. P. Arcon, Z. Qureshi, M. Orozco and T. Ha (2022). "Deciphering the mechanical code of the genome and epigenome." Nat Struct Mol Biol. Riolo, J., & Steckl, A. J. (2022). Comparative analysis of genome code complexity and manufacturability with engineering benchmarks. Scientific Reports, 12(1), 2808.
138	Genomic code	The Genomic Code	Pennisi, E. (2004). "Searching for the genome's second code." Science 306(5696): 632-635. Segal, E., Y. Fondufe-Mittendorf, L. Chen, A. Thåström, Y. Field, I. K. Moore, J.-P. Z. Wang and J. Widom (2006). "A genomic code for nucleosome positioning." Nature 442(7104): 772-778.

			Lee, B., H. Song, K. Rizzoti, Y. Son, J. Yoon, K. Baek and Y. Jeong (2013). "Genomic code for Sox2 binding uncovers its regulatory role in Six3 activation in the forebrain." Dev Biol 381(2): 491-501. Ward, M. C. and Y. Gilad (2017). "Human genomics: Cracking the regulatory code." Nature 550(7675): 190-191. Bernardi, G. (2019). “The Genomic Code: A Pervasive Encoding/Molding of Chromatin Structures and a Solution of the “Non-Coding DNA” Mystery.” BioEssays 41(12): 1900106. Dinh, T. T., Xiang, M., Rajaraman, A., Wang, Y., Salazar, N., Roper, W., . . . Butcher, E. C. (2022). An NKX-COUP-TFII genomic code for mucosal vascular addressins and organ morphogenesis. bioRxiv, 2022.2002.2017.480956. Riolo, J. and A. J. Steckl (2022). “Comparative analysis of genome code complexity and manufacturability with engineering benchmarks.” Sci Rep 12(1): 2808. Anastasiadi, D., & Wellenreuther, M. (2023). A conserved genomic code underpins animal DNA methylation patterns. Trends in Ecology & Evolution, 38(11), 1016-1018. Wander, S. A., & Bardia, A. (2024). Cracking the Genomic Code of CDK4/6 Inhibitor Resistance. Clinical Cancer Research, 30(10), 2008-2010. Cheng, S., Wei, Y., Zhou, Y., Xu, Z., Wright, D. N., Liu, J., & Peng, Y. (2025). Deciphering genomic codes using advanced natural language processing techniques: a scoping review. Journal of the American Medical Informatics Association, 32(4), 761-772. Meralli, Sameer (2025). Adaptive Archaic Introgression and Phenotypic Modulation: A New Framework to Deciphering the Genomic Code of Denisovan-derived Haplotypes in Modern Humans
139	Ghrelin code	The Ghrelin Receptor Code	Bouzo-Lorenzo, M., Santo-Zas, I., Lodeiro, M., Nogueiras, R., Casanueva, F. F., Castro, M., . . . Camiña, J. P. (2016). Distinct phosphorylation sites on the ghrelin receptor, GHSR1a, establish a code that determines the functions of ß-arrestins. Scientific Reports, 6(1), 22495.
140	Gli code	The Gli Codes	Ruiz i Altaba, A., V. Nguyên and V. Palma (2003). "The emergent design of the neural tube: prepattern, SHH morphogen and GLI code." Curr Opin Genet Dev 13(5): 513-521. Ruiz i Altaba, A., C. Mas and B. Stecca (2007). "The Gli code: an information nexus regulating cell fate, stemness and cancer." Trends Cell Biol 17(9): 438-447.

			Devine, C. A., J. L. Sbrogna, B. Guner, M. Osgood, M. C. Shen and R. O. Karlstrom (2009). "A dynamic Gli code interprets Hh signals to regulate induction, patterning, and endocrine cell specification in the zebrafish pituitary." Dev Biol 326(1): 143-154. Stecca, B. and A. Ruiz i Altaba (2010). "Context-dependent regulation of the GLI code in cancer by HEDGEHOG and non-HEDGEHOG signals." J Mol Cell Biol 2(2): 84-95. Ruiz i Altaba, A. (2011). "Hedgehog signaling and the Gli code in stem cells, cancer, and metastases." Sci Signal 4(200): pt9. Aberger, F. and A. Ruiz i Altaba (2014). "Context-dependent signal integration by the GLI code: the oncogenic load, pathways, modifiers and implications for cancer therapy." Semin Cell Dev Biol 33(100): 93-104. Matz-Soja, M., C. Rennert, K. Schönefeld, S. Aleithe, J. Boettger, W. Schmidt-Heck, T. S. Weiss, A. Hovhannisyan, S. Zellmer, N. Klöting, A. Schulz, J. Kratzsch, R. Guthke and R. Gebhardt (2016). "Hedgehog signaling is a potent regulator of liver lipid metabolism and reveals a GLI-code associated with steatosis." Elife 5. Timmis, A. J. and N. A. Riobo-Del Galdo (2020). "Another twist to the GLI code." Biochem J 477(22): 4343-4347. Unger, L., Mathisen, A., Chera, S., Legøy, T. A., & Ghila, L. (2024). The GLI code controls HNF1A levels during foregut differentiation. Int J Dev Biol, 68(4), 223-230.
141	Glioma code	The Glioma Code	Lowenstein, P. R., G. J. Baker and M. G. Castro (2014). "Cracking the glioma-NK inhibitory code: toward successful innate immunotherapy." Oncoimmunology 3(11): e965573.
142	Glycomic code	The Glycomic Code	Jones, C. J., & Larive, C. K. (2011). Cracking the glycan sequence code. Nat Chem Biol, 7(11), 758-759. Gupta, G. and A. Surolia (2012). Glycomics: An Overview of the Complex Glycocode. Biochemical Roles of Eukaryotic Cell Surface Macromolecules, New York, NY, Springer New York. Buckeridge, M. S. and A. P. de Souza (2014). "Breaking the "Glycomic Code" of Cell Wall Polysaccharides May Improve Second-Generation Bioenergy Production from Biomass." BioEnergy Research 7(4): 1065-1073. Simone, G. (2014). "Micro analysis to map the glycome code." Proteomics 14(9): 994-1000. Buckeridge, M. S. (2018). "The evolution of the Glycomic Codes of extracellular matrices." Biosystems 164: 112-120.

			Josenhans, C., Müthing, J., Elling, L., Bartfeld, S., & Schmidt, H. (2020). How bacterial pathogens of the gastrointestinal tract use the mucosal glyco-code to harness mucus and microbiota: New ways to study an ancient bag of tricks. International Journal of Medical Microbiology, 310(2), 151392. Banerjee, D. K., Ed. (2021). Glycome: The Hidden Code in Biology, Nova Science Publishers, Inc. Buckeridge, M. S. (2023). The Glycomic Code of the Plant Cell Wall - How Structure Leads to Function In A. Geitmann (Ed.), Plant Cell Walls. CRC Press. Sosa Cuevas, E., Roubinet, B., Mouret, S., Thépaut, M., de Fraipont, F., Charles, J., . . . Aspord, C. (2023). The melanoma tumor glyco-code impacts human dendritic cells' functionality and dictates clinical outcomes. Front Immunol, 14, 1120434. Mohammed Shibah, Sami Rashid (2025), Decoding the Glycomic Code: Beyond Genetic Centrality in Chemical Glycobiology Integrated with Bio-Inorganic Chemistry Available at SSRN. Tvaroška, I. (2025). The Role of Glycans in Human Immunity—A Sweet Code. Molecules, 30(13), 2678.
143	Glycosylation code	The Glycocode	Gama, C. I. and L. C. Hsieh-Wilson (2005). “Chemical approaches to deciphering the glycosaminoglycan code.” Curr Opin Chem Biol 9(6): 609-619. Hebert, D. N., S. C. Garman and M. Molinari (2005). "The glycan code of the endoplasmic reticulum: asparagine-linked carbohydrates as protein maturation and quality-control tags." Trends Cell Biol 15(7): 364-370. Shental-Bechor, D. and Y. Levy (2009). “Folding of glycoproteins: toward understanding the biophysics of the glycosylation code.” Current Opinion in Structural Biology 19(5): 524-533. Becer, C. R. (2012). "The glycopolymer code: synthesis of glycopolymers and multivalent carbohydrate-lectin interactions." Macromol Rapid Commun 33(9): 742-752. Ellis, C. R. and W. G. Noid (2014). “Deciphering the glycosylation code.” J Phys Chem B 118(39): 11462-11469. Dumych, T., C. Bridot, S. G. Gouin, M. F. Lensink, S. Paryzhak, S. Szunerits, R. Blossey, R. Bilyy, J. Bouckaert and E. M. Krammer (2018). "A Novel Integrated Way for Deciphering the Glycan Code for the FimH Lectin." Molecules 23(11). Rodriguez, E., K. Boelaars, K. Brown, K. Madunić, T. van Ee, F. Dijk, J. Verheij, R. J. E. Li, S. T. T. Schetters, L. L. Meijer, T. Y. S. Le Large, E. Driehuis, H. Clevers, S. C. M. Bruijns, T. O'Toole, S. J. van Vliet, M. F. Bijlsma, M. Wuhrer, G. Kazemier, E. Giovannetti, J. J. Garcia-Vallejo and Y. van Kooyk

			(2022). "Analysis of the glyco-code in pancreatic ductal adenocarcinoma identifies glycan-mediated immune regulatory circuits." Commun Biol 5(1): 41. Wisnovsky, S. and C. R. Bertozzi (2022). "Reading the glyco-code: New approaches to studying protein-carbohydrate interactions." Curr Opin Struct Biol 75: 102395. Dai, J., Ma, M., Niu, Q., Eisert, R. J., Wang, X., Das, P., . . . Brown, A. (2024). Mastigoneme structure reveals insights into the O-linked glycosylation code of native hydroxyproline-rich helices. Cell, 187(8), 1907-1921.e1916. Gędaj, A., Gregorczyk, P., Żukowska, D., Chorążewska, A., Ciura, K., Kalka, M., . . . Opaliński, Ł. (2024). Glycosylation of FGF/FGFR: An underrated sweet code regulating cellular signaling programs. Cytokine Growth Factor Rev, 77, 39-55. Wei, Y., Wei, A., Li, Y., Yang, Y., Si, Y., Li, Y., . . . Jiang, J. (2024). Deciphering the cell surface glyco-code: a promising perspective on unveiling the vulnerability of cancer stem cells. Cancer Biol Med, 21(11), 963-969. Yang, H., Lin, Z., Wu, B., Xu, J., Tao, S. C., & Zhou, S. (2024). Deciphering disease through glycan codes: leveraging lectin microarrays for clinical insights. Acta biochimica et biophysica Sinica, 56(8), 1145-1155. Yehuda, S., & Padler-Karavani, V. (2024). Cracking the diversity of sweet drugs. Nat Chem Biol, 20(11), 1397-1398. Li, X., & Tan, Z. (2026). Mapping the glycosylation code through synthetic chemistry. Cell Reports Physical Science, 7(2).
144	Growth code	The Growth Codes	Erland, L. A. E., C. E. Turi, P. K. Saxena and S. J. Murch (2020). “Metabolomics and hormonomics to crack the code of filbert growth.” Metabolomics 16(5): 62.
145	Grb2 code	The Grb2 Interaction Code	Neumann, K., Oellerich, T., Urlaub, H., & Wienands, J. (2009). The B-lymphoid Grb2 interaction code. Immunological Reviews, 232(1), 135-149.
146	GRP code	The G-Protein-Coupled Receptor Codes	Tan, E. S., E. S. Groban, M. P. Jacobson and T. S. Scanlan (2008). "Toward deciphering the code to aminergic G protein-coupled receptor drug design." Chem Biol 15(4): 343-353. Butcher, A. J., R. Prihandoko, K. C. Kong, P. McWilliams, J. M. Edwards, A. Bottrill, S. Mistry and A. B. Tobin (2011). "Differential G-protein-coupled receptor phosphorylation provides evidence for a signaling bar code." J Biol Chem 286(13): 11506-11518.

			Gough, N. R. (2011). "Focus issue: Cracking the G protein-coupled receptor code." Sci Signal 4(185): eg7. Zhou, X. E., He, Y., de Waal, P. W., Gao, X., Kang, Y., Van Eps, N., . . . Xu, H. E. (2017). Identification of Phosphorylation Codes for Arrestin Recruitment by G Protein-Coupled Receptors. Cell, 170(3), 457-469.e413 Chen, H., Zhang, S., Zhang, X., & Liu, H. (2022). QR code model: a new possibility for GPCR phosphorylation recognition. Cell Communication and Signaling, 20(1), 23.
147	Gut code	The Gut Codes	Liu, C. Y. (2020). Beta-7 Gives Tregs a Gut Area Code. Cell Mol Gastroenterol Hepatol, 9(3), 543-544. Braszczyńska-Sochacka, J., Sochacki, J., & Mik, M. (2025). The Gut's Secret Code: Bowel Microbiota as a Biomarker for Adaptation. Nutrients, 17(13), 2117. Hwang, D., Chong, E., Li, Y., Li, Y., & Roh, K. (2025). Deciphering the gut microbiome's metabolic code: pathways to bone health and novel therapeutic avenues [Review]. Front Endocrinol (Lausanne), Volume 16 - 2025. Ye, L. (2026). Cracking the code of gut–brain sensing. Nature Reviews Neuroscience, 27(3), 158-158.
148	Healing code	The Wound Healing Code	Kumar, A., Kumar, D., Kondaveeti, S. B., Dabburu, K., Awasthi, A., Singh, T. G., . . . Kumar, M. (2025). Unlocking healing codes: Nanocarriers and signalling pathways modulation for wound repair. Materials Today Communications, 49, 114149.
149	Hearing code	The Hearing Code	Cremers, C. W. (2000). "Hearing: cracking the code." J Laryngol Otol 114(1): 6-16.
150	Hepatocyte code	The Hepatocyte Code **SEE also Stem Cell Code** **SEE also Transcription Factor Code**	Willenbring, H. (2011). A simple code for installing hepatocyte function. Cell Stem Cell, 9(2), 89-91. Rombaut, M., Boeckmans, J., Rodrigues, R. M., van Grunsven, L. A., Vanhaecke, T., & De Kock, J. (2021). Direct reprogramming of somatic cells into induced hepatocytes: Cracking the Enigma code. J Hepatol, 75(3), 690-705.
151	Herbivore defense code	The Herbivore Defense Codes	Hedrich, R., & Roelfsema, M. R. G. (2023). Cracking the code of plant herbivore defense. Cell, 186(7), 1300-1302.
152	Hidden protein code	The Hidden Code Within the Genetic Code	Baker, M. (2010). "Hidden code in the protein code." Nature Methods 7(11): 874-874. Weatheritt, R. J. and M. M. Babu (2013). "The Hidden Codes That Shape Protein Evolution." Science 342(6164): 1325-1326.

153	Hippocampal code	The Neuronal Hippocampal Codes	Jensen, O. (2005). "Reading the hippocampal code by theta phase-locking." Trends Cogn Sci 9(12): 551-553. Tsanov, M. (2015). "Septo-hippocampal signal processing: breaking the code." Prog Brain Res 219: 103-120. Liberti, W. A., Schmid, T. A., Forli, A., Snyder, M., & Yartsev, M. M. (2022). A stable hippocampal code in freely flying bats. Nature, 604(7904), 98-103. Liu, C., Todorova, R., Tang, W., Oliva, A., & Fernandez-Ruiz, A. (2023). Associative and predictive hippocampal codes support memory-guided behaviors. Science, 382(6668), eadi8237. Graves, K. N., Letrou, A., Gray, T. E., Quraishi, I. H., & Turk-Browne, N. B. (2023). Hippocampal Codes for Real-World Human Navigation. bioRxiv, 2023.2006.2022.545396. Kolibius, L. D., Roux, F., Parish, G., Ter Wal, M., Van Der Plas, M., Chelvarajah, R., . . . Hanslmayr, S. (2023). Hippocampal neurons code individual episodic memories in humans. Nat Hum Behav, 7(11), 1968-1979.
154	Histone code – A (general)	The Histone Code (General Aspects) **SEE also Epigenetic (Chromatin) Code**	Strahl, B. D. and C. D. Allis (2000). "The language of covalent histone modifications." Nature 403(6765): 41-45. Turner, B. M. (2000). "Histone acetylation and an epigenetic code." Bioessays 22(9): 836-845. Jenuwein, T. and C. D. Allis (2001). "Translating the histone code." Science 293(5532): 1074-1080. Agalioti, T., Chen, G., & Thanos, D. (2002). Deciphering the Transcriptional Histone Acetylation Code for a Human Gene. Cell, 111(3), 381-392. Turner, B. M. (2002). "Cellular memory and the histone code." Cell 111(3): 285-291. Dutnall, R. N. (2003). Cracking the Histone Code One, Two, Three Methyls, You're Out! Molecular Cell, 12(1), 3-4. Yu, J., Li, Y., Ishizuka, T., Guenther, M. G., & Lazar, M. A. (2003). A SANT motif in the SMRT corepressor interprets the histone code and promotes histone deacetylation. Embo j, 22(13), 3403-3410. Cosgrove, M. S., J. D. Boeke and C. Wolberger (2004). "Regulated nucleosome mobility and the histone code." Nature Structural & Molecular Biology 11(11): 1037-1043.

			Wang, Y., W. Fischle, W. Cheung, S. Jacobs, S. Khorasanizadeh and C. D. Allis (2004). "Beyond the double helix: writing and reading the histone code." Novartis Found Symp 259: 3-17; discussion 17-21, 163-169. Cosgrove, M. S. and C. Wolberger (2005). "How does the histone code work?" Biochem Cell Biol 83(4): 468-476. de la Cruz, X., S. Lois, S. Sánchez-Molina and M. A. Martínez-Balbás (2005). "Do protein motifs read the histone code?" BioEssays 27(2): 164-175. Hartman, H. B., J. Yu, T. Alenghat, T. Ishizuka and M. A. Lazar (2005). "The histone-binding code of nuclear receptor co-repressors matches the substrate specificity of histone deacetylase 3." EMBO Rep 6(5): 445-45 Ivanovska, I., T. Khandan, T. Ito and T. L. Orr-Weaver (2005). "A histone code in meiosis: the histone kinase, NHK-1, is required for proper chromosomal architecture in Drosophila oocytes." Genes Dev 19(21): 2571-2582. Linggi, B. E., Brandt, S. J., Sun, Z.-W., & Hiebert, S. W. (2005). Translating the histone code into leukemia. Journal of Cellular Biochemistry, 96(5), 938-950. Margueron, R., P. Trojer and D. Reinberg (2005). "The key to development: interpreting the histone code?" CurrOpin Genet Dev 15(2): 163-176. Morris, K. V. (2005). "siRNA-mediated transcriptional gene silencing: the potential mechanism and a possible role in the histone code." Cell Mol Life Sci 62(24): 3057-3066. Yoon, H. G., Y. Choi, P. A. Cole and J. Wong (2005). "Reading and function of a histone code involved in targeting corepressor complexes for repression." Mol Cell Biol 25(1): 324-335. Iñiguez-Lluhí, J. A. (2006). "For a healthy histone code, a little SUMO in the tail keeps the acetyl away." ACS Chem Biol 1(4): 204-206. Valley, C. M., L. M. Pertz, B. S. Balakumaran and H. F. Willard (2006). "Chromosome-wide, allele-specific analysis of the histone code on the human X chromosome." Hum Mol Genet 15(15): 2335-2347. Comeaux, C. A. and M. T. Duraisingh (2007). "Unravelling a histone code for malaria virulence." Mol Microbiol 66(6): 1291-1295.

			Yue, W. W., M. Hassler, S. M. Roe, V. Thompson-Vale and L. H. Pearl (2007). "Insights into histone code syntax from structural and biochemical studies of CARM1 methyltransferase." Embo j 26(20): 4402-4412. Boussouar, F., S. Rousseaux and S. Khochbin (2008). "A new insight into male genome reprogramming by histone variants and histone code." Cell Cycle 7(22): 3499-3502. Fillingham, J. and J. F. Greenblatt (2008). "A histone code for chromatin assembly." Cell 134(2): 206-208. Godde, J. S. and K. Ura (2008). “Cracking the enigmatic linker histone code.” J Biochem 143(3): 287-293. Lukas, J. and J. Bartek (2008). "DNA damage: a histone-code mediator leaves the stage." Nat Struct Mol Biol 15(5): 430-432. Raychaudhuri, N., S. Raychaudhuri, M. Thamotharan and S. U. Devaskar (2008). "Histone code modifications repress glucose transporter 4 expression in the intrauterine growth-restricted offspring." J Biol Chem 283(20): 13611-13626. Cerutti, H. and J. A. Casas-Mollano (2009). "Histone H3 phosphorylation: universal code or lineage specific dialects?" Epigenetics 4(2): 71-75. Fu, Q., X. Yu, C. W. Callaway, R. H. Lane and R. A. McKnight (2009). "Epigenetics: intrauterine growth retardation (IUGR) modifies the histone code along the rat hepatic IGF-1 gene." Faseb j 23(8): 2438-2449. Gopalakrishnan, S., Sullivan, B. A., Trazzi, S., Della Valle, G., & Robertson, K. D. (2009). DNMT3B interacts with constitutive centromere protein CENP-C to modulate DNA methylation and the histone code at centromeric regions. Hum Mol Genet, 18(17), 3178-3193. Koshibu, K., J. Gräff, M. Beullens, F. D. Heitz, D. Berchtold, H. Russig, M. Farinelli, M. Bollen and I. M. Mansuy (2009). “Protein phosphatase 1 regulates the histone code for long-term memory.” J Neurosci 29(41): 13079-13089. Sanchez Mde, L. and C. Gutierrez (2009). “Novel insights into the plant histone code: lessons from ORC1.” Epigenetics 4(4): 205-208. Zippo, A., R. Serafini, M. Rocchigiani, S. Pennacchini, A. Krepelova and S. Oliviero (2009). "Histone crosstalk between H3S10ph and H4K16ac generates a histone code that mediates transcription elongation." Cell 138(6): 1122-1136.

			Sakabe, K., Z. Wang and G. W. Hart (2010). "Beta-N-acetylglucosamine (O-GlcNAc) is part of the histone code." Proc Natl Acad Sci U S A 107(46): 19915-19920. Ylä-Herttuala, S. and C. K. Glass (2011). "Review focus on epigenetics and the histone code in vascular biology." Cardiovasc Res 90(3): 402-403. Cosgrove, M. S. (2012). "Writers and readers: deconvoluting the harmonic complexity of the histone code." Nat Struct Mol Biol 19(8): 739-740. Rusk, N. (2012). "Writing the histone code." Nat Methods 9(8): 777. Teng, L. and K. Tan (2012). "Finding combinatorial histone code by semi-supervised biclustering." BMC Genomics 13: 301. Crea, F. (2012). "Histone code, human growth and cancer." Oncotarget 3(1): 1-2. Chen, H., S. Lonardi and J. Zheng (2014). "Deciphering histone code of transcriptional regulation in malaria parasites by large-scale data mining." Comput Biol Chem 50: 3-10. Dehennaut, V., D. Leprince and T. Lefebvre (2014). "O-GlcNAcylation, an Epigenetic Mark. Focus on the Histone Code, TET Family Proteins, and Polycomb Group Proteins." Front Endocrinol (Lausanne) 5: 155. Inamochi, Y., K. Mochizuki and T. Goda (2014). "Histone code of genes induced by co-treatment with a glucocorticoid hormone agonist and a p44/42 MAPK inhibitor in human small intestinal Caco-2 cells." Biochim Biophys Acta 1840(1): 693-700. Kühn, S. and J.-H. S. Hofmeyr (2014). "Is the "Histone Code" an Organic Code?" Biosemiotics 7(2): 203-222. Zuchegna, C., F. Aceto, A. Bertoni, A. Romano, B. Perillo, P. Laccetti, M. E. Gottesman, E. V. Avvedimento and A. Porcellini (2014). "Mechanism of retinoic acid-induced transcription: histone code, DNA oxidation and formation of chromatin loops." Nucleic Acids Res 42(17): 11040-11055. Fischle, W., H. D. Mootz and D. Schwarzer (2015). "Synthetic histone code." Curr Opin Chem Biol 28: 131-140. Sidoli, S. and B. A. Garcia (2015). "Properly reading the histone code by MS-based proteomics." Proteomics 15(17): 2901-2902. Soffers, J. H., X. Li, S. M. Abmayr and J. L. Workman (2016). "Reading and Interpreting the Histone Acylation Code." Genomics Proteomics Bioinformatics 14(6): 329-332.

			Wang, D., N. Kon and W. Gu (2016). "Acidic domains: "converse readers" for acetylation code." Oncotarget 7(49): 80101-80102. Aldrich, J. C., A. Leibholz, M. S. Cheema, J. Ausió and P. M. Ferree (2017). "A 'selfish' B chromosome induces genome elimination by disrupting the histone code in the jewel wasp Nasonia vitripennis." Sci Rep 7: 42551. Chang, H. W. and V. M. Studitsky (2017). "Chromatin replication: TRANSmitting the histone code." J Nat Sci 3(2). Herrera-Solorio, A. M., Armas-López, L., Arrieta, O., Zúñiga, J., Piña-Sánchez, P., & Ávila-Moreno, F. (2017). Histone code and long non-coding RNAs (lncRNAs) aberrations in lung cancer: implications in the therapy response. Clinical Epigenetics, 9(1), 98. Lee, D., An, J., Park, Y.-U., Liaw, H., Woodgate, R., Park, J. H., & Myung, K. (2017). SHPRH regulates rRNA transcription by recognizing the histone code in an mTOR-dependent manner. Proceedings of the National Academy of Sciences, 114(17), E3424-E3433. Salomé, P. A. (2017). "Know Your Histone (Zip) Code: Flowering Time and Phosphorylation of Histone H2A on Serine 95." Plant Cell 29(9): 2084-2085. Turner, A. W., & Margolis, D. M. (2017). Chromatin Regulation and the Histone Code in HIV Latency Prakash, K. and D. Fournier (2018). "Evidence for the implication of the histone code in building the genome structure." Biosystems 164: 49-59. Wang, C. and S. Zhang (2018). "Reveal cell type-specific regulatory elements and their characterized histone code classes via a hidden Markov model." BMC Genomics 19(Suppl 10): 903. Bálint, M., I. Horváth, N. Mészáros and C. Hetényi (2019). "Towards Unraveling the Histone Code by Fragment Blind Docking." Int J Mol Sci 20(2). Farrelly, L. A. and I. Maze (2019). "An emerging perspective on 'histone code' mediated regulation of neural plasticity and disease." Curr Opin Neurobiol 59: 157-163. Bano, D., P. Salomoni, D. Ehninger and P. Nicotera (2021). "The histone code in dementia: Transcriptional and chromatin plasticity fades away." Curr Opin Pharmacol 60: 117-122. Bonitto, K., K. Sarathy, K. Atai, M. Mitra and H. A. Coller (2021). "Is There a Histone Code for Cellular Quiescence?" Front Cell Dev Biol 9: 739780.

			Halsall, J. A., Andrews, S., Krueger, F., Rutledge, C. E., Ficz, G., Reik, W., & Turner, B. M. (2021). Histone modifications form a cell-type-specific chromosomal bar code that persists through the cell cycle. Scientific Reports, 11(1), 3009. Li, X. and X. D. Li (2021). "Integrative Chemical Biology Approaches to Deciphering the Histone Code: A Problem-Driven Journey." Acc Chem Res 54(19): 3734-3747. Maksimovic, I. and Y. David (2021). "Non-enzymatic Covalent Modifications as a New Chapter in the Histone Code." Trends Biochem Sci 46(9): 718-730. Choi, I., Song, J., & Park, H. (2022). Gold and silver plasmonic nanoprobes trace the positions of histone codes. BMB Rep, 55(3), 111-112. Driver, T., Pipkorn, R., Averbukh, V., Frasinski, L., Marangos, J. P., & Edelson-Averbukh, M. (2022). Breaking the Histone Code with Two-Dimensional Partial Covariance Mass Spectrometry. ChemRxiv, 2022(0718). Lee, D., Yang, J., & Kim, S. (2022). Learning the histone codes with large genomic windows and three-dimensional chromatin interactions using transformer. Nat Commun, 13(1), 6678. von Grüning, H., M. Coradin, M. R. Mendoza, J. Reader, S. Sidoli, B. A. Garcia and L. M. Birkholtz (2022). "A Dynamic and Combinatorial Histone Code Drives Malaria Parasite Asexual and Sexual Development." Mol Cell Proteomics 21(3): 100199. Zhang, X., Noberini, R., Bonaldi, T., Collemare, J., & Seidl, M. F. (2022). The histone code of the fungal genus Aspergillus uncovered by evolutionary and proteomic analyses. Microbial Genomics, 8(9). Zhang, X., Noberini, R., Vai, A., Bonaldi, T., Seidl, M. F., & Collemare, J. (2023). Detection and quantification of the histone code in the fungal genus Aspergillus. Fungal Genetics and Biology, 167, 103800. Heinke, L. (2024). A histone code controls positional identity in limb regeneration. Nat Rev Mol Cell Biol, 25(7), 514. Jeffers, V. (2024). Histone code: a common language and multiple dialects to meet the different developmental requirements of apicomplexan parasites. Curr Opin Microbiol, 79, 102472. Noerenberg, D., & Damm, F. (2024). Beyond the code: the role of histone methylation in cancer resistance and therapy. Signal Transduction and Targeted Therapy, 9(1), 161.

			Ma, S., Dahabieh, M. S., Mann, T. H., Zhao, S., McDonald, B., Song, W.-S., . . . Kaech, S. M. (2025). Nutrient-driven histone code determines exhausted CD8+ T cell fates. Science, 387(6734), eadj3020. Prakash, K., & Fournier, D. (2024). Unraveling the Histone Code: Exploring the Dynamic Relationship Between DNA and Chromatin Structure in Epigenetic Signaling. In G. Witzany (Ed.), Epigenetics in Biological Communication (pp. 317-332). Springer Nature Switzerland. Watson, M., Sabirova, D., Hardy, M. C., Pan, Y., Carpentier, D. C. J., Yates, H., . . . Stott, K. (2024). A DNA condensation code for linker histones. Proceedings of the National Academy of Sciences, 121(33), e2409167121. Akkouche, A., Kneuss, E., Bornelöv, S., Renaud, Y., Eastwood, E. L., van Lopik, J., . . . Hannon, G. J. (2025). A dual histone code specifies the binding of heterochromatin protein Rhino to a subset of piRNA source loci. bioRxiv, 2024.2001.2011.575256. Grunau, C., Lu, Z., Coghlan, A., Moescheid, M., Quack, T., Chaparro, C., . . . de Carvalho Augusto, R. (2026). The histone code of love: epigenetics of maturation of gonads in the human blood fluke Schistosoma mansoni. bioRxiv, 2026.2001.2023.701327. Malone, K. L., Singh, A. K., Lignos, J. M., Cook, E. D., Phillips, M., Boyle, B. W., . . . Glass, K. C. (2026). Unraveling the complexity of the histone code: implications for gene regulation and disease. Genome Biology.
155	Histone code – B (enhancer)	The Histone Code – Enhancers	Hecker, N., Kempynck, N., Mauduit, D., Abaffyová, D., Vandepoel, R., Dieltiens, S., . . . Aerts, S. (2025). Enhancer-driven cell type comparison reveals similarities between the mammalian and bird pallium. Science, 387(6735), eadp3957. Wong, E. S., Zheng, D., Tan, S. Z., Bower, N. I., Garside, V., Vanwalleghem, G., . . . Degnan, B. M. (2020). Deep conservation of the enhancer regulatory code in animals. Science, 370(6517), eaax8137. Panigrahi, A., & O'Malley, B. W. (2021). Mechanisms of enhancer action: the known and the unknown. Genome Biology, 22(1), 108. Ay, A. and D. N. Arnosti (2010). "Nucleosome positioning: an essential component of the enhancer regulatory code?" Curr Biol 20(9): R404-406. Allende, M. L., M. Manzanares, J. J. Tena, C. G. Feijóo and J. L. Gómez-Skarmeta (2006). "Cracking the genome's second code: enhancer detection by combined phylogenetic footprinting and transgenic fish and frog embryos." Methods 39(3): 212-219.

			Rastegar, S., I. Hess, T. Dickmeis, J. C. Nicod, R. Ertzer, Y. Hadzhiev, W. G. Thies, G. Scherer and U. Strähle (2008). "The words of the regulatory code are arranged in a variable manner in highly conserved enhancers." Dev Biol 318(2): 366-377. Betancur, P., M. Bronner-Fraser and T. Sauka-Spengler (2010). "Genomic code for Sox10 activation reveals a key regulatory enhancer for cranial neural crest." Proc Natl Acad Sci U S A 107(8): 3570-3575. Lau, P. N. and P. Cheung (2011). "Histone code pathway involving H3 S28 phosphorylation and K27 acetylation activates transcription and antagonizes polycomb silencing." Proc Natl Acad Sci U S A 108(7): 2801-2806. Aksoy, I., R. Jauch, J. Chen, M. Dyla, U. Divakar, G. K. Bogu, R. Teo, C. K. Leng Ng, W. Herath, S. Lili, A. P. Hutchins, P. Robson, P. R. Kolatkar and L. W. Stanton (2013). "Oct4 switches partnering from Sox2 to Sox17 to reinterpret the enhancer code and specify endoderm." Embo j 32(7): 938-953. Zhou, J. and O. G. Troyanskaya (2016). "Probabilistic modelling of chromatin code landscape reveals functional diversity of enhancer-like chromatin states." Nat Commun 7: 10528. Wong, E. S., D. Zheng, S. Z. Tan, N. L. Bower, V. Garside, G. Vanwalleghem, F. Gaiti, E. Scott, B. M. Hogan, K. Kikuchi, E. McGlinn, M. Francois and B. M. Degnan (2020). "Deep conservation of the enhancer regulatory code in animals." Science 370(6517). Wolfe, J. C., L. A. Mikheeva, H. Hagras and N. R. Zabet (2021). "An explainable artificial intelligence approach for decoding the enhancer histone modifications code and identification of novel enhancers in Drosophila." Genome Biol 22(1): 308.
156	Histone code – C (trans)	The Trans-Histone Code	Sims, J. K., S. I. Houston, T. Magazinnik and J. C. Rice (2006). "A trans-tail histone code defined by monomethylated H4 Lys-20 and H3 Lys-9 demarcates distinct regions of silent chromatin." J Biol Chem 281(18): 12760-12766. Sims, J. K. and J. C. Rice (2008). "PR-Set7 establishes a repressive trans-tail histone code that regulates differentiation." Mol Cell Biol 28(14): 4459-4468. Congdon, L. M., J. K. Sims, C. T. Tuzon and J. C. Rice (2014). "The PR-Set7 binding domain of Riz1 is required for the H4K20me1-H3K9me1 trans-tail 'histone code' and Riz1 tumor suppressor function." Nucleic Acids Res 42(6): 3580-3589.

			Bhanu, N. V., S. Sidoli, Z. F. Yuan, R. C. Molden and B. A. Garcia (2019). "Regulation of proline-directed kinases and the trans-histone code H3K9me3/H4K20me3 during human myogenesis." J Biol Chem 294(20): 8296-8308.
157	Histone code – D (readers)	The Histone Code Readers	Forneris, F., Binda, C., Vanoni, M. A., Battaglioli, E., & Mattevi, A. (2005). Human Histone Demethylase LSD1 Reads the Histone Code *. Journal of Biological Chemistry, 280(50), 41360-41365. Winter, S., Simboeck, E., Fischle, W., Zupkovitz, G., Dohnal, I., Mechtler, K., . . . Seiser, C. (2008). 14-3-3 Proteins recognize a histone code at histone H3 and are required for transcriptional activation. Embo j, 27(1), 88-99. Gao, C., J. M. Herold and D. Kireev (2012). "Assessment of free energy predictors for ligand binding to a methyllysine histone code reader." J Comput Chem 33(6): 659-665. Franz, H., H. Greschik, D. Willmann, L. Ozretić, C. A. Jilg, E. Wardelmann, M. Jung, R. Buettner and R. Schüle (2015). "The histone code reader SPIN1 controls RET signaling in liposarcoma." Oncotarget 6(7): 4773-4789. Kim, C. H., J. W. Kim, S. M. Jang, J. H. An, S. B. Seo and K. H. Choi (2015). "The chromodomain-containing histone acetyltransferase TIP60 acts as a code reader, recognizing the epigenetic codes for initiating transcription." Biosci Biotechnol Biochem 79(4): 532-538. Greschik, H., D. Duteil, N. Messaddeq, D. Willmann, L. Arrigoni, M. Sum, M. Jung, D. Metzger, T. Manke, T. Günther and R. Schüle (2017). "The histone code reader Spin1 controls skeletal muscle development." Cell Death Dis 8(11): e3173. Wei, W., J. J. Tao, H. W. Chen, Q. T. Li, W. K. Zhang, B. Ma, Q. Lin, J. S. Zhang and S. Y. Chen (2017). "A Histone Code Reader and a Transcriptional Activator Interact to Regulate Genes for Salt Tolerance." Plant Physiol 175(3): 1304-1320. Molnar, C., J. P. Heinen, J. Reina, S. Llamazares, E. Palumbo, A. Breschi, M. Gay, L. Villarreal, M. Vilaseca, G. Pollarolo and C. Gonzalez (2019). "The histone code reader PHD finger protein 7 controls sex-linked disparities in gene expression and malignancy in Drosophila." Sci Adv 5(8): eaaw7965. Li, D., J. Guo and R. Jia (2021). "Histone code reader SPIN1 is a promising target of cancer therapy." Biochimie 191: 78-86. Li, D., Guo, J., & Jia, R. (2023). Epigenetic Control of Cancer Cell Proliferation and Cell Cycle Progression by HNRNPK via Promoting Exon 4 Inclusion of Histone Code Reader SPIN1. J Mol Biol, 435(6), 167993.

158	Histone code – E (writers)	The Histone Code Writers	Strahl, B. (2024). Abstract 1245 Chromatin mechanisms and genome maintenance functions of histone code writers. Journal of Biological Chemistry, 300(3).
159	Histone code – F (miscellaneous)	The Histone Code Miscellaneous	Fish, J. E., Matouk, C. C., Rachlis, A., Lin, S., Tai, S. C., D'Abreo, C., & Marsden, P. A. (2005). The Expression of Endothelial Nitric-oxide Synthase Is Controlled by a Cell-specific Histone Code*. Journal of Biological Chemistry, 280(26), 24824-24838. Igunnu, A., Seok, Y.-M., Olatunji, L. A., Kang, S.-H., & Kim, I. (2015). Combined oral contraceptive synergistically activates mineralocorticoid receptor through histone code modifications. European Journal of Pharmacology, 769, 48-54.
160	Histone code – G (disease)	The Histone Disease Codes	Farrelly, L. A. and I. Maze (2019). "An emerging perspective on 'histone code' mediated regulation of neural plasticity and disease." Curr Opin Neurobiol 59: 157-163. Bano, D., P. Salomoni, D. Ehninger and P. Nicotera (2021). "The histone code in dementia: Transcriptional and chromatin plasticity fades away." Curr Opin Pharmacol 60: 117-122. Cracking the histone code for prostate cancer therapy. (2025). Nat Genet, 57(10), 2357-2358. Thakur, C., Qiu, Y., Liu, Z., Bamrah, J., Svenson, D. W., Pawar, A. S., . . . Wang, Z. (2026). Histone code rewriting in mdig-deficient triple-negative breast cancer cells drives metastasis-promoting transcription. Genes & Diseases, 102120.
161	Histone sub-code	The Histone Sub-Code	Lomberk, G., D. Bensi, M. E. Fernandez-Zapico and R. Urrutia (2006). “Evidence for the existence of an HP1-mediated subcode within the histone code.” Nat Cell Biol 8(4): 407-415. Quénet, D., Gasser, V., Fouillen, L., Cammas, F., Sanglier-Cianferani, S., Losson, R., & Dantzer, F. (2008). The histone subcode: poly(ADP-ribose) polymerase-1 (Parp-1) and Parp-2 control cell differentiation by regulating the transcriptional intermediary factor TIF1β and the heterochromatin protein HPIα. The FASEB Journal, 22(11), 3853-3865. Harouz, H., Rachez, C., Meijer, B. M., Marteyn, B., Donnadieu, F., Cammas, F., . . . Arbibe, L. (2014). Shigella flexneri targets the HP1-gamma subcode through the phosphothreonine lyase OspF. Embo J, 33(22), 2606-2622.
162	Homeodomain code	(Protein) Homeodomain Code	Briscoe, J., Pierani, A., Jessell, T. M., & Ericson, J. (2000). A Homeodomain Protein Code Specifies Progenitor Cell Identity and Neuronal Fate in the Ventral Neural Tube. Cell, 101(4), 435-445.
163	Homeokinetic code	The Homeokinetic Muscle Code	Que, C. L., G. Maksym and P. T. Macklem (2000). “Deciphering the homeokinetic code of airway smooth muscle.” Am J Respir Crit Care Med 161(3 Pt 2): S161-163.

164	Hormone code	The Hormone Code	Kodama, M. and T. Kodama (1994). "An essay on the nature of hormonal codes involved in the genesis of human neoplasias (review)." Anticancer research 14(6B): 2653-2665. Jorgensen, J. S., C. C. Quirk and J. H. Nilson (2004). "Multiple and Overlapping Combinatorial Codes Orchestrate Hormonal Responsiveness and Dictate Cell-Specific Expression of the Genes Encoding Luteinizing Hormone." Endocrine Reviews 25(4): 521-542.
165	HOX code – A (general)	The HOX Code (General)	Kessel, M. and P. Gruss (1991). "Homeotic transformations of murine vertebrae and concomitant alteration of Hox codes induced by retinoic acid." Cell 67(1): 89-104. Marshall, H., S. Nonchev, M. H. Sham, I. Muchamore, A. Lumsden and R. Krumlauf (1992). "Retinoic acid alters hindbrain Hox code and induces transformation of rhombomeres 2/3 into a 4/5 identity." Nature 360(6406): 737-741. Bayascas, J. R., E. Castillo and E. Saló (1998). "Platyhelminthes have a Hox code differentially activated during regeneration, with genes closely related to those of spiralian protostomes." Development Genes and Evolution 208(8): 467-473. Pitera, J. E., V. V. Smith, P. Thorogood and P. J. Milla (1999). "Coordinated expression of 3' hox genes during murine embryonal gut development: an enteric Hox code." Gastroenterology 117(6): 1339-1351. Kawazoe, Y., T. Sekimoto, M. Araki, K. Takagi, K. Araki and K. Yamamura (2002). "Region-specific gastrointestinal Hox code during murine embryonal gut development." Dev Growth Differ 44(1): 77-84. Horton, S. J., Grier, D. G., McGonigle, G. J., Thompson, A., Morrow, M., De Silva, I., . . . Williams, O. (2005). Continuous MLL-ENL expression is necessary to establish a "Hox Code" and maintain immortalization of hematopoietic progenitor cells. Cancer Res, 65(20), 9245-9252. Shimizu, T., Y. K. Bae and M. Hibi (2006). "Cdx-Hox code controls competence for responding to Fgfs and retinoic acid in zebrafish neural tissue." Development 133(23): 4709-4719. Ryan, J. F., M. E. Mazza, K. Pang, D. Q. Matus, A. D. Baxevanis, M. Q. Martindale and J. R. Finnerty (2007). "Pre-bilaterian origins of the Hox cluster and the Hox code: evidence from the sea anemone, Nematostella vectensis." PloS One 2(1): e153. Ackema, K. B., & Charité, J. (2008). Mesenchymal Stem Cells from Different Organs are Characterized by Distinct Topographic Hox Codes. Stem Cells and Development, 17(5), 979-992.

			Liedtke, S., A. Buchheiser, J. Bosch, F. Bosse, F. Kruse, X. Zhao, S. Santourlidis and G. Kögler (2010). "The HOX Code as a "biological fingerprint" to distinguish functionally distinct stem cell populations derived from cord blood." Stem Cell Research 5(1): 40-50. Mukaigasa, K., C. Sakuma, T. Okada, S. Homma, T. Shimada, K. Nishiyama, N. Sato and H. Yaginuma (2017). "Motor neurons with limb-innervating character in the cervical spinal cord are sculpted by apoptosis based on the Hox code in chick embryo." Development 144(24): 4645-4657. Devi, M. S., R. Meiguilungpou, A. L. Sharma, C. Anjali, K. M. Devi, L. S. Singh and T. R. Singh (2019). "Spindlin docking protein (SPIN.DOC) interaction with SPIN1 (a histone code reader) regulates Wnt signaling." Biochem Biophys Res Commun 511(3): 498-503. Tomoyasu, Y. (2020). "Breaking bad in the rice field by breaking the Hox code." Natl Sci Rev 7(10): 1616. Pfeiferová, L., Španko, M., Šáchová, J., Hradilová, M., Pienta, K. J., Valach, J., . . . Smetana, K. (2025). The HOX code of human adult fibroblasts reflects their ectomesenchymal or mesodermal origin. Histochemistry and Cell Biology, 163(1), 38.
166	HOX code – B (pattern)	The HOX Code Pattern Formation	Hunt, P., & Krumlauf, R. (1991). Deciphering the Hox code: Clues to patterning branchial regions of the head. Cell, 66(6), 1075-1078. Hunt, P., J. Whiting, S. Nonchev, M.-H. Sham, H. Marshall, A. Graham, M. Cook, R. Allemann, P. W. J. Rigby, M. Gulisano, A. Faiella, E. Boncinelli and R. Krumlauf (1991). "The branchial Hox code and its implications for gene regulation, patterning of the nervous system and head evolution." Development 113(Supplement_2): 63-77. Hunt, P., J. D. Clarke, P. Buxton, P. Ferretti and P. Thorogood (1998). "Stability and plasticity of neural crest patterning and branchial arch Hox code after extensive cephalic crest rotation." Dev Biol 198(1): 82-104. Sekimoto, T., K. Yoshinobu, M. Yoshida, S. Kuratani, S. Fujimoto, M. Araki, N. Tajima, K. Araki and K. Yamamura (1998). "Region-specific expression of murine Hox genes implies the Hox code-mediated patterning of the digestive tract." Genes Cells 3(1): 51-64. Woltering, J. M., F. J. Vonk, H. Müller, N. Bardine, I. L. Tuduce, M. A. de Bakker, W. Knöchel, I. O. Sirbu, A. J. Durston and M. K. Richardson (2009). "Axial patterning in snakes and caecilians: evidence for an alternative interpretation of the Hox code." Dev Biol 332(1): 82-89.

			Oulion, S., V. Borday-Birraux, M. Debiais-Thibaud, S. Mazan, P. Laurenti and D. Casane (2011). "Evolution of repeated structures along the body axis of jawed vertebrates, insights from the Scyliorhinus canicula Hox code." Evol Dev 13(3): 247-259.# Nishimoto, S., C. Minguillon, S. Wood and M. P. Logan (2014). "A combination of activation and repression by a colinear Hox code controls forelimb-restricted expression of Tbx5 and reveals Hox protein specificity." PLoS Genet 10(3): e1004245. Matsuda, R., C. Hosono, K. Saigo and C. Samakovlis (2015). "The intersection of the extrinsic hedgehog and WNT/wingless signals with the intrinsic Hox code underpins branching pattern and tube shape diversity in the drosophila airways." PloS Genet 11(1): e1004929. He, S., F. Del Viso, C. Y. Chen, A. Ikmi, A. E. Kroesen and M. C. Gibson (2018). "An axial Hox code controls tissue segmentation and body patterning in Nematostella vectensis." Science 361(6409): 1377-1380. Sato, T., K. Kataoka, Y. Ito, S. Yokoyama, M. Inui, M. Mori, S. Takahashi, K. Akita, S. Takada, H. Ueno-Kudoh and H. Asahara (2020). "Lin28a/let-7 pathway modulates the Hox code via Polycomb regulation during axial patterning in vertebrates." Elife 9. Adachi, U., Koita, R., Seto, A., Maeno, A., Ishizu, A., Oikawa, S., . . . Kawamura, A. (2024). Teleost Hox code defines regional identities competent for the formation of dorsal and anal fins. Proceedings of the National Academy of Sciences, 121(25), e2403809121. Maeno, A., Koita, R., Nakazawa, H., Fujii, R., Yamada, K., Oikawa, S., . . . Kawamura, A. (2024). The Hox code responsible for the patterning of the anterior vertebrae in zebrafish. Development, 151(14).
167	Hox code -C (disease)	The Hox Disease Codes	Cheng, S., S. Yang, Y. Shi, R. Shi, Y. Yeh and X. Yu (2021). "Neuroendocrine prostate cancer has distinctive, non-prostatic HOX code that is represented by the loss of HOXB13 expression." Sci Rep 11(1): 2778.
168	HSF code	The Heat Shock Factor (HSF) Code	Alasady, M. J., & Mendillo, M. L. (2024). The heat shock factor code: Specifying a diversity of transcriptional regulatory programs broadly promoting stress resilience. Cell Stress and Chaperones, 29(6), 735-749.
169	Hypothalamic code	The Hypothalamic Code	Bhumbra, G. S. and R. E. Dyball (2010). "Reading between the spikes of the hypothalamic neural code." J Neuroendocrinol 22(12): 1239-1250.

			Ferran, J. L., Puelles, L., & Rubenstein, J. L. R. (2015). Molecular codes defining rostrocaudal domains in the embryonic mouse hypothalamus [Original Research]. Frontiers in Neuroanatomy, Volume 9 - 2015. Alpár, A., Benevento, M., Romanov, R. A., Hökfelt, T., & Harkany, T. (2019). Hypothalamic cell diversity: non-neuronal codes for long-distance volume transmission by neuropeptides. Current Opinion in Neurobiology, 56, 16-23.
170	Identity code	The Identity Code	Shirasaki, R., & Pfaff, S. L. (2002). Transcriptional Codes and the Control of Neuronal Identity. Annu Rev Neurosci, 25(Volume 25, 2002), 251-281. Santa-Olalla, J., J. M. Baizabal, M. Fregoso, M. del Carmen Cárdenas and L. Covarrubias (2003). "The in vivo positional identity gene expression code is not preserved in neural stem cells grown in culture." Eur J Neurosci 18(5): 1073-1084. Khalturin, K., Kürn, U., Pinnow, N., & Bosch, T. C. (2005). Towards a molecular code for individuality in the absence of MHC: screening for individually variable genes in the urochordate Ciona intestinalis. Dev Comp Immunol, 29(9), 759-773. Serizawa, S., K. Miyamichi, H. Takeuchi, Y. Yamagishi, M. Suzuki and H. Sakano (2006). “A neuronal identity code for the odorant receptor-specific and activity-dependent axon sorting.” Cell 127(5): 1057-1069 Brill, M. S., M. Snapyan, H. Wohlfrom, J. Ninkovic, M. Jawerka, G. S. Mastick, R. Ashery-Padan, A. Saghatelyan, B. Berninger and M. Götz (2008). "A dlx2- and pax6-dependent transcriptional code for periglomerular neuron specification in the adult olfactory bulb." J Neurosci 28(25): 6439-6452. Rhodes, G., E. Jaquet, L. Jeffery, E. Evangelista, J. Keane and A. J. Calder (2011). "Sex-specific norms code face identity." J Vis 11(1): 1. Menendez, J. A. and T. Alarcón (2016). "Nuclear reprogramming of cancer stem cells: Corrupting the epigenetic code of cell identity with oncometabolites." Mol Cell Oncol 3(6): e1160854. Reillo, I., de Juan Romero, C., Cárdenas, A., Clascá, F., Martínez-Martinez, M., & Borrell, V. (2017). A Complex Code of Extrinsic Influences on Cortical Progenitor Cells of Higher Mammals. Cereb Cortex, 27(9), 4586-4606. Guo, T., G. Liu, H. Du, Y. Wen, S. Wei, Z. Li, G. Tao, Z. Shang, X. Song, Z. Zhang, Z. Xu, Y. You, B. Chen, J. L. Rubenstein and Z. Yang (2019). "Dlx1/2 are Central and Essential Components in the Transcriptional Code for Generating Olfactory Bulb Interneurons." Cereb Cortex 29(11): 4831-4849.

171	Immune code	The Immune Codes	Jakobiec, F. A. and P. Henkind (1981). “The Graves’ enigma: breaking an immunological code.” Ophthalmology 88(6): 26a-27a. Prodi, G. (1988). Signs and Codes in Immunology. The Semiotics of Cellular Communication in the Immune System, Berlin, Heidelberg, Springer Berlin Heidelberg. Pisetsky, D. S. (1996). Immune Activation by Bacterial DNA: A New Genetic Code. Immunity, 5(4), 303-310. Pakravan, N., A. T. Hassan and Z. M. Hassan (2007). "Naturally occurring self-reactive CD4+CD25+ regulatory T cells: universal immune code." Cell Mol Immunol 4(3): 197-201. Cifuentes, G., A. Bermúdez, R. Rodriguez, M. A. Patarroyo and M. E. Patarroyo (2008). "Shifting the polarity of some critical residues in malarial peptides' binding to host cells is a key factor in breaking conserved antigens' code of silence." Med Chem 4(3): 278-292. Neuman, Y. (2008). The Immune Self Code: From Correspondence to Complexity. The Codes of Life: The Rules of Macroevolution. M. Barbieri and J. Hoffmeyer. Dordrecht, Springer Netherlands: 247-263. Sioud, M. (2009). “Deciphering the code of innate immunity recognition of siRNAs.” Methods Mol Biol 487: 41-59. Harvey, C. J. and K. W. Wucherpfennig (2013). “Cracking the code of human T-cell immunity.” Nat Biotechnol 31(7): 609-610. Xu, H., P. Dong, X. He, X. Ma, D. Xue, Y. Zhang and X. Zhang (2014). "B-cell-activating factor code and human cytomegalovirus infection in renal transplant recipients." Microbiol Immunol 58(8): 439-448. Assi, T. (2019). “Are targeted agents the key to unlock the code for immune checkpoint inhibitors in soft-tissue sarcomas?” Future Oncol 15(28): 3185-3187. Griffin, T. M. and R. J. Lories (2020). “Cracking the code on the innate immune program in OA.” Osteoarthritis Cartilage 28(5): 529-531. Aleahmad, M., M. Bozorgmehr, S. Nikoo, A. Ghanavatinejad, M. R. Shokri, S. Montazeri, F. Shokri and A. H. Zarnani (2021). "Endometrial mesenchymal stem/stromal cells: The Enigma to code messages for generation of functionally active regulatory T cells." Stem Cell Res Ther 12(1): 536. Bracke, K. R., & Polverino, F. (2023). Blunted adaptive immune responses and acute exacerbations of COPD: breaking the code. European Respiratory Journal, 62(2), 2301030.

			Mami, S., Shekarchian, S., Mousavi, M. J., & Nicknam, M. H. (2025). Cracking the Human Cytomegalovirus Code: Trinary Challenges of Latency, Immune Evasion, and Correlates of Protection. Iran J Allergy Asthma Immunol, 24(4), 403-427. Vegesana, K., & Thomas, P. G. (2024). Cracking the code of adaptive immunity: The role of computational tools. Cell Syst, 15(12), 1156-1167. Gray, G. I., Chukwuma, P. C., Eldaly, B., Perera, W. W. J. G., Brambley, C. A., Rosales, T. J., & Baker, B. M. (2025). The Evolving T Cell Receptor Recognition Code: The Rules Are More Like Guidelines. Immunological Reviews, 329(1), e13439. Fang, L., Zhao, Y., Zhao, J., Mao, C., & Jiang, Y. (2026). Deciphering the immunomodulatory code: how metal nanoadjuvants orchestrate intracellular immune signaling cascades. Biochem Pharmacol, 117932.
172	Immunoglobulin code	The Immunoglobulin Code	Szczepanski, T. (2006). Deciphering the immunoglobulin code in multiple myeloma. Haematologica, 91(6), 725b.
173	Importin code	The Importin Codes **SEE also Transport Codes** **SEE also Translocation Codes**	Lu, M., J. Zak, S. Chen, L. Sanchez-Pulido, D. T. Severson, J. Endicott, C. P. Ponting, C. J. Schofield and X. Lu (2014). "A code for RanGDP binding in ankyrin repeats defines a nuclear import pathway." Cell 157(5): 1130-1145. Lever, M. B., A. Karpova and M. R. Kreutz (2015). "An Importin Code in neuronal transport from synapse-to-nucleus?" Front Mol Neurosci 8: 33.
174	Imprinting code	The Epigenetic Imprinting Code	Vu, T. H., Li, T., & Hoffman, A. R. (2004). Promoter-restricted histone code, not the differentially methylated DNA regions or antisense transcripts, marks the imprinting status of IGF2R in human and mouse. Hum Mol Genet, 13(19), 2233-2245. Vu, T. H., R. L. Jirtle and A. R. Hoffman (2006). “Cross-species clues of an epigenetic imprinting regulatory code for the IGF2R gene.” Cytogenetic and Genome Research 113(1-4): 202-208. Nilendu, P., & Sharma, N. K. (2017). Epigenomic Hard Drive Imprinting: A Hidden Code Beyond the Biological Death of Cancer Patients. Journal of Cancer Prevention, 22(4), 211-218. Wu, D., Poddar, A., Ninou, E., Hwang, E., Cole, M. A., Liu, S. J., . . . Lim, D. A. (2022). Dual genome-wide coding and lncRNA screens in neural induction of induced pluripotent stem cells. Cell Genomics, 2(11).

175	Impulsive codes	The Impulsive Behaviour Codes	Tsutsui-Kimura, I., Y. Ohmura, T. Izumi, T. Matsushima, H. Amita, T. Yamaguchi, T. Yoshida and M. Yoshioka (2016). "Neuronal codes for the inhibitory control of impulsive actions in the rat infralimbic cortex." Behavioural Brain Research 296: 361-372.
176	Indole code	The Indole Physiological Code	Fu, S. F., J. Y. Wei, H. W. Chen, Y. Y. Liu, H. Y. Lu and J. Y. Chou (2015). "Indole-3-acetic acid: A widespread physiological code in interactions of fungi with other organisms." Plant Signal Behav 10(8): e1048052.
177	Inflammation code	The Inflammation Codes	Inflammation: the elusive common denominator. Inflammation underlies a host of common illnesses; scientists think they're beginning to crack the code. (2006). Health News, 12(2), 14-15. Escamilla-Tilch, M., Filio-Rodríguez, G., García-Rocha, R., Mancilla-Herrera, I., Mitchison, N. A., Ruiz-Pacheco, J. A., . . . Vázquez-Sánchez, E. A. (2013). The interplay between pathogen-associated and danger-associated molecular patterns: an inflammatory code in cancer? Immunology & Cell Biology, 91(10), 601-610. Serhan, C. N., Chiang, N., & Dalli, J. (2015). The resolution code of acute inflammation: Novel pro-resolving lipid mediators in resolution. Semin Immunol, 27(3), 200-215. Amagai, M. (2016). "Cracking the code of skin inflammation with CD1a." Nat Immunol 17(10): 1133-1134. Gomez-Arroyo, J., Abbate, A., & Voelkel, N. F. (2016) Pulmonary arterial hypertension and the Enigma code of smouldering inflammation. European Respiratory Journal, 48(2), 305-307.
178	Inflammatory-Metabolic code	The Inflammatory-Metabolic Code	Monzo, L., & Girerd, N. (2026). Decoding the inflammatory-metabolic code: machine learning potential for outcome prediction in heart failure with diabetes. Int J Cardiol, 442, 133828.
179	Injury code	The Injury Response Codes	Zamboni, M., Martínez-Martín, A., Rydholm, G., Häneke, T., Pintado Almeida, L., Seçilmiş, D., . . . Llorens-Bobadilla, E. (2026). The regulatory code of injury-responsive enhancers enables precision cell-state targeting in the CNS. Nat Neurosci, 29(2), 337-349.
180	Inositol Phosphate code	The Inositol Phosphate Codes	Otto, J. C., P. Kelly, S. T. Chiou and J. D. York (2007). "Alterations in an inositol phosphate code through synergistic activation of a G protein and inositol phosphate kinases." Proc Natl Acad Sci U S A 104(40): 15653-15658. Dovey, C. M., Diep, J., Clarke, B. P., Hale, A. T., McNamara, D. E., Guo, H., . . . Carette, J. E. (2018). MLKL Requires the Inositol Phosphate Code to Execute Necroptosis. Molecular Cell, 70(5), 936-948.e937.

181	Invasion codes	The (Tuberculosis) Invasion Code	Aldhous, P. (1993). “Breaking the code for the tuberculosis invasion.” Science 261(5127): 1390.
182	Ion channel code	The Ion Channel Code	Barakat, A. I., D. K. Lieu and A. Gojova (2006). “Secrets of the code: do vascular endothelial cells use ion channels to decipher complex flow signals?” Biomaterials 27(5): 671-678.
183	Irisin code	The Irisin (Muscle) Code	Ma, C., H. Ding, Y. Deng, H. Liu, X. Xiong and Y. Yang (2021). “Irisin: A New Code Uncover the Relationship of Skeletal Muscle and Cardiovascular Health During Exercise.” Frontiers in Physiology 12.
184	kappaB code	The kappaB Immune Code	Busse, M. S., C. P. Arnold, P. Towb, J. Katrivesis and S. A. Wasserman (2007). "A kappaB sequence code for pathway-specific innate immune responses." Embo J 26(16): 3826-3835.
185	Karyotype code	The Karyotype Code	Heng, H. H., G. Liu, J. B. Stevens, S. W. Bremer, K. J. Ye, B. Y. Abdallah, S. D. Horne and C. J. Ye (2011). "Decoding the genome beyond sequencing: the new phase of genomic research." Genomics 98(4): 242-252. Ye, C. J., L. Stilgenbauer, A. Moy, G. Liu and H. H. Heng (2019). "What Is Karyotype Coding and Why Is Genomic Topology Important for Cancer and Evolution?" Front Genet 10: 1082. Heng, J. and H. H. Heng (2021). "Karyotype coding: The creation and maintenance of system information for complexity and biodiversity." Biosystems 208: 104476.
186	Keratin code	The Keratin Code	Di Russo, J., Magin, T. M., & Leube, R. E. (2023). A keratin code defines the textile nature of epithelial tissue architecture. Curr Opin Cell Biol, 85, 102236.
187	Keto code	The Keto(n) Codes	Wackler, B., Lackner, G., Chooi, Y. H., & Hoffmeister, D. (2012). Characterization of the Suillus grevillei Quinone Synthetase GreA Supports a Nonribosomal Code for Aromatic α-Keto Acids. Chembiochem, 13(12), 1798-1804. Ametaj, B. N. (2025). From Network to Code: The Calci-Keto-Inflammatory Language of Metabolic Adaptation. In Preprints: Preprints. Ametaj, B. N. (2026). The Keto–Inflammatory Network: From Systems Biology to Biological Code. Dairy, 7(1), 19. van den Hurk Joris, J., Schiattarella Gabriele, G., & Westenbrink, B. D. (2025). From Fuel to Code: How Ketones Drive Coronary Revascularization. JACC: Basic to Translational Science, 10(5), 608-611.
188	Kinase code	Protein Kinase Codes	Tengholm, A. and T. Meyer (2002). "A PI3-kinase signaling code for insulin-triggered insertion of glucose transporters into the plasma membrane." Curr Biol 12(21): 1871-1876.

			Bou-Nader, C., J. M. Gordon, F. E. Henderson and J. Zhang (2019). "The search for a PKR code-differential regulation of protein kinase R activity by diverse RNA and protein regulators." Rna 25(5): 539-556. Fatma, M., Parveen, S., & Mir, S. S. (2025). Unraveling the kinase code: Role of protein kinase in lung cancer pathogenesis and therapeutic strategies. Biochimica et Biophysica Acta (BBA) - Reviews on Cancer, 1880(3), 189309. Östling, E. M., Baltrunas, T., Grootenboer, N., & Urbonavicius, S. (2025). Cracking the Kinase Code: Urinary Biomarkers as Early Alarms for AAA Rupture—A Pilot Study. J Clin Med, 14(11), 3845.
189	Lactylation code	The Lactylation Code	Chen, A.-N., Luo, Y., Yang, Y.-H., Fu, J.-T., Geng, X.-M., Shi, J.-P., & Yang, J. (2021). Lactylation, a Novel Metabolic Reprogramming Code: Current Status and Prospects [Review]. Front Immunol, Volume 12 - 2021. Xu, X., Wu, X., Jin, D., Ji, J., Wu, T., Huang, M., . . . Cao, X. (2025). Lactylation: the regulatory code of cellular life activity and a barometer of diseases. Cellular Oncology, 48(5), 1203-1217.
190	Lamin code	The Lamin Code	Maraldi, N. M. (2018). “The lamin code.” Biosystems 164: 68-75.
191	Language code	The Language Code	Javier, R. A. and L. R. Marcos (1989). “The role of stress on the language-independence and code-switching phenomena.” J Psycholinguist Res 18(5): 449-472. Baron-Cohen, S., D. A. Baldwin and M. Crowson (1997). "Do children with autism use the speaker's direction of gaze strategy to crack the code of language?" Child Dev 68(1): 48-57. McNealy, K., J. C. Mazziotta and M. Dapretto (2006). “Cracking the language code: neural mechanisms underlying speech parsing.” J Neurosci 26(29): 7629-7639. Love, N. (2007). “Are languages digital codes?” Language Sciences 29(5): 690-709. Cowley, S. J. (2008). The Codes of Language: Turtles All the Way Up? The Codes of Life: The Rules of Macroevolution. M. Barbieri and J. Hoffmeyer. Dordrecht, Springer Netherlands: 319-345. Ng, S., C. Gonzalez and N. Y. Wicha (2014). "The fox and the cabra: an ERP analysis of reading code switched nouns and verbs in bilingual short stories." Brain Res 1557: 127-140. Guevara Erra, R. and J. Gervain (2016). “The Efficient Coding of Speech: Cross-Linguistic Differences.” PLOS ONE 11(2): e0148861.

			Adler, R. M., J. R. Valdés Kroff and J. M. Novick (2020). "Does integrating a code-switch during comprehension engage cognitive control?" J Exp Psychol Learn Mem Cogn 46(4): 741-759. Emmorey, K., C. Li, J. Petrich and T. H. Gollan (2020). "Turning languages on and off: Switching into and out of code-blends reveals the nature of bilingual language control." J Exp Psychol Learn Mem Cogn 46(3): 443-454. Kheder, S. and E. Kaan (2021). "Cognitive control in bilinguals: Proficiency and code-switching both matter." Cognition 209: 104575. Blackburn, A. M. and N. Y. Y. Wicha (2022). "The Effect of Code-Switching Experience on the Neural Response Elicited to a Sentential Code Switch." Languages (Basel) 7(3). Gross, M. C. and M. Kaushanskaya (2022). "Language Control and Code-Switching in Bilingual Children With Developmental Language Disorder." J Speech Lang Hear Res 65(3): 1104-1127.
192	Latency code	The Latency Behaviour Codes	Sawtell, N. B., A. Williams, P. D. Roberts, G. von der Emde and C. C. Bell (2006). "Effects of sensing behavior on a latency code." J Neurosci 26(32): 8221-8234.
193	Laugh code	The Laugh Code	Berger, A. A. (1975). What makes people laugh? Cracking the cultural code. Etc., 32(4), 427–428. Siegel, J. (1995). How to get a laugh in Fijian: Code-switching and humor. Language in Society, 24(1), 95-110. McGraw, P., & Warner, J. (2014). The Humor Code: A Global Search for What Makes Things Funny. Simon & Schuster Paperbacks. Johnson, E. (2018). Don't Make Me Laugh - Speech Codes and the Humorless Campus In D. A. Downs & C. W. Surprenant (Eds.), The Value and Limits of Academic Speech - Philosophical, Political, and Legal Perspectives Routledge. Caruana, F., Palagi, E., & de Waal, F. B. M. (2022). Cracking the laugh code: laughter through the lens of biology, psychology and neuroscience. Philosophical Transactions of the Royal Society B: Biological Sciences, 377(1863).
194	Life cycle code	Th Life Cycle Code	Liu, J. (2020). "The "life code": A theory that unifies the human life cycle and the origin of human tumors." Semin Cancer Biol 60: 380-397.
195	Light code	The Neuron Light Code	Moro, C., A. Liebert, C. Hamilton, N. Pasqual, G. Jeffery, J. Stone and J. Mitrofanis (2022). "The code of light: do neurons generate light to communicate and repair?" Neural Regen Res 17(6): 1251-1252.

196	Lipid code	The Lipid Codes	Zhou, Y. and J. F. Hancock (2018). "Deciphering lipid codes: K-Ras as a paradigm." Traffic 19(3): 157-165. Platre, M. P., L. C. Noack, M. Doumane, V. Bayle, M. L. A. Simon, L. Maneta-Peyret, L. Fouillen, T. Stanislas, L. Armengot, P. Pejchar, M. C. Caillaud, M. Potocký, A. Čopič, P. Moreau and Y. Jaillais (2018). "A Combinatorial Lipid Code Shapes the Electrostatic Landscape of Plant Endomembranes." Dev Cell 45(4): 465-480.e411. Schuhmacher, M., A. T. Grasskamp, P. Barahtjan, N. Wagner, B. Lombardot, J. S. Schuhmacher, P. Sala, A. Lohmann, I. Henry, A. Shevchenko, Ü. Coskun, A. M. Walter and A. Nadler (2020). "Live-cell lipid biochemistry reveals a role of diacylglycerol side-chain composition for cellular lipid dynamics and protein affinities." Proceedings of the National Academy of Sciences 117(14): 7729-7738. Tan, S., Zhang, X., Kong, W., Yang, X. L., Molnár, G., Vondráková, Z., . . . Xue, H. W. (2020). The lipid code-dependent phosphoswitch PDK1-D6PK activates PIN-mediated auxin efflux in Arabidopsis. Nat Plants, 6(5), 556-569. Zhou, Y. and J. F. Hancock (2020). "A novel prenyl-polybasic domain code determines lipid-binding specificity of the K-Ras membrane anchor." Small GTPases 11(3): 220-224. Herrmann, E., Langemeyer, L., Auffarth, K., Ungermann, C., & Kümmel, D. (2023). Targeting of the Mon1-Ccz1 Rab guanine nucleotide exchange factor to distinct organelles by a synergistic protein and lipid code. Journal of Biological Chemistry, 299(3), 102915. Melero, A., & Jiménez-Rojo, N. (2023). Cracking the membrane lipid code. Curr Opin Cell Biol, 83, 102203. Lopez-Martin, M., Catalina-Hernandez, E., & Peralvarez-Marin, A. (2025). Computational insights into the lipid code of transient receptor potential vanilloid channels reveal overlap with drug binding sites. International Journal of Biological Macromolecules, 330, 148108. Tang, H., Zhang, Y., Zhao, D., Guo, M., Yuan, X., & Wang, X. (2025). Unlocking the lipid code: SREBPs as key drivers in gastrointestinal tumour metabolism. Lipids in Health and Disease, 24(1), 190.
197	Lipidation code	The (Protein) Lipidation Code	Sani, S. A., Chytła, A., & Sztacho, M. (2026). Lipidation as a post-translational code for protein liquid-liquid phase separation. Journal of Lipid Research, 67(3), 101001.
198	Longevity code	The Longevity Code	Wang, M. C. (2022). Cracking genetic codes of longevity. Nature Reviews Molecular Cell Biology, 23(1), 2-2.

			Chen, Z., Wang, H., Chen, Y., & Ni, J. (2026). The longevity code in four letters (amino acids). Chinese Medical Journal, 139(03), 317-318.
199	Lumpy skin code	The Lumpy Skin Disease Code	Yadav, D., Rao, G. K., Paliwal, D., Singh, A., Alam, A., Kumar Sharma, P., . . . Kumar, Y. (2024). Cracking the Code of Lumpy Skin Disease: Identifying Causes, Symptoms and Treatment Options for Livestock Farmers. Infectious Disorders - Drug Targets, 24(5), 57-71.
200	Lymphoid ETS code	The Lymphoid ETS-Code	Nagel, S., Meyer, C., & Pommerenke, C. (2023). Establishment of the lymphoid ETS-code reveals deregulated ETS genes in Hodgkin lymphoma. PLoS One, 18(7), e0288031.
201	Macrophage code	The Macrophage Codes	Jubrail, J., Kurian, N., & Niedergang, F. (2017). Macrophage phagocytosis cracking the defect code in COPD. Biomed J, 40(6), 305-312. Bronte, V. (2019). Deciphering Macrophage and Monocyte Code to Stratify Human Breast Cancer Patients. Cancer Cell, 35(4), 538-539. Monaco, C., & Dib, L. (2023). Breaking the macrophage code in atherosclerosis. Cardiovasc Res, 119(8), 1622-1623. Hoffmann, A. (2025). Macrophage reprogramming regulated by temporal and combinatorial signaling codes 2382. The Journal of Immunology, 214(Supplement_1).
202	Magnitude codes	The Magnitude Neuronal Codes	Polley, D. B., Heiser, M. A., Blake, D. T., Schreiner, C. E., & Merzenich, M. M. (2004). Associative learning shapes the neural code for stimulus magnitude in primary auditory cortex. Proceedings of the National Academy of Sciences, 101(46), 16351-16356. Piazza, M., Pinel, P., Le Bihan, D., & Dehaene, S. (2007). A Magnitude Code Common to Numerosities and Number Symbols in Human Intraparietal Cortex. Neuron, 53(2), 293-305. Chiou, R. Y., E. C. Chang, O. J. Tzeng and D. H. Wu (2009). "The common magnitude code underlying numerical and size processing for action but not for perception." Exp Brain Res 194(4): 553-562. Nieder, A. (2017). “Magnitude Codes for Cross-Modal Working Memory in the Primate Frontal Association Cortex.” Front Neurosci 11: 202.
203	Matrix code	The Pericellular Matrix Code	Baumann, B. T., Nieuwstraten, J., Konrads, C., Guilak, F., & Danalache, M. (2025). Cracking the Pericellular Matrix Code: Exploring how MMP-2, -3, and -7 influence matrix breakdown and biomechanical properties. Osteoarthritis Cartilage, 33(2), 241-246.

204	Mechanical code	The Mechanical Codes	Das, R., L. C. Lin, F. Català-Castro, N. Malaiwong, N. Sanfeliu-Cerdán, M. Porta-de-la-Riva, A. Pidde and M. Krieg (2021). "An asymmetric mechanical code ciphers curvature-dependent proprioceptor activity." Sci Adv 7(38): eabg4617.
205	Meiosis codes	The Meiosis Codes	Kim, J.-M., H. Liu , M. Tazaki, M. Nagata and F. Aoki (2003). "Changes in histone acetylation during mouse oocyte meiosis." Journal of Cell Biology 162(1): 37-46. Ivanovska, I., T. Khandan, T. Ito and T. L. Orr-Weaver (2005). "A histone code in meiosis: the histone kinase, NHK-1, is required for proper chromosomal architecture in Drosophila oocytes." Genes & Development 19(21): 2571-2582. Xu, D., J. Bai, Q. Duan, M. Costa and W. Dai (2009). "Covalent modifications of histones during mitosis and meiosis." Cell Cycle 8(22): 3688-3694. Ishiguro, K.-i., J. Kim, S. Fujiyama-Nakamura, S. Kato and Y. Watanabe (2011). "A new meiosis-specific cohesin complex implicated in the cohesin code for homologous pairing." EMBO reports 12(3): 267-275. Wang, L., Z. Xu, M. B. Khawar, C. Liu and W. Li (2017). "The histone codes for meiosis." Reproduction 154(3): R65-R79.
206	Melatonin codes	The Melatonin Codes **SEE also Circardian codes**	Wayne, N. L., B. Malpaux and F. J. Karsch (1988). "How does melatonin code for day length in the ewe: duration of nocturnal melatonin release or coincidence of melatonin with a light-entrained sensitive period?" Biol Reprod 39(1): 66-75. Karsch, F. J., B. Malpaux, N. L. Wayne and J. E. Robinson (1988). "Characteristics of the melatonin signal that provide the photoperiodic code for timing seasonal reproduction in the ewe." Reprod Nutr Dev (1980) 28(2b): 459-472. Stehle, J. H., C. von Gall, C. Schomerus and H. W. Korf (2001). "Of rodents and ungulates and melatonin: creating a uniform code for darkness by different signaling mechanisms." J Biol Rhythms 16(4): 312-325.
207	Melody code	The Neural Melody Code	Narmour, E. (1989). The "genetic code" of melody: Cognitive structures generated by the implication-realization model. Contemporary Music Review, 4(1), 45-63. Samson, S., & Zatorre, R. J. (1991). Recognition memory for text and melody of songs after unilateral temporal lobe lesion: Evidence for dual encoding. Journal of Experimental Psychology: Learning, Memory, and Cognition, 17(4), 793–804.

			Plantinga, J., & Trainor, L. J. (2005). Memory for melody: infants use a relative pitch code. Cognition, 98(1), 1-11. Sankaran, N., Leonard, M. K., Theunissen, F., & Chang, E. F. (2024). Encoding of melody in the human auditory cortex. Sci Adv, 10(7), eadk0010.
208	Membrane code	The Membrane Code	Halbhuber, K. J., W. Linss, N. Zimmermann, H. Oehring and L. Pätzold (1986). "Cytochemical and cellbiological investigations of the signal function of the erythrocyte plasmalemma–the membrane structure as code for cell life span." Acta Histochem Suppl 33: 23-44. Lundin, C., H. Kim, I. Nilsson, S. H. White and G. von Heijne (2008). "Molecular code for protein insertion in the endoplasmic reticulum membrane is similar for N(in)-C(out) and N(out)-C(in) transmembrane helices." Proc Natl Acad Sci U S A 105(41): 15702-15707. Futerman, A. H. and M. Schuldiner (2010). "Lipids: The plasma membrane code." Nat Chem Biol 6(7): 487-488. Wells, J. (2013) The Membrane Code: A Carrier of Essential Biological Information That Is Not Specified by DNA and Is Inherited Apart from It. Biological Information: 474-488. Futerman, A. H. and M. Schuldiner (2010). "The plasma membrane code." Nature Chemical Biology 6(7): 487-488. Salzer, U., J. Kostan and K. Djinović-Carugo (2017). "Deciphering the BAR code of membrane modulators." Cell Mol Life Sci 74(13): 2413-2438. Nwamba, O. C. (2020). "Membranes as the third genetic code." Mol Biol Rep 47(5): 4093-4097. Skilling, Q. M., B. Eniwaye, B. C. Clawson, J. Shaver, N. Ognjanovski, S. J. Aton and M. Zochowski (2021). "Acetylcholine-gated current translates wake neuronal firing rate information into a spike timing-based code in Non-REM sleep, stabilizing neural network dynamics during memory consolidation." PLoS Comput Biol 17(9): e1009424. Kunnath Muhammedkutty, F. N., & Zhou, H.-X. (2025). BPS2025 - A membrane-insertion code for intrinsically disordered proteins. Biophysical Journal, 124(3), 71a.
209	Memory code	The Memory Code	Eichenbaum, H. (2001). "The hippocampus and declarative memory: cognitive mechanisms and neural codes." Behavioural Brain Research 127(1): 199-207. Jensen, O. (2001). "Information transfer between rhythmically coupled networks: reading the hippocampal phase code." Neural Comput 13(12): 2743-2761.

			Chapouthier, G. (2004). From the Search for a Molecular Code of Memory to the Role of Neurotransmitters: A Historical Perspective. Neural Plast, 11(3-4), 318075. Wood, M. A., J. D. Hawk and T. Abel (2006). “Combinatorial chromatin modifications and memory storage: a code for memory?” Learn Mem 13(3): 241-244. Tsien, J. Z. (2007). "The memory code. Researchers are closing in on the rules that the brain uses to lay down memories. Discovery of this memory code could lead to the design of smarter computers and robots and even to new ways to peer into the human mind." Sci Am 297(1): 52-59. Jaramillo, J. and R. Kempter (2017). "Phase precession: a neural code underlying episodic memory?" Curr Opin Neurobiol 43: 130-138. Snider, K. H., K. A. Sullivan and K. Obrietan (2018). “Circadian Regulation of Hippocampal-Dependent Memory: Circuits, Synapses, and Molecular Mechanisms.” Neural Plast 2018: 7292540. Rawashdeh, O., R. Parsons and E. Maronde (2018). “Clocking In Time to Gate Memory Processes: The Circadian Clock Is Part of the Ins and Outs of Memory.” Neural Plasticity 2018: 6238989. Skilling, Q. M., B. Eniwaye, B. C. Clawson, J. Shaver, N. Ognjanovski, S. J. Aton and M. Zochowski (2021). "Acetylcholine-gated current translates wake neuronal firing rate information into a spike timing-based code in Non-REM sleep, stabilizing neural network dynamics during memory consolidation." PLoS Comput Biol 17(9): e1009424. Cattaneo, A. and M. Mainardi (2022). “Editorial: From Whole-Cell to Single Synapse Engrams – Breaking the Code for Memory Formation, Storage and Recall.” Front Mol Neurosci 15: 845516. Gershman, S. J. (2023). "The molecular memory code and synaptic plasticity: A synthesis." Biosystems 224: 104825.
210	Mercury Methylation Code	The Mercury Methylation Code	Poulain, A. J., & Barkay, T. (2013). Cracking the Mercury Methylation Code. Science, 339(6125), 1280-1281.
211	MeshCODE	The Memory Code	Goult, B. T. (2021). “The Mechanical Basis of Memory – the MeshCODE Theory.” Frontiers in Molecular Neuroscience 14. Barnett, S. F. H. and B. T. Goult (2022). “The MeshCODE to scale – Visualising synaptic binary information.” bioRxiv: 2022.2006.2016.496395.
212	Meta code	The Metacode	Paredes, O., J. A. Morales, A. P. Mendizabal and R. Romo-Vázquez (2021). “Metacode: One code to rule them all.” Biosystems 208: 104486.

213	Metabolic code	The Metabolic Code	Tomkins, G. M. (1975). “The Metabolic Code.” Science 189(4205): 760-763. Zhao, X. Y. and J. D. Lin (2015). "Long Noncoding RNAs: A New Regulatory Code in Metabolic Control." Trends Biochem Sci 40(10): 586-596. Korošak, D. and M. Slak Rupnik (2018). “Collective Sensing of β-Cells Generates the Metabolic Code.” Front Physiol 9: 31. Neu, C., B. Ibrahim and P. Dittrich (2018). “Molecular Codes in Large Metabolic Network.” MATCH Commun. Math. Comput. Chem. 80: 587-604. Korošak, D. and M. Slak Rupnik (2018). “Collective Sensing of β-Cells Generates the Metabolic Code.” Front Physiol 9: 31. Bukowski, M., M. Kosecka-Strojek, A. Madry, R. Zagorski-Przybylo, T. Zadlo, K. Gawron and B. Wladyka (2022). “Staphylococcal saoABC Operon Codes for a DNA-Binding Protein SaoC Implicated in the Response to Nutrient Deficit.” International Journal of Molecular Sciences 23(12): 6443. Campit, S. E., A. Meliki, N. A. Youngson and S. Chandrasekaran (2020). “Nutrient Sensing by Histone Marks: Reading the Metabolic Histone Code Using Tracing, Omics, and Modeling.” Bioessays 42(9): e2000083. Hwang, D., Chong, E., Li, Y., Li, Y., & Roh, K. (2025). Deciphering the gut microbiome’s metabolic code: pathways to bone health and novel therapeutic avenues [Review]. Front Endocrinol (Lausanne), Volume 16 - 2025. Khalid, M. B. (2025). Deep learning: Cracking the metabolic code. Hepatology, 81(3). Tschuck, J., Skafar, V., Friedmann Angeli, J. P., & Hadian, K. (2025). The metabolic code of ferroptosis: nutritional regulators of cell death. Trends Biochem Sci, 50(8), 663-676. Monzo, L., & Girerd, N. (2026). Decoding the inflammatory–metabolic code: machine learning potential for outcome prediction in heart failure with diabetes. International Journal of Cardiology, 442.
214	Methylation code (DNA)	The DNA Methylation Code	Papin, C., A. Ibrahim, S. L. Gras, A. Velt, I. Stoll, B. Jost, H. Menoni, C. Bronner, S. Dimitrov and A. Hamiche (2017). “Combinatorial DNA methylation codes at repetitive elements.” Genome Res 27(6): 934-946.
215	Methlyation code (RNA)	The RNA Methlyation Code	Song, D., & Shyh-Chang, N. (2022). An RNA methylation code to regulate protein translation and cell fate. Cell Prolif, 55(5), e13224.

216	MHC code	The Major Histocompatibility Complex class II Code	Liu, J., Song, X., Guo, W., Liu, W., Xu, S., Yang, Y., . . . Lei, Z. (2025). Unlock the code of MHC II-enabled Cancer immunotherapy. Critical Reviews in Oncology/Hematology, 214, 104813.
217	Microbiome code	The Microbiome Composition Code	Rosen, C. E. and N. W. Palm (2017). "Functional Classification of the Gut Microbiota: The Key to Cracking the Microbiota Composition Code: Functional classifications of the gut microbiota reveal previously hidden contributions of indigenous gut bacteria to human health and disease." Bioessays 39(12). Sultana, M., Hossain, A., Noor, E. M., & Begum, A. (2026). Microbial Genomics: Unraveling the Healthomic Code. In A. H. M. N. Nabi & H. Uddin Shekhar (Eds.), Biotechnological Advances in Healthomics (pp. 13-33). Springer Nature Singapore. Tana, C., Bernardinello, N., & Spagnolo, P. (2026). Editorial: Unlocking the microbial code: potential role in sarcoidosis pathogenesis and treatment [Editorial]. Front Immunol, Volume 17 - 2026. Zhang, Y., Jia, Z., & Zhang, T. (2026). Microbes: the invisible codes of forensic science. Journal of Applied Microbiology, 137(3).
218	Microenvironmental code	The Microenvironmental Codes **SEE also Cancer Code**	Zhou, Q. Q., Ren, Y. M., Shi, S. M., & Liu, T. F. (2025). Microenvironmental code of pancreatic ductal adenocarcinoma: The prognostic symphony of budding, matrix and lymphocytes. World J Gastrointest Oncol, 17(10), 110523.
219	Microtubular code	The Microtubular Code	Koruga, D. L. (1986). "Microtubular screw symmetry: packing of spheres as a latent bioinformation code." Ann N Y Acad Sci 466: 953-955.
220	Mineral code	The Mineral Codes	Ding, Z., Han, G., Tian, Y., Qu, R., Liu, J., Wang, D., & Zhao, Y. (2025). Deciphering the mineral code of urinary stones: A first look at zinc isotopes. Environmental Pollution, 367, 125586.
221	miRNA codes	The Micro-RNA Codes	Forman, J. J. and H. A. Coller (2010). "The code within the code: microRNAs target coding regions." Cell Cycle 9(8): 1533-1541. Shin, C., J. W. Nam, K. K. Farh, H. R. Chiang, A. Shkumatava and D. P. Bartel (2010). "Expanding the microRNA targeting code: functional sites with centered pairing." Mol Cell 38(6): 789-802. Pepe, S. (2012). "MicroRNAs in heart, lung and circulation (and beyond): life's ubiquitous code for regulating complex function." Heart Lung Circ 21(3): 127-128. Gheinani, A. H., Burkhard, F. C., & Monastyrskaya, K. (2013). Deciphering microRNA code in pain and inflammation: lessons from bladder pain syndrome. Cellular and Molecular Life Sciences, 70(20), 3773-3789.

			Cora, D. and M. Caselle (2018). “The Epithelial-Mesenchymal Transition, as Hacked by a microRNA Combinatorial Code.” Cell Syst 7(1): 3-4. Verduci, L., S. Strano, Y. Yarden and G. Blandino (2019). "The circRNA-microRNA code: emerging implications for cancer diagnosis and treatment." Mol Oncol 13(4): 669-680. Garcia-Martin, R., Wang, G., Brandão, B. B., Zanotto, T. M., Shah, S., Kumar Patel, S., . . . Kahn, C. R. (2022). MicroRNA sequence codes for small extracellular vesicle release and cellular retention. Nature, 601(7893), 446-451. Cammarata, G., N. Barraco, I. Giusti, V. Gristina, V. Dolo and S. Taverna (2022). "Extracellular Vesicles-ceRNAs as Ovarian Cancer Biomarkers: Looking into circRNA-miRNA-mRNA Code." Cancers (Basel) 14(14). Murakami, S., & Jaffrey, S. R. (2022). Hidden codes in mRNA: Control of gene expression by m6A. Molecular Cell, 82(12), 2236-2251. Fujii, Y. R. (2023). The MicroRNA Quantum Code Book. Springer Singapore.
222	Mirror code	The Cholesterol Recognition/Mirror Code	Fantini, J., C. Di Scala, L. S. Evans, P. T. F. Williamson and F. J. Barrantes (2016). “A mirror code for protein-cholesterol interactions in the two leaflets of biological membranes.” Scientific Reports 6(1): 21907. Sutter, M. L., L. Console, A. F. Fahner, S. L. Samodelov, Z. Gai, G. Ciarimboli, C. Indiveri, G. A. Kullak-Ublick and M. Visentin (2021). “The role of cholesterol recognition (CARC/CRAC) mirror codes in the allosterism of the human organic cation transporter 2 (OCT2, SLC22A2).” Biochem Pharmacol 194: 114840.
223	Mitochondrial genetic code	The Mitochondrial Genetic Code	Swire, J., O. P. Judson and A. Burt (2005). “Mitochondrial genetic codes evolve to match amino acid requirements of proteins.” J Mol Evol 60(1): 128-139. Sengupta, S., X. Yang and P. G. Higgs (2007). “The Mechanisms of Codon Reassignments in Mitochondrial Genetic Codes.” Journal of Molecular Evolution 64(6): 662-688.
224	Mitosis codes	The Mitosis Codes **SEE also Tubulin codes**	Bloom, K. S. (2008). “Beyond the code: the mechanical properties of DNA as they relate to mitosis.” Chromosoma 117(2): 103-110. Georgatos, S. D., Y. Markaki, A. Christogianni and A. S. Politou (2009). “Chromatin remodeling during mitosis: a structure-based code?” Front Biosci (Landmark Ed) 14(6): 2017-2027.

			Barisic, M. and H. Maiato (2015). “Cracking the (tubulin) code of mitosis.” Oncotarget 6(23): 19356-19357. Ferreira, L. T., A. C. Figueiredo, B. Orr, D. Lopes and H. Maiato (2018). Chapter 3 – Dissecting the role of the tubulin code in mitosis. Methods in Cell Biology. H. Maiato and M. Schuh, Academic Press. 144: 33-74. Lopes, D. and H. Maiato (2020). “The Tubulin Code in Mitosis and Cancer.” Cells 9(11): 2356.
225	Mnemonic code	The Mnemonic codes	Goosens, K. A., J. A. Hobin and S. Maren (2003). "Auditory-evoked spike firing in the lateral amygdala and Pavlovian fear conditioning: mnemonic code or fear bias?" Neuron 40(5): 1013-1022. Patai, E. Z. and H. J. Spiers (2016). “Cracking the mnemonic code.” Nat Neurosci 20(1): 8-9.
226	Modification code	The RNA Polymerase Modification Codes	Brookes, E. and A. Pombo (2012). “Code breaking: The RNAPII modification code in pluripotency.” Cell Cycle 11(7): 1267-1268.
227	Modularity codes	The Modularity Codes	Prinz, R. (2022). “The modularity codes.” Biosystems 219: 104735.
228	Molecular codes	The Molecular Codes	Raykhel, I., H. Alanen, K. Salo, J. Jurvansuu, V. D. Nguyen, M. Latva-Ranta and L. Ruddock (2007). "A molecular specificity code for the three mammalian KDEL receptors." J Cell Biol 179(6): 1193-1204. De Beule, J., E. Hovig and M. Benson (2011). “Introducing Dynamics into the Field of Biosemiotics.” Biosemiotics 4(1): 5-24. Görlich, D., S. Artmann and P. Dittrich (2011). “Cells as semantic systems.” Biochimica et Biophysica Acta (BBA) – General Subjects 1810(10): 914-923. Görlich, D. and P. Dittrich (2013). “Molecular codes in biological and chemical reaction networks.” PloS One 8(1): e54694. DiChiara, A. S., R. C. Li, P. H. Suen, A. S. Hosseini, R. J. Taylor, A. F. Weickhardt, D. Malhotra, D. R. McCaslin and M. D. Shoulders (2018). "A cysteine-based molecular code informs collagen C-propeptide assembly." Nat Commun 9(1): 4206.
229	Monocyte code	The Monocyte Codes	Hedrick, C. C. (2024). Single-Cell Sleuthing: Cracking the Monocyte Code for Cardiovascular Clues. Circ Res, 135(6), 701-703.
230	Morphogenetic code	The Morphogenetic Code	Matsuda, K., H. Gotoh, Y. Tajika, T. Sushida, H. Aonuma, T. Niimi, M. Akiyama, Y. Inoue and S. Kondo (2017). “Complex furrows in a 2D epithelial sheet code the 3D structure of a beetle horn.” Sci Rep 7(1): 13939.

			Tassinari, R., C. Cavallini, E. Olivi, V. Taglioli, C. Zannini and C. Ventura (2021). "Unveiling the morphogenetic code: A new path at the intersection of physical energies and chemical signaling." World J Stem Cells 13(10): 1382-1393. Tassinari, R., C. Cavallini, E. Olivi, F. Facchin, V. Taglioli, C. Zannini, M. Marcuzzi and C. Ventura (2022). "Cell Responsiveness to Physical Energies: Paving the Way to Decipher a Morphogenetic Code." Int J Mol Sci 23(6). Qin, J., Kinobe, R., Schaeffer, P. M., & Hong, Y. (2025). The bacterial cell envelope as a morphogenetic code for biofilm development. Microbiology Australia, 46(4), 227-230.
231	Motor neuron code	The Motor Neuron Codes	Lumsden, A. (1995). "Neural development. A 'LIM code' for motor neurons?" Curr Biol 5(5): 491-495. Thor, S., S. G. Andersson, A. Tomlinson and J. B. Thomas (1999). "A LIM-homeodomain combinatorial code for motor-neuron pathway selection." Nature 397(6714): 76-80. Glaze, C. M. and T. W. Troyer (2007). "Behavioral measurements of a temporally precise motor code for birdsong." J Neurosci 27(29): 7631-7639. Stein, W., O. Straub, J. Ausborn, W. Mader and H. Wolf (2008). "Motor pattern selection by combinatorial code of interneuronal pathways." J Comput Neurosci 25(3): 543-561. Igarashi, J., Y. Isomura, K. Arai, R. Harukuni and T. Fukai (2013). "A θ-γ oscillation code for neuronal coordination during motor behavior." J Neurosci 33(47): 18515-18530. Chaisanguanthum, K. S., M. Joshua, J. F. Medina, W. Bialek and S. G. Lisberger (2014). "The Neural Code for Motor Control in the Cerebellum and Oculomotor Brainstem." eNeuro 1(1). Pazzaglia, M., & Galli, G. (2015). Translating novel findings of perceptual-motor codes into the neuro-rehabilitation of movement disorders [Perspective]. Front Behav Neurosci, Volume 9 - 2015. Behroozmand, R., S. Sangtian, O. Korzyukov and C. R. Larson (2016). "A temporal predictive code for voice motor control: Evidence from ERP and behavioral responses to pitch-shifted auditory feedback." Brain Res 1636: 1-12. Rothermund, K., & Giesen, C. (2016). Multi-Level Response Coding in Stimulus-Response Bindings: Irrelevant Distractors Retrieve Both Semantic and Motor Response Codes. Journal of Experimental Psychology: Learning, Memory, and Cognition, 42(10), 1643-1656.

			Payne, H. L., R. L. French, C. C. Guo, T. B. Nguyen-Vu, T. Manninen and J. L. Raymond (2019). "Cerebellar Purkinje cells control eye movements with a rapid rate code that is invariant to spike irregularity." Elife 8. Rinnert, P. and A. Nieder (2021). "Neural Code of Motor Planning and Execution during Goal-Directed Movements in Crows." J Neurosci 41(18): 4060-4072.
232	mRNA degradation code	The mRNA Degradation Code **SEE also mRNA Stability Code**	Alonso, C. R. (2012). A complex ‘mRNA degradation code’ controls gene expression during animal development. Trends in Genetics, 28(2), 78-88.
233	mRNA stability code	The Universal mRNA Stability Code **SEE also mRNA Degradation Code**	Chen, Y.-H., & Coller, J. (2016). A Universal Code for mRNA Stability? Trends in Genetics, 32(11), 687-688.
234	Musical code	The Musical Codes	Cariani, P. (2001). Temporal Codes, Timing Nets, and Music Perception. Journal of New Music Research, 30(2), 107-135. Reybrouck, M. (2008). The Musical Code between Nature and Nurture: Ecosemiotic and Neurobiological Claims. The Codes of Life: The Rules of Macroevolution. M. Barbieri and J. Hoffmeyer. Dordrecht, Springer Netherlands: 395-434. Jacko, V. A., Choi, J. H., Carballo, A., Charlson, B., & Moore, J. E. (2015). A New Synthesis of Sound and Tactile Music Code Instruction in a Pilot Online Braille Music Curriculum. Journal of Visual Impairment & Blindness, 109(2), 153-157. Igamberdiev, A. U. (2024). Reflexive neural circuits and the origin of language and music codes. Biosystems, 246, 105346.
235	Mutualism code	The Mutualism Ant-Plant Code	Letourneau, D. K. (1990). “Code of ant-plant mutualism broken by parasite.” Science 248(4952): 215-217.
236	Myelin code	The Myelin Code	Farhadi, H. F., P. Lepage, R. Forghani, H. C. H. Friedman, W. Orfali, L. Jasmin, W. Miller, T. J. Hudson and A. C. Peterson (2003). “A Combinatorial Network of Evolutionarily Conserved Myelin Basic Protein Regulatory Sequences Confers Distinct Glial-Specific Phenotypes.” The Journal of Neuroscience 23(32): 10214-10223. Wood, H. (2004). “A time code for myelin.” Nature Reviews Neuroscience 5(1): 9-9.

237	Navigation codes	The Navigation / Orientation / Movement Codes	Camhi, J. M. and A. Levy (1989). "The code for stimulus direction in a cell assembly in the cockroach." J Comp Physiol A 165(1): 83-97. Frens, M. A., Y. Suzuki, H. Scherberger, K. Hepp and V. Henn (1998). "The collicular code of saccade direction depends on the roll orientation of the head relative to gravity." Exp Brain Res 120(3): 283-290. Erdi, P., Z. Huhn and T. Kiss (2005). "Hippocampal theta rhythms from a computational perspective: code generation, mood regulation and navigation." Neural Netw 18(9): 1202-1211. Bremner, A. J., D. Mareschal, S. Lloyd-Fox and C. Spence (2008). "Spatial localization of touch in the first year of life: early influence of a visual spatial code and the development of remapping across changes in limb position." J Exp Psychol Gen 137(1): 149-162. Nadler, J. W., M. Nawrot, D. E. Angelaki and G. C. DeAngelis (2009). "MT neurons combine visual motion with a smooth eye movement signal to code depth-sign from motion parallax." Neuron 63(4): 523-532. Takahashi, M., J. Lauwereyns, Y. Sakurai and M. Tsukada (2009). "A code for spatial alternation during fixation in rat hippocampal CA1 neurons." J Neurophysiol 102(1): 556-567. Khosravi-Hashemi, N. and M. J. Chacron (2012). "Bursts and isolated spikes code for opposite movement directions in midbrain electrosensory neurons." PloS One 7(6): e40339. Takahashi, M., H. Nishida, A. D. Redish and J. Lauwereyns (2014). "Theta phase shift in spike timing and modulation of gamma oscillation: a dynamic code for spatial alternation during fixation in rat hippocampal area CA1." J Neurophysiol 111(8): 1601-1614. Dewar, A. D. M., A. Wystrach, P. Graham and A. Philippides (2015). "Navigation-specific neural coding in the visual system of Drosophila." Biosystems 136: 120-127. Shine, J. P., J. P. Valdés-Herrera, M. Hegarty and T. Wolbers (2016). "The Human Retrosplenial Cortex and Thalamus Code Head Direction in a Global Reference Frame." J Neurosci 36(24): 6371-6381. Hardcastle, K., N. Maheswaranathan, S. Ganguli and L. M. Giocomo (2017). "A Multiplexed, Heterogeneous, and Adaptive Code for Navigation in Medial Entorhinal Cortex." Neuron 94(2): 375-387.e377. Johari, K. and R. Behroozmand (2017). "Premotor neural correlates of predictive motor timing for speech production and hand movement: evidence for a temporal predictive code in the motor system." Exp Brain Res 235(5): 1439-1453.

			Takahashi, S. (2018). “The Hippocampal Ensemble Code for Spatial Navigation and Episodic Memory.” Adv Neurobiol 21: 49-70. Aery Jones, E. A., & Giocomo, L. M. (2023). Neural ensembles in navigation: From single cells to population codes. Curr Opin Neurobiol, 78, 102665.
238	Nerve growth code	The Nerve Growth Factor Code	Ottoson, D. (1999). “The unravelling of the code of nerve growth: a modern Saga of the dedication to science.” Brain Res Bull 50(5-6): 473-474. Beaujean, D., Rosenbaum, C., Müller, H.-W., Willemsen, J. J., Lenders, J., & Bornstein, S. R. (2003). Combinatorial code of growth factors and neuropeptides define neuroendocrine differentiation in PC12 cells. Exp Neurol, 184(1), 348-358. Morris, A. J., Parker, R. S., Nazzal, M. K., Natoli, R. M., Fehrenbacher, J. C., Kacena, M. A., & White, F. A. (2024). Cracking the Code: The Role of Peripheral Nervous System Signaling in Fracture Repair. Current Osteoporosis Reports, 22(1), 193-204.
239	Neural codes – A (general)	The General Neural Codes	Rose, G. J., M. Kawasaki and W. Heiligenberg (1988). "'Recognition units' at the top of a neuronal hierarchy? Prepacemaker neurons in Eigenmannia code the sign of frequency differences unambiguously." J Comp Physiol A 162(6): 759-772. Bialek, W., F. Rieke, R. R. de Ruyter van Steveninck and D. Warland (1991). “Reading a neural code.” Science 252(5014): 1854-1857. Ferster, D. and N. Spruston (1995). “Cracking the neuronal code.” Science 270(5237): 756-757. Gawne, T. J., T. W. Kjaer and B. J. Richmond (1996). "Latency: another potential code for feature binding in striate cortex." J Neurophysiol 76(2): 1356-1360. Richmond, B. J., T. J. Gawne and G.-X. Jin (1997). "Neuronal codes: reading them and learning how their structure influences network organization." Biosystems 40(1): 149-157. Tsodyks, M. V. and H. Markram (1997). "The neural code between neocortical pyramidal neurons depends on neurotransmitter release probability." Proc Natl Acad Sci U S A 94(2): 719-723. Lábos, E. (2000). "Codes, operations, measurements and neural networks." Biosystems 58(1): 9-18. Lemon, W. C. and W. M. Getz (2000). "Rate code input produces temporal code output from cockroach antennal lobes." Biosystems 58(1): 151-158. Lewis, E. R., K. R. Henry and W. M. Yamada (2000). "Essential roles of noise in neural coding and in studies of neural coding." Biosystems 58(1): 109-115.

			Segundo, J. P. (2000). "Some thoughts about neural coding and spike trains1Supported by Trent H. Wells jr. Inc.1." Biosystems 58(1): 3-7. Liu, R. C., S. Tzonev, S. Rebrik and K. D. Miller (2001). "Variability and information in a neural code of the cat lateral geniculate nucleus." J Neurophysiol 86(6): 2789-2806. Steinmetz, P. N., A. Manwani and C. Koch (2001). "Variability and coding efficiency of noisy neural spike encoders." Biosystems 62(1): 87-97. Bugmann, G. (2002). "Synaptic depression increases the selectivity of a neuron to its preferred pattern and binarizes the neural code." Biosystems 67(1-3): 17-25. Harris, C. M. (2002). "Temporal uncertainty in reading the neural code (proportional noise)." Biosystems 67(1-3): 85-94. Litvak, V., Sompolinsky, H., Segev, I., & Abeles, M. (2003). On the transmission of rate code in long feedforward networks with excitatory-inhibitory balance. J Neurosci, 23(7), 3006-3015. Rodríguez, M., E. Pereda, J. González, P. Abdala and J. A. Obeso (2003). "How is firing activity of substantia nigra cells regulated? Relevance of pattern-code in the basal ganglia." Synapse 49(4): 216-225. Bottjer, S. W. (2005). "Timing and prediction the code from basal ganglia to thalamus." Neuron 46(1): 4-7. Leonardo, A. (2005). "Degenerate coding in neural systems." J Comp Physiol A Neuroethol Sens Neural Behav Physiol 191(11): 995-1010. Nicolelis M and Ribeiro S (2006) Seeking the Neural Code. Scientific American, 295, 70-77. Ventriglia, F. (2006). "Global rhythmic activities in hippocampal neural fields and neural coding." Biosystems 86(1): 38-45. Villa, A. E. P. (2008). Neural Coding in the Neuroheuristic Perspective. The Codes of Life: The Rules of Macroevolution. M. Barbieri and J. Hoffmeyer. Dordrecht, Springer Netherlands: 357-377. Jacobs, A. L., G. Fridman, R. M. Douglas, N. M. Alam, P. E. Latham, G. T. Prusky and S. Nirenberg (2009). "Ruling out and ruling in neural codes." Proceedings of the National Academy of Sciences 106(14): 5936-5941. Samengo, I. and M. A. Montemurro (2010). "Conversion of phase information into a spike-count code by bursting neurons." PLoS One 5(3): e9669.

			King, P. D., Zylberberg, J., & DeWeese, M. R. (2013). Inhibitory interneurons decorrelate excitatory cells to drive sparse code formation in a spiking model of V1. J Neurosci, 33(13), 5475-5485. MacGregor, D. J., T. F. Clayton and G. Leng (2013). "Information coding in vasopressin neurons—The role of asynchronous bistable burst firing." Biosystems 112(2): 85-93. Stanley, G. B. (2013). “Reading and writing the neural code.” Nat Neurosci 16(3): 259-263. Turkheimer, F. E., R. Leech, P. Expert, L. D. Lord and A. C. Vernon (2015). "The brain's code and its canonical computational motifs. From sensory cortex to the default mode network: A multi-scale model of brain function in health and disease." Neurosci Biobehav Rev 55: 211-222. Yamada, K., Y. Miyawaki and Y. Kamitani (2015). "Inter-subject neural code converter for visual image representation." Neuroimage 113: 289-297. Joris, P. X. (2016). "Entracking as a Brain Stem Code for Pitch: The Butte Hypothesis." Adv Exp Med Biol 894: 347-354. Lareo, A., Forlim, C. G., Pinto, R. D., Varona, P., & Rodriguez, F. B. (2016). Temporal Code-Driven Stimulation: Definition and Application to Electric Fish Signaling. Front Neuroinform, 10, 41. Tamura, S., Y. Nishitani, C. Hosokawa, T. Miyoshi, H. Sawai, T. Kamimura, Y. Yagi, Y. Mizuno-Matsumoto and Y. W. Chen (2016). "Spike Code Flow in Cultured Neuronal Networks." Comput Intell Neurosci 2016: 7267691. Vyssotski, A. L., A. E. Stepien, G. B. Keller and R. H. Hahnloser (2016). "A Neural Code That Is Isometric to Vocal Output and Correlates with Its Sensory Consequences." PLoS Biol 14(10): e2000317. Bouton, C. (2017). Cracking the neural code, treating paralysis and the future of bioelectronic medicine. Journal of Internal Medicine, 282(1), 37-45. Souza, B. C. and A. B. L. Tort (2017). "Asymmetry of the temporal code for space by hippocampal place cells." Sci Rep 7(1): 8507. Naud, R., & Sprekeler, H. (2018). Sparse bursts optimize information transmission in a multiplexed neural code. Proceedings of the National Academy of Sciences, 115(27), E6329-E6338. Huetz, C., Souffi, S., Adenis, V., & Edeline, J. M. (2019). Neural code: Another breach in the wall? Behav Brain Sci, 42, e232.

			Sievers, B., C. Lee, W. Haslett and T. Wheatley (2019). "A multi-sensory code for emotional arousal." Proc Biol Sci 286(1906): 20190513. Rousseau, P. F., S. Boukezzi, R. Garcia, T. Chaminade and S. Khalfa (2020). "Cracking the EMDR code: Recruitment of sensory, memory and emotional networks during bilateral alternating auditory stimulation." Aust N Z J Psychiatry 54(8): 818-831. Sriram, B., Li, L., Cruz-Martín, A., & Ghosh, A. (2020). A Sparse Probabilistic Code Underlies the Limits of Behavioral Discrimination. Cerebral Cortex, 30(3), 1040-1055. Climer, J. R. and D. A. Dombeck (2021). "Information Theoretic Approaches to Deciphering the Neural Code with Functional Fluorescence Imaging." eNeuro 8(5). Lyall, E. H., D. P. Mossing, S. R. Pluta, Y. W. Chu, A. Dudai and H. Adesnik (2021). "Synthesis of a comprehensive population code for contextual features in the awake sensory cortex." Elife 10. Rossi, E., P. E. Dussias, M. Diaz, J. G. van Hell and S. Newman (2021). “Neural signatures of inhibitory control in intra-sentential code-switching: Evidence from fMRI.” J Neurolinguistics 57. Hudson, M. R., & Jones, N. C. (2022). Deciphering the code: Identifying true gamma neural oscillations. Exp Neurol, 357, 114205. Padamsey, Z., Katsanevaki, D., Dupuy, N., & Rochefort, N. L. (2022). Neocortex saves energy by reducing coding precision during food scarcity. Neuron, 110(2), 280-296.e210. Perks, K. E., & Sawtell, N. B. (2022). Neural readout of a latency code in the active electrosensory system. Cell Rep, 38(13). Friedenberger, Z., Harkin, E., Tóth, K., & Naud, R. (2023). Silences, spikes and bursts: Three-part knot of the neural code. J Physiol, 601(23), 5165-5193. Manookin, M. B., & Rieke, F. (2023). Two Sides of the Same Coin: Efficient and Predictive Neural Coding. Annual Review of Vision Science, 9(Volume 9, 2023), 293-311. Karlsson, V., & Kämäräinen, J. (2025). Neural Code Translation With LIF Neuron Microcircuits. Neural Comput, 37(6), 1124-1153. Kolibius, L. D., Josselyn, S. A., & Hanslmayr, S. (2025). And yet, the hippocampus codes conjunctively. Trends in Cognitive Sciences, 29(8), 689-690. Saito, Y., Osako, Y., & Murayama, M. (2025). Unraveling the neural code: analysis of large-scale two-photon microscopy data. Microscopy, Vol. 74 (3), 146-163.

			Shi, Y., Bi, D., Hesse, J. K., Lanfranchi, F. F., Chen, S., & Tsao, D. Y. (2026). Rapid concerted switching of the neural code in the inferotemporal cortex. Nature, 653(8113), 146-155.
240	Neural Code – B (motion)	The Neural Motion Codes	Frost, B. J. and K. Nakayama (1983). "Single visual neurons code opposing motion independent of direction." Science 220(4598): 744-745. Geisler, W. S. (1999). "Motion streaks provide a spatial code for motion direction." Nature 400(6739): 65-69. Lia, B., K. R. Dobkins, J. Palmer and D. Y. Teller (1999). "Infants code the direction of chromatic quadrature motion." Vision Res 39(10): 1783-1794. Inaba, N., S. Shinomoto, S. Yamane, A. Takemura and K. Kawano (2007). "MST neurons code for visual motion in space independent of pursuit eye movements." J Neurophysiol 97(5): 3473-3483. Clarke, S. E., A. Longtin and L. Maler (2014). "A neural code for looming and receding motion is distributed over a population of electrosensory ON and OFF contrast cells." J Neurosci 34(16): 5583-5594. McIntyre, S., I. Birznieks, R. M. Vickery, A. O. Holcombe and T. Seizova-Cajic (2016). "The tactile motion aftereffect suggests an intensive code for speed in neurons sensitive to both speed and direction of motion." J Neurophysiol 115(3): 1703-1712. Van Humbeeck, N., T. Putzeys and J. Wagemans (2016). "Apparent Motion Suppresses Responses in Early Visual Cortex: A Population Code Model." PLoS Comput Biol 12(10): e1005155. Turner, M. H., A. Krieger, M. M. Pang and T. R. Clandinin (2022). "Visual and motor signatures of locomotion dynamically shape a population code for feature detection in Drosophila." Elife 11. Zhang, Y., R. Huang, W. Nörenberg and A. B. Arrenberg (2022). "A robust receptive field code for optic flow detection and decomposition during self-motion." Curr Biol 32(11): 2505-2516.e2508.
241	Neural Code – C (perception & recognition)	The Neural Perception & Recognition Codes	Erickson, R. P. (1973). "Adaptation and the neural code for visual form." Brain Res 52: 374-377. Szeto, A. Y. (1982). "Electrocutaneous code pairs for artificial sensory communication systems." Ann Biomed Eng 10(4): 175-192. Johnson, B. R., R. Voigt, C. L. Merrill and J. Atema (1991). "Across-fiber patterns may contain a sensory code for stimulus intensity." Brain Res Bull 26(3): 327-331. Barinaga, M. (1994). Neurons tap out a code that may help locate sounds. Science, 264(5160), 775.

			Hart, A. C., S. Sims and J. M. Kaplan (1995). "Synaptic code for sensory modalities revealed by C. elegans GLR-1 glutamate receptor." Nature 378(6552): 82-85. Sejnowski, T. J. (1995). “Pattern recognition. Time for a new neural code?” Nature 376(6535): 21-22. Baddeley, R. (1996). "Visual perception. An efficient code in V1?" Nature 381(6583): 560-561. Buonomano, D. V. and M. Merzenich (1999). “A neural network model of temporal code generation and position-invariant pattern recognition.” Neural Comput 11(1): 103-116. March, L., A. Cienfuegos, L. Goldbloom, W. Ritter, N. Cowan and D. C. Javitt (1999). "Normal time course of auditory recognition in schizophrenia, despite impaired precision of the auditory sensory ("echoic") memory code." J Abnorm Psychol 108(1): 69-75. Prins, N. and A. J. Mussap (2001). "Adaptation reveals a neural code for the visual location of orientation change." Perception 30(6): 669-680. Nisly-Nagele, S. J. and G. S. Wasserman (2001). "Dissociating sensory and cognitive contributions to visual persistence I. Photoreceptor response duration as a function of flash intensity, adaptation state, and candidate code." Biol Cybern 85(3): 167-183. Wasserman, G. S. and S. J. Nisly-Nagele (2001). "Dissociating sensory and cognitive contributions to visual persistence II. Photoreceptor integration of flash pairs as a function of interflash interval, intensity, integration site, and candidate code." Biol Cybern 85(3): 185-194. Petersen, R. S., S. Panzeri and M. E. Diamond (2002). "The role of individual spikes and spike patterns in population coding of stimulus location in rat somatosensory cortex." Biosystems 67(1): 187-193. Höltje, M. and R. Hustert (2003). "Rapid mechano-sensory pathways code leg impact and elicit very rapid reflexes in insects." J Exp Biol 206(Pt 16): 2715-2724. Koch, I., B. Metin and S. Schuch (2003). "The role of temporal unpredictability for process interference and code overlap in perception-action dual tasks." Psychol Res 67(4): 244-252. Romo, R., & Salinas, E. (2003). Flutter Discrimination: neural codes, perception, memory and decision making. Nature Reviews Neuroscience, 4(3), 203-218. Turiel, A. and N. Parga (2003). "Role of statistical symmetries in sensory coding: an optimal scale invariant code for vision." J Physiol Paris 97(4-6): 491-502. Wyss, R., P. Konig and P. F. Verschure (2003). "Invariant representations of visual patterns in a temporal population code." Proc Natl Acad Sci U S A 100(1): 324-329.

			Hosokawa, T., K. Kato, M. Inoue and A. Mikami (2004). "Neurons in the orbitofrontal cortex code both visual shapes and reward types." Neuroreport 15(9): 1493-1496. Krug, K. (2004). "A common neuronal code for perceptual processes in visual cortex? Comparing choice and attentional correlates in V5/MT." Philos Trans R Soc Lond B Biol Sci 359(1446): 929-941. Melzer, P., G. C. Champney, M. J. Maguire and F. F. Ebner (2006). "Rate code and temporal code for frequency of whisker stimulation in rat primary and secondary somatic sensory cortex." Exp Brain Res 172(3): 370-386. Tailby, C., S. G. Solomon, N. T. Dhruv, N. J. Majaj, S. H. Sokol and P. Lennie (2007). "A new code for contrast in the primate visual pathway." J Neurosci 27(14): 3904-3909. Zwickel, T., T. Wachtler and R. Eckhorn (2007). "Coding the presence of visual objects in a recurrent neural network of visual cortex." Biosystems 89(1): 216-226. Eyherabide, H. G., A. Rokem, A. V. Herz and I. Samengo (2008). “Burst firing is a neural code in an insect auditory system.” Front Comput Neurosci 2: 3. Bale, M. R. and R. S. Petersen (2009). "Transformation in the neural code for whisker deflection direction along the lemniscal pathway." J Neurophysiol 102(5): 2771-2780. Gollisch, T. (2009). "Throwing a glance at the neural code: rapid information transmission in the visual system." Hfsp j 3(1): 36-46. Huetz, C., B. Philibert and J. M. Edeline (2009). "A spike-timing code for discriminating conspecific vocalizations in the thalamocortical system of anesthetized and awake guinea pigs." J Neurosci 29(2): 334-350. Freeman, W. J. (2011). Understanding Perception Through Neural “Codes”. IEEE Transactions on Biomedical Engineering, 58(7), 1884-1890. van den Berg, R., J. B. Roerdink and F. W. Cornelissen (2010). "A neurophysiologically plausible population code model for feature integration explains visual crowding." PLoS Comput Biol 6(1): e1000646 Clemens, J., O. Kutzki, B. Ronacher, S. Schreiber and S. Wohlgemuth (2011). "Efficient transformation of an auditory population code in a small sensory system." Proc Natl Acad Sci U S A 108(33): 13812-13817.

			Dimitrov, A. G., G. I. Cummins, A. Baker and Z. N. Aldworth (2011). "Characterizing the fine structure of a neural sensory code through information distortion." J Comput Neurosci 30(1): 163-179. de Lafuente, V. and R. Romo (2011). "Dopamine neurons code subjective sensory experience and uncertainty of perceptual decisions." Proc Natl Acad Sci U S A 108(49): 19767-19771. Hallem, E. A., A. R. Dillman, A. V. Hong, Y. Zhang, J. M. Yano, S. F. DeMarco and P. W. Sternberg (2011). "A sensory code for host seeking in parasitic nematodes." Curr Biol 21(5): 377-383. Lim, S. L., J. P. O'Doherty and A. Rangel (2011). "The decision value computations in the vmPFC and striatum use a relative value code that is guided by visual attention." J Neurosci 31(37): 13214-13223. Nestor, A., D. C. Plaut and M. Behrmann (2011). “Unraveling the distributed neural code of facial identity through spatiotemporal pattern analysis.” Proc Natl Acad Sci U S A 108(24): 9998-10003. Roach, N. W., J. Heron, D. Whitaker and P. V. McGraw (2011). "Asynchrony adaptation reveals neural population code for audio-visual timing." Proc Biol Sci 278(1710): 1314-1322. Wilson, S. P., J. A. Bednar, T. J. Prescott and B. Mitchinson (2011). "Neural computation via neural geometry: a place code for inter-whisker timing in the barrel cortex?" PLoS Comput Biol 7(10): e1002188. Lyons-Warren, A. M., M. Hollmann and B. A. Carlson (2012). "Sensory receptor diversity establishes a peripheral population code for stimulus duration at low intensities." J Exp Biol 215(Pt 15): 2586-2600. Lee, J. and J. M. Groh (2014). "Different stimuli, different spatial codes: a visual map and an auditory rate code for oculomotor space in the primate superior colliculus." PLoS One 9(1): e85017. El-Shamayleh, Y. and A. Pasupathy (2016). "Contour Curvature As an Invariant Code for Objects in Visual Area V4." J Neurosci 36(20): 5532-5543. Vergara, J., N. Rivera, R. Rossi-Pool and R. Romo (2016). "A Neural Parametric Code for Storing Information of More than One Sensory Modality in Working Memory." Neuron 89(1): 54-62. Vass, L. K., M. S. Copara, M. Seyal, K. Shahlaie, S. T. Farias, P. Y. Shen and A. D. Ekstrom (2016). "Oscillations Go the Distance: Low-Frequency Human Hippocampal Oscillations Code Spatial Distance in the Absence of Sensory Cues during Teleportation." Neuron 89(6): 1180-1186.

			Gau, P., A. Curtright, L. Condon, D. W. Raible and A. Dhaka (2017). "An ancient neurotrophin receptor code; a single Runx/Cbfβ complex determines somatosensory neuron fate specification in zebrafish." PLoS Genet 13(7): e1006884. Panzeri, S., C. D. Harvey, E. Piasini, P. E. Latham and T. Fellin (2017). "Cracking the Neural Code for Sensory Perception by Combining Statistics, Intervention, and Behavior." Neuron 93(3): 491-507. Esfahany, K., I. Siergiej, Y. Zhao and I. M. Park (2018). "Organization of Neural Population Code in Mouse Visual System." eNeuro 5(4). Follmann, R., C. J. Goldsmith and W. Stein (2018). "Multimodal sensory information is represented by a combinatorial code in a sensorimotor system." PLoS Biol 16(10): e2004527 Mittal, A. M., S. S. Singh and N. Gupta (2018). "Sensory Coding: Neurons That Wire Together Fire Longer." Curr Biol 28(10): R608-r610. Arguin, M., I. Marleau, M. Aubin, S. Zahabi and E. C. Leek (2019). "A surface-based code contributes to visual shape perception." J Vis 19(11): 6. James, B., L. Darnet, J. Moya-Díaz, S. H. Seibel and L. Lagnado (2019). "An amplitude code transmits information at a visual synapse." Nat Neurosci 22(7): 1140-1147. Kindel, W. F., E. D. Christensen and J. Zylberberg (2019). "Using deep learning to probe the neural code for images in primary visual cortex." J Vis 19(4): 29. Verschooten, E., S. Shamma, A. J. Oxenham, B. C. J. Moore, P. X. Joris, M. G. Heinz and C. J. Plack (2019). "The upper frequency limit for the use of phase locking to code temporal fine structure in humans: A compilation of viewpoints." Hear Res 377: 109-121. Downer, J. D., J. R. Verhein, B. C. Rapone, K. N. O'Connor and M. L. Sutter (2021). "An Emergent Population Code in Primary Auditory Cortex Supports Selective Attention to Spectral and Temporal Sound Features." J Neurosci 41(36): 7561-7577. Snyder, A. C., B. M. Yu and M. A. Smith (2021). "A Stable Population Code for Attention in Prefrontal Cortex Leads a Dynamic Attention Code in Visual Cortex." J Neurosci 41(44): 9163-9176. Sharma, D., K. K. W. Ng, I. Birznieks and R. M. Vickery (2022). "The burst gap is a peripheral temporal code for pitch perception that is shared across audition and touch." Sci Rep 12(1): 11014. Zhang, N., R. M. Grieves and K. J. Jeffery (2022). "Environment symmetry drives a multidirectional code in rat retrosplenial cortex." J Neurosci.

			Zhao, Q., Yu, C. D., Wang, R., Xu, Q. J., Dai Pra, R., Zhang, L., & Chang, R. B. (2022). A multidimensional coding architecture of the vagal interoceptive system. Nature, 603(7903), 878-884. Zhao, X., C. L. Hsu and N. Spruston (2022). "Rapid synaptic plasticity contributes to a learned conjunctive code of position and choice-related information in the hippocampus." Neuron 110(1): 96-108.e104. Wang, R. L., & Chang, R. B. (2024). The Coding Logic of Interoception. Annual Review of Physiology, 86, 301-327. Plitt, M. H., Kaganovsky, K., Say, E., Sosa, M., Südhof, T. C., & Giocomo, L. M. (2026). Hippocampal place code plasticity in CA1 requires postsynaptic membrane fusion. Neuron.
242	Neural code – D (tactile)	The Tactile Neural Codes	Goodwin, A. W. (1993). "Touch: the code for roughness." Curr Biol 3(6): 378-379. Johansson, R. S. and I. Birznieks (2004). "First spikes in ensembles of human tactile afferents code complex spatial fingertip events." Nat Neurosci 7(2): 170-177. Vázquez, Y., E. Salinas and R. Romo (2013). "Transformation of the neural code for tactile detection from thalamus to cortex." Proc Natl Acad Sci U S A 110(28): E2635-2644. Rossi-Pool, R., E. Salinas, A. Zainos, M. Alvarez, J. Vergara, N. Parga and R. Romo (2016). "Emergence of an abstract categorical code enabling the discrimination of temporally structured tactile stimuli." Proc Natl Acad Sci U S A 113(49): E7966-e7975. Birznieks, I., & Vickery, R. M. (2017). Spike Timing Matters in Novel Neuronal Code Involved in Vibrotactile Frequency Perception. Current Biology, 27(10), 1485-1490.e1482. Goodman, J. M., & Bensmaia, S. J. (2017). A Variation Code Accounts for the Perceived Roughness of Coarsely Textured Surfaces. Scientific Reports, 7(1), 46699. Lieber, J. D., X. Xia, A. I. Weber and S. J. Bensmaia (2017). “The neural code for tactile roughness in the somatosensory nerves.” J Neurophysiol 118(6): 3107-3117. Delhaye, B. P., M. K. O'Donnell, J. D. Lieber, K. R. McLellan and S. J. Bensmaia (2019). "Feeling fooled: Texture contaminates the neural code for tactile speed." PLoS Biol 17(8): e3000431. Perks, K. M. and J. T. Pierce (2019). "A quantal code for touch intensity in C. elegans." J Gen Physiol 151(12): 1343-1346.

			Bollini, A., C. Campus, D. Esposito and M. Gori (2020). "The Magnitude Effect on Tactile Spatial Representation: The Spatial-Tactile Association for Response Code (STARC) Effect." Front Neurosci 14: 557063. Ng, K. K. W., C. Olausson, R. M. Vickery and I. Birznieks (2020). "Temporal patterns in electrical nerve stimulation: Burst gap code shapes tactile frequency perception." PLoS One 15(8): e0237440. Ng, K. K. W., I. N. Snow, I. Birznieks and R. M. Vickery (2021). "Burst gap code predictions for tactile frequency are valid across the range of perceived frequencies attributed to two distinct tactile channels." J Neurophysiol 125(2): 687-692.
243	Neural code – E (specific)	The Other Specific Neural Codes	Sakagami, M., K. Tsutsui, J. Lauwereyns, M. Koizumi, S. Kobayashi and O. Hikosaka (2001). "A code for behavioral inhibition on the basis of color, but not motion, in ventrolateral prefrontal cortex of macaque monkey." J Neurosci 21(13): 4801-4808. Meyer-Luehmann, M., J. F. Thompson, K. C. Berridge and J. W. Aldridge (2002). "Substantia nigra pars reticulata neurons code initiation of a serial pattern: implications for natural action sequences and sequential disorders." Eur J Neurosci 16(8): 1599-1608. Paz, R. and E. Vaadia (2004). “Specificity of sensorimotor learning and the neural code: neuronal representations in the primary motor cortex.” J Physiol Paris 98(4-6): 331-348. van Duuren, E., J. Lankelma and C. M. Pennartz (2008). "Population coding of reward magnitude in the orbitofrontal cortex of the rat." J Neurosci 28(34): 8590-8603. Zheng, Y., & Escabí, M. A. (2008). Distinct Roles for Onset and Sustained Activity in the Neuronal Code for Temporal Periodicity and Acoustic Envelope Shape. The Journal of Neuroscience, 28(52), 14230-14244. Siddiqui, T. J., R. Pancaroglu, Y. Kang, A. Rooyakkers and A. M. Craig (2010). "LRRTMs and neuroligins bind neurexins with a differential code to cooperate in glutamate synapse development." J Neurosci 30(22): 7495-7506. Hu, Z., X. J. Tong and J. M. Kaplan (2013). "UNC-13L, UNC-13S, and Tomosyn form a protein code for fast and slow neurotransmitter release in Caenorhabditis elegans." Elife 2: e00967. Schlaffke, L., A. Golisch, L. M. Haag, M. Lenz, S. Heba, S. Lissek, T. Schmidt-Wilcke, U. T. Eysel and M. Tegenthoff (2015). "The brain's dress code: How The Dress allows to decode the neuronal pathway of an optical illusion." Cortex 73: 271-275.

			Li, M. and J. Z. Tsien (2017). "Neural Code-Neural Self-information Theory on How Cell-Assembly Code Rises from Spike Time and Neuronal Variability." Front Cell Neurosci 11: 236. Lee, J. S., J. J. Briguglio, J. D. Cohen, S. Romani and A. K. Lee (2020). "The Statistical Structure of the Hippocampal Code for Space as a Function of Time, Context, and Value." Cell 183(3): 620-635.e622. Huang, H., Rubenstein, J. L., & Qiu, M. (2021). Cracking the Codes of Cortical Glial Progenitors: Evidence for the Common Lineage of Astrocytes and Oligodendrocytes. Neurosci Bull, 37(4), 437-439. Noborn, F. and F. H. Sterky (2021). "Role of neurexin heparan sulfate in the molecular assembly of synapses - Expanding the neurexin code?" FEBS J. Prag, M. (2022). THESIS Deciphering the regulatory code driving neural crest evolution and development OpenUCT. Çimen, S., Çam, F. B. C., Kurtuluş, S., Toksoy, Ş. E., Eser, H. Y., & Ozyurt, O. (2026). Discovery of a product's unconscious culture code and testing with fMRI [Original Research]. Front Behav Neurosci, Volume 20 - 2026.
244	Neural code – F (phase codes)	The Neural Phase Codes	Hasselmo, M. E., M. P. Brandon, M. Yoshida, L. M. Giocomo, J. G. Heys, E. Fransen, E. L. Newman and E. A. Zilli (2009). "A phase code for memory could arise from circuit mechanisms in entorhinal cortex." Neural Netw 22(8): 1129-1138. Heusser, A. C., D. Poeppel, Y. Ezzyat and L. Davachi (2016). "Episodic sequence memory is supported by a theta-gamma phase code." Nat Neurosci 19(10): 1374-1380. Jaramillo, J. and R. Kempter (2017). "Phase precession: a neural code underlying episodic memory?" Curr Opin Neurobiol 43: 130-138. Costa, M., D. Lozano-Soldevilla, A. Gil-Nagel, R. Toledano, C. R. Oehrn, L. Kunz, M. Yebra, C. Mendez-Bertolo, L. Stieglitz, J. Sarnthein, N. Axmacher, S. Moratti and B. A. Strange (2022). "Aversive memory formation in humans involves an amygdala-hippocampus phase code." Nat Commun 13(1): 6403.
245	Neuroinflammation code	The Neuroinflammation Code	Latif M., Noreen S., Fatima H., Ahmad H., & Sheikh N.(2025). Neuroinflammation: The hidden code through the brain.Albus Scientia, 2025,Article ID e250508,1-9.
246	Neuronal crest code	Neuronal crest segregation code	Nitzan, E., S. Krispin, E. R. Pfaltzgraff, A. Klar, P. A. Labosky and C. Kalcheim (2013). "A dynamic code of dorsal neural tube genes regulates the segregation between neurogenic and melanogenic neural crest cells." Development 140(11): 2269-2279.

247	Neuronal wiring code	The Neuronal Wiring Code	Kovalenko, A. and A. Yaron (2022). “Cracking the combinatorial code of neuronal wiring.” Neuron 110(14): 2204-2206.
248	Neuropeptide code	The Neuropeptide Codes	Chen, Z.-F. (2021). A neuropeptide code for itch. Nature Reviews Neuroscience, 22(12), 758-776. Das Gupta, R. R., L. Scheurer, P. Pelczar, H. Wildner and H. U. Zeilhofer (2021). “Neuron-specific spinal cord translatomes reveal a neuropeptide code for mouse dorsal horn excitatory neurons.” Sci Rep 11(1): 5232.
249	Neurotransmitter code	The Neurotransmitter Codes	Furness, J. B., Costa, M., Morris, J. L., & Gibbins, I. L. (1987). Novel Neurotransmitters and the Chemical Coding of Neurones. In H. McLennan, J. R. Ledsome, C. H. S. McIntosh, & D. R. Jones (Eds.), Advances in Physiological Research (pp. 143-165). Springer US.
250	Neurotrophin code	The Neurotrophin Codes	Gau, Philia (2016) THESIS An ancient neurotrophin code in zebrafish; the Runx/Cbfβ complex specifies the fate switch from TrkB+ to TrkC+ nociceptors and sensory receptor expression. University of Washington
251	NF-kappa-B code	The NF-kappa-B Code	Calao, M., Burny, A., Quivy, V., Dekoninck, A., & Van Lint, C. (2008). A pervasive role of histone acetyltransferases and deacetylases in an NF-kappaB-signaling code. Trends Biochem Sci, 33(7), 339-349. Tkach, K. E., J. E. Oyler and G. Altan-Bonnet (2014). “Cracking the NF-κB code.” Sci Signal 7(313): pe5.
252	Niche codes	The Cellular Niche Codes	Reen, F. J., Almagro-Moreno, S., Ussery, D., & Boyd, E. F. (2006). The genomic code: inferring Vibrionaceae niche specialization. Nat Rev Microbiol, 4(9), 697-704. Forsberg, E. C. and S. Smith-Berdan (2009). “Parsing the niche code: the molecular mechanisms governing hematopoietic stem cell adhesion and differentiation.” Haematologica 94(11): 1477-1481. Chaker, Z., Makarouni, E., & Doetsch, F. (2024). The Organism as the Niche: Physiological States Crack the Code of Adult Neural Stem Cell Heterogeneity. Annu Rev Cell Dev Biol, 40(1), 381-406.
253	NKL code	The NKL Homeobox Code	Nagel, S., Pommerenke, C., MacLeod, R. A. F., Meyer, C., Kaufmann, M., & Drexler, H. G. (2020). The NKL-code for innate lymphoid cells reveals deregulated expression of NKL homeobox genes HHEX and HLX in anaplastic large cell lymphoma (ALCL). Oncotarget, 11(34), 3208-3226. Nagel, S. (2021). "NKL-Code in Normal and Aberrant Hematopoiesis." Cancers (Basel) 13(8). Nagel, S. (2022). The NKL- and TALE-Codes Represent Hematopoietic Gene Signatures to Evaluate Deregulated Homeobox Genes in Hodgkin Lymphoma. Hemato, 3(1), 122-130.

254	NKX code	The NKX Homeodomain Code	Stanfel, M. N., K. A. Moses, R. J. Schwartz and W. E. Zimmer (2005). "Regulation of organ development by the NKX-homeodomain factors: an NKX code." Cell Mol Biol (Noisy-le-grand) Suppl 51: Ol785-799. Dinh, T. T., M. Xiang, A. Rajaraman, Y. Wang, N. Salazar, Y. Zhu, W. Roper, S. Rhee, K. Brulois, E. O'Hara, H. Kiefel, T. M. Dinh, Y. Bi, D. Gonzalez, E. P. Bao, K. Red-Horse, P. Balogh, F. Gábris, B. Gaszner, G. Berta, J. Pan and E. C. Butcher (2022). "An NKX-COUP-TFII morphogenetic code directs mucosal endothelial addressin expression." Nat Commun 13(1): 7448.
255	NLRP3 code	The NLRP3 Inflammasome Code **SEE also Fibrogenic Code**	Weber, A. N. R., Tortola, M. M., & Kuemmerle-Deschner, J. B. (2024). Cracking the NLRP3 code: Pioneering precision medicine for inflammation. Journal of Experimental Medicine, 221(5). Tang, X., He, Y., Bao, X., Peng, Z., Xu, H., He, Y., . . . Wei, J. (2025). The Anti-Pulmonary Fibrosis Code of Plant Anthocyanins—A Multi-Targeted Anti-Fibrotic Bioactive Compound by Inhibiting the NLRP3 Inflammasome. Molecular Nutrition & Food Research, 69(23), e70275.
256	Non-ribosomal code	The Non-Ribosomal Code	von Döhren, H., R. Dieckmann and M. Pavela-Vrancic (1999). “The nonribosomal code.” Chem Biol 6(10): R273-279. Ackerley, D. F. (2016). “Cracking the Nonribosomal Code.” Cell Chem Biol 23(5): 535-537.
257	NOS code	The Nitric Oxide Synthase (Chemical) Code	Costa, M., Furness, J. B., Pompolo, S., Brookes, S. J. H., Bornstein, J. C., Bredt, D. S., & Snyder, S. H. (1992). Projections and chemical coding of neurons with immunoreactivity for nitric oxide synthase in the guinea-pig small intestine. Neurosci Lett, 148(1), 121-125. Anderson, C. R., McAllen, R. M., & Edwards, S. L. (1995). Nitric oxide synthase and chemical coding in cat sympathetic postganglionic neurons. Neuroscience, 68(1), 255-264.
258	Notch Code	The Notch Code	Cave, J. W., F. Loh, J. W. Surpris, L. Xia and M. A. Caudy (2005). “A DNA transcription code for cell-specific gene activation by notch signaling.” Curr Biol 15(2): 94-104. Cave, J. W., L. Xia and M. A. Caudy (2009). “The Daughterless N-terminus directly mediates synergistic interactions with Notch transcription complexes via the SPS+A DNA transcription code.” BMC Res Notes 2: 65. Kakuda, S. and R. S. Haltiwanger (2017). “Deciphering the Fringe-Mediated Notch Code: Identification of Activating and Inhibiting Sites Allowing Discrimination between Ligands.” Dev Cell 40(2): 193-201.

259	Nuclear rigidity code	The Nuclear Rigidity Code	Tagay, Y. (2025). BPS2025 - Cracking the code of nuclear rigidity: New frontiers in cell migration and therapy. Biophysical Journal, 124(3), 302a-303a.
260	Nuclear signalling code	The Nuclear Signalling Code	Maraldi, N. M. (2008). A Lipid-based Code in Nuclear Signalling. The Codes of Life: The Rules of Macroevolution. M. Barbieri and J. Hoffmeyer. Dordrecht, Springer Netherlands: 207-221.
261	Nucleoprotein code	The Nucleoprotein Code	Moreira É, A., A. Weber, H. Bolte, L. Kolesnikova, S. Giese, S. Lakdawala, M. Beer, G. Zimmer, A. García-Sastre, M. Schwemmle and M. Juozapaitis (2016). "A conserved influenza A virus nucleoprotein code controls specific viral genome packaging." Nat Commun 7: 12861.
262	Nucleosome code	The Nucleosome Code	Segal, E., Y. Fondufe-Mittendorf, L. Chen, A. Thåström, Y. Field, I. K. Moore, J.-P. Z. Wang and J. Widom (2006). "A genomic code for nucleosome positioning." Nature 442(7104): 772-778. Segal, M. R. (2008). "Re-cracking the nucleosome positioning code." Stat Appl Genet Mol Biol 7(1): Article14. Warnecke, T., Batada, N. N., & Hurst, L. D. (2008). The impact of the nucleosome code on protein-coding sequence evolution in yeast. PLoS Genet, 4(11), e1000250. Choi, J. K. and Y. J. Kim (2009). "Implications of the nucleosome code in regulatory variation, adaptation and evolution." Epigenetics 4(5): 291-295. Cohanim, A. B. and T. E. Haran (2009). "The coexistence of the nucleosome positioning code with the genetic code on eukaryotic genomes." Nucleic acids research 37(19): 6466-6476. Clark, D. J. (2010). "Nucleosome positioning, nucleosome spacing and the nucleosome code." J Biomol Struct Dyn 27(6): 781-793. Jones, B. (2016). "Chromatin: Cracking the nucleosome code." Nat Rev Genet 17(7): 376-377. Zuiddam, M., R. Everaers and H. Schiessel (2017). "Physics behind the mechanical nucleosome positioning code." Phys Rev E 96(5-1): 052412. Colino-Sanguino, Y., S. J. Clark and F. Valdes-Mora (2022). "The H2A.Z-nucleosome code in mammals: emerging functions." Trends Genet 38(5): 516.
263	O-GlcNAc code	The O-GlcNAc code	Love, D. C. and J. A. Hanover (2005). "The hexosamine signaling pathway: deciphering the "O-GlcNAc code"." Sci STKE 2005(312): re13. Ruan, H.-B., J. P. Singh, M.-D. Li, J. Wu and X. Yang (2013). "Cracking the O-GlcNAc code in metabolism." Trends in Endocrinology & Metabolism 24(6): 301-309.

			Ma, J., Hou, C., & Wu, C. (2022). Demystifying the O-GlcNAc Code: A Systems View. Chemical Reviews, 122(20), 15822-15864. Zhou, S., Lou, W., Wei, Z., Wang, T., Li, Y., Zhao, Q., . . . Xu, Z. (2026). Decoding the regulatory code: O-GlcNAcylation in epithelial-mesenchymal transition (EMT). Journal of Biological Chemistry, 302(3), 111265.
264	Oil code	The Plant Oil Production Code	Moreno, S. R. (2024). Mining the oil code: New insights behind oil production in Brassica napus. Plant Physiol, 197(1).
265	Olfactory code – A (general)	The General Olfactory Code	Amoore, J. E. (1967). “Specific anosmia: a clue to the olfactory code.”Nature 214(5093): 1095-1098. Wright, R. H., J. R. Hughes and D. E. Hendrix (1967). "Olfactory coding." Nature 216(5113): 404-406. Amoore, J. E. (1974). “Evidence for the chemical olfactory code in man.” Ann N Y Acad Sci 237(0): 137-143. Laffort, P., F. Patte and M. Etcheto (1974). "Olfactory coding on the basis of physicochemical properties." Ann N Y Acad Sci 237(0): 193-208. Wright, R. H. and R. E. Burgess (1975). "Molecular coding of olfactory specificity." Can J Zool 53(9): 1247-1253. Menevse, A., G. H. Dodd, T. M. Poynder and D. Squirrel (1977). “A chemical-modification approach to the olfactory code.” Biochem Soc Trans 5(1): 191-194. Menevse, A., G. Dodd and T. M. Poynder (1978). “A chemical-modification approach to the olfactory code. Studies with a thiol-specific reagent.” Biochem J 176(3): 845-854. Mair, R. G. (1986). “Ontogeny of the olfactory code.” Experientia 42(3): 213-223. Laing, D. G. (1987). "Coding of chemosensory stimulus mixtures." Ann N Y Acad Sci 510: 61-66. Visser, J. H. and R. de Jong (1988). "Olfactory coding in the perception of semiochemicals." J Chem Ecol 14(11): 2005-2018. Menevşe, S. and A. Menevşe (1989). “A chemical modification approach to the olfactory code: vapor phase labeling using photoaffinity odorants.” Jpn J Physiol 39(5): 779-784. Schild, D. and H. Riedel (1992). "Significance of glomerular compartmentalization for olfactory coding." Biophys J 61(3): 704-715. Lánský, P. and J.-P. Rospars (1993). “Coding of odor intensity.” Biosystems 31(1): 15-38.

			Ngai, J., A. Chess, M. M. Dowling, N. Necles, E. R. Macagno and R. Axel (1993). "Coding of olfactory information: topography of odorant receptor expression in the catfish olfactory epithelium." Cell 72(5): 667-680. Trotier, D. (1994). "Intensity coding in olfactory receptor cells." Semin Cell Biol 5(1): 47-54. Sullivan, S. L., K. J. Ressler and L. B. Buck (1995). "Spatial patterning and information coding in the olfactory system." Curr Opin Genet Dev 5(4): 516-523. Av-Ron, E. and J.-F. Vibert (1996). “A model for temporal and intensity coding in insect olfaction by a network of inhibitory neurons.” Biosystems 39(3): 241-250. Buck, L. B. (1996). "Information coding in the mammalian olfactory system." Cold Spring Harb Symp Quant Biol 61: 147-155. Lai, S. C., N. Vasilieva and R. E. Johnston (1996). “Odors providing sexual information in Djungarian hamsters: evidence for an across-odor code.” Horm Behav 30(1): 26-36. Getz, W. M. and R. P. Akers (1997). “Coding properties of peak and average response rates in American cockroach olfactory sensory cells.” Biosystems 40(1): 55-63. Laurent, G. (1997). "Olfactory processing: maps, time and codes." Curr Opin Neurobiol 7(4): 547-553. Vermeulen, A., P. Lánský, H. Tuckwell and J.-P. Rospars (1997). “Coding of odour intensity in a sensory neuron.” Biosystems 40(1): 203-210. Dorries, K. M. (1998). "Olfactory coding: time in a model." Neuron 20(1): 7-10. Dudai, Y. (1999). “The smell of representations.” Neuron 23(4): 633-635. Galizia, C. G., S. Sachse, A. Rappert and R. Menzel (1999). “The glomerular code for odor representation is species specific in the honeybee Apis mellifera.” Nat Neurosci 2(5): 473-478. Mori, K., H. Nagao and Y. Yoshihara (1999). "The olfactory bulb: coding and processing of odor molecule information." Science 286(5440): 711-715. Laurent, G. (1999). "A systems perspective on early olfactory coding." Science 286(5440): 723-728. Malnic, B., Hirono, J., Sato, T., & Buck, L. B. (1999). Combinatorial Receptor Codes for Odors. Cell, 96(5), 713-723.

			Sachse, S., A. Rappert and C. G. Galizia (1999). “The spatial representation of chemical structures in the antennal lobe of honeybees: steps towards the olfactory code.” Eur J Neurosci 11(11): 3970-3982. Galizia, C. G. and R. Menzel (2000). “Probing the olfactory code.” Nat Neurosci 3(9): 853-854. Herz, R. S. (2000). "Verbal coding in olfactory versus nonolfactory cognition." Mem Cognit 28(6): 957-964. Johnson, B. A. and M. Leon (2000). “Odorant molecular length: one aspect of the olfactory code.” J Comp Neurol 426(2): 330-338. Bozza, T. C. and P. Mombaerts (2001). "Olfactory coding: revealing intrinsic representations of odors." Curr Biol 11(17): R687-690. Kauer, J. S. and J. White (2001). "Imaging and coding in the olfactory system." Annu Rev Neurosci 24: 963-979. Rogers, M. E. and S. J. Firestein (2001). “Unlocking the DOR code.” Neuron 30(2): 305-307. Vickers, N. J., T. A. Christensen, T. C. Baker and J. G. Hildebrand (2001). “Odour-plume dynamics influence the brain’s olfactory code.” Nature 410(6827): 466-470. Laurent, G. (2002). "Olfactory network dynamics and the coding of multidimensional signals." Nat Rev Neurosci 3(11): 884-895. Leon, M. and B. A. Johnson (2003). "Olfactory coding in the mammalian olfactory bulb." Brain Res Brain Res Rev 42(1): 23-32. Stensmyr, M. C., T. Dekker and B. S. Hansson (2003). “Evolution of the olfactory code in the Drosophila melanogaster subgroup.” Proc Biol Sci 270(1531): 2333-2340. Stopfer, M., V. Jayaraman and G. Laurent (2003). "Intensity versus identity coding in an olfactory system." Neuron 39(6): 991-1004. Buck, L. B. (2004). "Olfactory receptors and odor coding in mammals." Nutr Rev 62(11 Pt 2): S184-188; discussion S224-141. Yu, D., A. Ponomarev and R. L. Davis (2004). “Altered representation of the spatial code for odors after olfactory classical conditioning; memory trace formation by synaptic recruitment.” Neuron 42(3): 437-449.

			Luu, P., F. Acher, H. O. Bertrand and J. Ngai (2005). "Odorant receptor specificities and receptor combinatorials: implications for olfactory coding." Chem Senses 30 Suppl 1: i97-98. Nodari, F. and T. E. Holy (2005). "Olfactory coding: sniffing out signals." Nat Neurosci 8(4): 406-407. Spehr, M. and T. Leinders-Zufall (2005). "One neuron--multiple receptors: increased complexity in olfactory coding?" Sci STKE 2005(285): pe25. Stopfer, M. (2005). "Olfactory coding: inhibition reshapes odor responses." Curr Biol 15(24): R996-998. Zufall, F. (2005). “Connexins and olfactory synchronicity: toward the olfactory code.” Neuron 46(5): 693-694. Antolin, S. and G. S. Jefferis (2006). "Olfactory coding: when smells collide." Curr Biol 16(23): R1000-1003. Franks, K. M. and J. S. Isaacson (2006). "Strong single-fiber sensory inputs to olfactory cortex: implications for olfactory coding." Neuron 49(3): 357-363. Rawson, N. E. and K. K. Yee (2006). "Transduction and coding." Adv Otorhinolaryngol 63: 23-43. Scott, J. W. (2006). "Sniffing and spatiotemporal coding in olfaction." Chem Senses 31(2): 119-130. Johnson, B. A. and M. Leon (2007). "Chemotopic odorant coding in a mammalian olfactory system." J Comp Neurol 503(1): 1-34. Jortner, R. A., S. S. Farivar and G. Laurent (2007). "A simple connectivity scheme for sparse coding in an olfactory system." J Neurosci 27(7): 1659-1669. Koulakov, A., A. Gelperin and D. Rinberg (2007). "Olfactory coding with all-or-nothing glomeruli." J Neurophysiol 98(6): 3134-3142. Vislay-Meltzer, R. L. and M. Stopfer (2007). "Olfactory coding: a plastic approach to timing precision." Curr Biol 17(18): R797-799. Asahina, Kenta (2008) THESIS "Cracking the Odor Code: Molecular and Cellular Deconstruction of the Olfactory Circuit of Drosophila Larvae" The Rockefeller University de Bruyne, M., & Baker, T. C. (2008). Odor Detection in Insects: Volatile Codes. J Chem Ecol, 34(7), 882-897.

			Raman, B. and M. Stopfer (2008). "Olfactory coding: non-linear amplification separates smells." Curr Biol 18(1): R29-32. Ray, A., W. van der Goes van Naters and J. R. Carlson (2008). “A regulatory code for neuron-specific odor receptor expression.” PLoS Biol 6(5): e125. Furudono, Y., Y. Sone, K. Takizawa, J. Hirono and T. Sato (2009). “Relationship between peripheral receptor code and perceived odor quality.” Chem Senses 34(2): 151-158. Saito, H., Q. Chi, H. Zhuang, H. Matsunami and J. D. Mainland (2009). "Odor coding by a Mammalian receptor repertoire." Sci Signal 2(60): ra9 Ferrero, D. M. and S. D. Liberles (2010). "The secret codes of mammalian scents." Wiley Interdiscip Rev Syst Biol Med 2(1): 23-33. Haddad, R., T. Weiss, R. Khan, B. Nadler, N. Mandairon, M. Bensafi, E. Schneidman and N. Sobel (2010). “Global features of neural activity in the olfactory system form a parallel code that predicts olfactory behavior and perception.” J Neurosci 30(27): 9017-9026. Junek, S., E. Kludt, F. Wolf and D. Schild (2010). "Olfactory coding with patterns of response latencies." Neuron 67(5): 872-884. Ong, R. C. and M. Stopfer (2010). "Olfactory coding: unusual conductances contribute to sparse neural representation. Focus on "Intrinsic membrane properties and inhibitory synaptic input of Kenyon cells as mechanisms for sparse coding?"." J Neurophysiol 103(1): 2-3. Gire, D. H., D. Restrepo, T. J. Sejnowski, C. Greer, J. A. De Carlos and L. Lopez-Mascaraque (2013). "Temporal processing in the olfactory system: can we see a smell?" Neuron 78(3): 416-432. Gupta, N. and M. Stopfer (2011). "Insect olfactory coding and memory at multiple timescales." Curr Opin Neurobiol 21(5): 768-773. Gupta, N. and M. Stopfer (2011). "Olfactory coding: giant inhibitory neuron governs sparse odor codes." Curr Biol 21(13): R504-506. Kay, L. M. (2011). "Olfactory coding: random scents make sense." Curr Biol 21(22): R928-929. Reisert, J. and H. Zhao (2011). "Perspectives on: information and coding in mammalian sensory physiology: response kinetics of olfactory receptor neurons and the implications in olfactory coding." J Gen Physiol 138(3): 303-310.

			Su, C. Y., C. Martelli, T. Emonet and J. R. Carlson (2011). "Temporal coding of odor mixtures in an olfactory receptor neuron." Proc Natl Acad Sci U S A 108(12): 5075-5080. Aldworth, Z. N. and M. Stopfer (2012). "Olfactory coding: tagging and tuning odor-activated synapses for memory." Curr Biol 22(7): R227-229. Miura, K., Z. F. Mainen and N. Uchida (2012). "Odor representations in olfactory cortex: distributed rate coding and decorrelated population activity." Neuron 74(6): 1087-1098. Nieberding, C. M., K. Fischer, M. Saastamoinen, C. E. Allen, E. A. Wallin, E. Hedenström and P. M. Brakefield (2012). "Cracking the olfactory code of a butterfly: the scent of ageing." Ecol Lett 15(5): 415-424. Boyle, S. M., S. McInally and A. Ray (2013). "Expanding the olfactory code by in silico decoding of odor-receptor chemical space." Elife 2: e01120. Campbell, R. A., K. S. Honegger, H. Qin, W. Li, E. Demir and G. C. Turner (2013). "Imaging a population code for odor identity in the Drosophila mushroom body." J Neurosci 33(25): 10568-10581. Dewan, A., R. Pacifico, R. Zhan, D. Rinberg and T. Bozza (2013). "Non-redundant coding of aversive odours in the main olfactory pathway." Nature 497(7450): 486-489. Gruntman, E. and G. C. Turner (2013). "Integration of the olfactory code across dendritic claws of single mushroom body neurons." Nat Neurosci 16(12): 1821-1829. Haddad, R., A. Lanjuin, L. Madisen, H. Zeng, V. N. Murthy and N. Uchida (2013). "Olfactory cortical neurons read out a relative time code in the olfactory bulb." Nat Neurosci 16(7): 949-957. Whalley, K. (2013). "Neural coding: timing is key in the olfactory system." Nat Rev Neurosci 14(7): 458. Galizia, C. G. (2014). "Olfactory coding in the insect brain: data and conjectures." Eur J Neurosci 39(11): 1784-1795. Park, I. M., Y. V. Bobkov, B. W. Ache and J. C. Príncipe (2014). "Intermittency coding in the primary olfactory system: a neural substrate for olfactory scene analysis." J Neurosci 34(3): 941-952. Schubert, M., B. S. Hansson and S. Sachse (2014). "The banana code-natural blend processing in the olfactory circuitry of Drosophila melanogaster." Front Physiol 5: 59. Hige, T., Y. Aso, G. M. Rubin and G. C. Turner (2015). "Plasticity-driven individualization of olfactory coding in mushroom body output neurons." Nature 526(7572): 258-262.

			Renou, M., V. Party, A. Rouyar and S. Anton (2015). “Olfactory signal coding in an odor background.” Biosystems 136: 35-45. Sirotin, Y. B., R. Shusterman and D. Rinberg (2015). "Neural Coding of Perceived Odor Intensity." eNeuro 2(6). Grillet, M., D. Campagner, R. Petersen, C. McCrohan and M. Cobb (2016). “The peripheral olfactory code in Drosophila larvae contains temporal information and is robust over multiple timescales.” Proc Biol Sci 283(1831). Iurilli, G. and S. R. Datta (2017). "Population Coding in an Innately Relevant Olfactory Area." Neuron 93(5): 1180-1197.e1187. Iwata, R., H. Kiyonari and T. Imai (2017). "Mechanosensory-Based Phase Coding of Odor Identity in the Olfactory Bulb." Neuron 96(5): 1139-1152.e1137. Jacob, V., C. Monsempès, J. P. Rospars, J. B. Masson and P. Lucas (2017). "Olfactory coding in the turbulent realm." PLoS Comput Biol 13(12): e1005870. Wilson, C. D., G. O. Serrano, A. A. Koulakov and D. Rinberg (2017). “A primacy code for odor identity.” Nat Commun 8(1): 1477. Carlson, K. S., M. A. Gadziola, E. S. Dauster and D. W. Wesson (2018). "Selective Attention Controls Olfactory Decisions and the Neural Encoding of Odors." Curr Biol 28(14): 2195-2205.e2194. Grabe, V. and S. Sachse (2018). “Fundamental principles of the olfactory code.” Biosystems 164: 94-101. Mohrhardt, J., M. Nagel, D. Fleck, Y. Ben-Shaul and M. Spehr (2018). "Signal Detection and Coding in the Accessory Olfactory System." Chem Senses 43(9): 667-695. Chen, Z., F. Liu and N. Liu (2019). "Human Odour Coding in the Yellow Fever Mosquito, Aedes aegypti." Sci Rep 9(1): 13336. Zwicker, D. (2019). "Primacy coding facilitates effective odor discrimination when receptor sensitivities are tuned." PLoS Comput Biol 15(7): e1007188. Blazing, R. M. and K. M. Franks (2020). "Neuroscience: Illuminating Principles of Odor Coding." Curr Biol 30(20): R1279-r1281. Chong, E., M. Moroni, C. Wilson, S. Shoham, S. Panzeri and D. Rinberg (2020). "Manipulating synthetic optogenetic odors reveals the coding logic of olfactory perception." Science 368(6497).

			de March, C. A., Titlow, W. B., Sengoku, T., Breheny, P., Matsunami, H., & McClintock, T. S. (2020). Modulation of the combinatorial code of odorant receptor response patterns in odorant mixtures. Molecular and Cellular Neuroscience, 104, 103469. Gill, J. V., G. M. Lerman, H. Zhao, B. J. Stetler, D. Rinberg and S. Shoham (2020). "Precise Holographic Manipulation of Olfactory Circuits Reveals Coding Features Determining Perceptual Detection." Neuron 108(2): 382-393.e385. Li, A., X. Rao, Y. Zhou and D. Restrepo (2020). "Complex neural representation of odour information in the olfactory bulb." Acta Physiol (Oxf) 228(1): e13333. Xu, L., W. Li, V. Voleti, D. J. Zou, E. M. C. Hillman and S. Firestein (2020). "Widespread receptor-driven modulation in peripheral olfactory coding." Science 368(6487). Kuruppath, P., L. Bai and L. Belluscio (2021). "Functional Relevance of Dual Olfactory Bulbs in Olfactory Coding." eNeuro 8(5). Sachse, S. and I. Manzini (2021). "Editorial for the special issue "Olfactory Coding and Circuitries". Cell Tissue Res 383(1): 1-6. Chen, Z. and K. Padmanabhan (2022). "Top-down feedback enables flexible coding strategies in the olfactory cortex." Cell Rep 38(12): 110545. George Barnum and Elizabeth J. Hong (2022) Olfactory coding. Current Biology, 32, R1287–R1303 Devineni, A. V. (2022). "Sensory biology: Olfactory crosstalk reshapes odor coding." Curr Biol 32(19): R1002-r1005. Manzini, I., D. Schild and C. Di Natale (2022). "Principles of odor coding in vertebrates and artificial chemosensory systems." Physiol Rev 102(1): 61-154. Milinski, M. (2022). “A Review of Suggested Mechanisms of MHC Odor Signaling.” Biology (Basel) 11(8).
266	Olfactory code – B (specific)	The Specific Olfactory Codes	Mackay-Sim, A., P. Shaman and D. G. Moulton (1982). "Topographic coding of olfactory quality: odorant-specific patterns of epithelial responsivity in the salamander." J Neurophysiol 48(2): 584-596. Karádi, Z., Y. Oomura, H. Nishino and S. Aou (1989). "Olfactory coding in the monkey lateral hypothalamus: behavioral and neurochemical properties of odor-responding neurons." Physiol Behav 45(6): 1249-1257.

			Friedrich, R. W. and S. I. Korsching (1997). "Combinatorial and chemotopic odorant coding in the zebrafish olfactory bulb visualized by optical imaging." Neuron 18(5): 737-752. Hekmat-Scafe, D. S., R. A. Steinbrecht and J. R. Carlson (1998). "Olfactory coding in a compound nose. Coexpression of odorant-binding proteins in Drosophila." Ann N Y Acad Sci 855: 311-315. Cobb, M. and I. Domain (2000). "Olfactory coding in a simple system: adaptation in Drosophila larvae." Proc Biol Sci 267(1457): 2119-2125. Derby, C. D. (2000). "Learning from spiny lobsters about chemosensory coding of mixtures." Physiol Behav 69(1-2): 203-209. Duchamp-Viret, P., A. Duchamp and M. A. Chaput (2000). "Peripheral odor coding in the rat and frog: quality and intensity specification." J Neurosci 20(6): 2383-2390. Galizia, C. G. and R. Menzel (2000). "Odour perception in honeybees: coding information in glomerular patterns." Curr Opin Neurobiol 10(4): 504-510. de Bruyne, M., K. Foster and J. R. Carlson (2001). "Odor coding in the Drosophila antenna." Neuron 30(2): 537-552. Rubin, B. D. and L. C. Katz (2001). "Spatial coding of enantiomers in the rat olfactory bulb." Nat Neurosci 4(4): 355-356. Hallem, E. A. and J. R. Carlson (2004). "The odor coding system of Drosophila." Trends Genet 20(9): 453-459. Boyle, J. and M. Cobb (2005). "Olfactory coding in Drosophila larvae investigated by cross-adaptation." J Exp Biol 208(Pt 18): 3483-3491. Mainen, Z. F. (2006). "Behavioral analysis of olfactory coding and computation in rodents." Curr Opin Neurobiol 16(4): 429-434. Qiu, Y. T., J. J. van Loon, W. Takken, J. Meijerink and H. M. Smid (2006). "Olfactory Coding in Antennal Neurons of the Malaria Mosquito, Anopheles gambiae." Chem Senses 31(9): 845-863. Stocker, R. F. (2006). "Olfactory coding: connecting odorant receptor expression and behavior in the Drosophila larva." Curr Biol 16(1): R16-18. Kostal, L., P. Lansky and J. P. Rospars (2008). "Efficient olfactory coding in the pheromone receptor neuron of a moth." PLoS Comput Biol 4(4): e1000053.

			Olsson, S. B., C. E. Linn, Jr., J. L. Feder, A. Michel, H. R. Dambroski, S. H. Berlocher and W. L. Roelofs (2009). "Comparing peripheral olfactory coding with host preference in the rhagoletis species complex." Chem Senses 34(1): 37-48. Hoare, D. J., J. Humble, D. Jin, N. Gilding, R. Petersen, M. Cobb and C. McCrohan (2011). "Modeling peripheral olfactory coding in Drosophila larvae." PLoS One 6(8): e22996. Nara, K., L. R. Saraiva, X. Ye and L. B. Buck (2011). "A large-scale analysis of odor coding in the olfactory epithelium." J Neurosci 31(25): 9179-9191. Bisch-Knaden, S., M. A. Carlsson, Y. Sugimoto, M. Schubert, C. Mißbach, S. Sachse and B. S. Hansson (2012). "Olfactory coding in five moth species from two families." J Exp Biol 215(Pt 9): 1542-1551. Carcaud, J., T. Hill, M. Giurfa and J. C. Sandoz (2012). "Differential coding by two olfactory subsystems in the honeybee brain." J Neurophysiol 108(4): 1106-1121. Meyer, A. and C. G. Galizia (2012). "Elemental and configural olfactory coding by antennal lobe neurons of the honeybee (Apis mellifera)." J Comp Physiol A Neuroethol Sens Neural Behav Physiol 198(2): 159-171. Saveer, A. M., S. H. Kromann, G. Birgersson, M. Bengtsson, T. Lindblom, A. Balkenius, B. S. Hansson, P. Witzgall, P. G. Becher and R. Ignell (2012). "Floral to green: mating switches moth olfactory coding and preference." Proc Biol Sci 279(1737): 2314-2322. Trona, F., G. Anfora, A. Balkenius, M. Bengtsson, M. Tasin, A. Knight, N. Janz, P. Witzgall and R. Ignell (2013). "Neural coding merges sex and habitat chemosensory signals in an insect herbivore." Proc Biol Sci 280(1760): 20130267. Yin, X. W., I. Iovinella, R. Marangoni, F. Cattonaro, G. Flamini, S. Sagona, L. Zhang, P. Pelosi and A. Felicioli (2013). "Odorant-binding proteins and olfactory coding in the solitary bee Osmia cornuta." Cell Mol Life Sci 70(16): 3029-3039. Nunez-Parra, A., A. Li and D. Restrepo (2014). "Coding odor identity and odor value in awake rodents." Prog Brain Res 208: 205-222. Roussel, E., J. Carcaud, M. Combe, M. Giurfa and J. C. Sandoz (2014). "Olfactory coding in the honeybee lateral horn." Curr Biol 24(5): 561-567. Carcaud, J., M. Giurfa and J. C. Sandoz (2015). "Differential combinatorial coding of pheromones in two olfactory subsystems of the honey bee brain." J Neurosci 35(10): 4157-4167.

			Gadziola, M. A., K. A. Tylicki, D. L. Christian and D. W. Wesson (2015). "The olfactory tubercle encodes odor valence in behaving mice." J Neurosci 35(11): 4515-4527. Zhou, J., C. Jia, Q. Feng, J. Bao and M. Luo (2015). "Prospective coding of dorsal raphe reward signals by the orbitofrontal cortex." J Neurosci 35(6): 2717-2730. Seki, Y., H. K. M. Dweck, J. Rybak, D. Wicher, S. Sachse and B. S. Hansson (2017). "Olfactory coding from the periphery to higher brain centers in the Drosophila brain." BMC Biol 15(1): 56. Soni, N., J. S. Chahda and J. R. Carlson (2019). "Odor coding in the antenna of the tsetse fly Glossina morsitans." Proc Natl Acad Sci U S A 116(28): 14300-14308. Jiang, N. J., R. Tang, H. Guo, C. Ning, J. C. Li, H. Wu, L. Q. Huang and C. Z. Wang (2020). "Olfactory coding of intra- and interspecific pheromonal messages by the male Mythimna separata in North China." Insect Biochem Mol Biol 125: 103439. Renou, M. and S. Anton (2020). "Insect olfactory communication in a complex and changing world." Curr Opin Insect Sci 42: 1-7. Mertes, M., J. Carcaud and J. C. Sandoz (2021). "Olfactory coding in the antennal lobe of the bumble bee Bombus terrestris." Sci Rep 11(1): 10947. Paoli, M. and G. C. Galizia (2021). "Olfactory coding in honeybees." Cell Tissue Res 383(1): 35-58. Herre, M., O. V. Goldman, T. C. Lu, G. Caballero-Vidal, Y. Qi, Z. N. Gilbert, Z. Gong, T. Morita, S. Rahiel, M. Ghaninia, R. Ignell, B. J. Matthews, H. Li, L. B. Vosshall and M. A. Younger (2022). "Non-canonical odor coding in the mosquito." Cell 185(17): 3104-3123.e3128. Yates, D. (2022). "Olfactory coding in mosquitoes." Nat Rev Neurosci 23(10): 583.
267	Omega Code	The Omega Leaf Code	Tomlinson, P. B., A. Ricciardi and B. A. Huggett (2018). “Cracking the omega code: hydraulic architecture of the cycad leaf axis.” Ann Bot 121(3): 483-488.
268	Oocyte code	The Oocyte Quality Code	Voros, C., Athanasiou, D., Papapanagiotou, I., Mavrogianni, D., Varthaliti, A., Bananis, K., . . . Daskalakis, G. (2025). Cracking the Code of Oocyte Quality: The Oxidative Stress Link to IVF Success. Int J Mol Sci, 26(13), 6377.
269	Organogenesis code	The Regulatory Organogenesis Codes	Scully, K. M. and M. G. Rosenfeld (2002). “Pituitary development: regulatory codes in mammalian organogenesis.” Science 295(5563): 2231-2235.
270	Orthographic code	The Orthographic Reading Code	Davis, C. J. (2012). “Developing a universal model of reading necessitates cracking the orthographic code.” Behav Brain Sci 35(5): 283-284.

			Wallot, S. (2014). “From “cracking the orthographic code” to “playing with language”: toward a usage-based foundation of the reading process.” Front Psychol 5: 891. Borleffs, E., B. A. M. Maassen, H. Lyytinen and F. Zwarts (2018). “Cracking the Code: The Impact of Orthographic Transparency and Morphological-Syllabic Complexity on Reading and Developmental Dyslexia.” Front Psychol 9: 2534.
271	Oscillation code	The neuronal Oscillatory /Frequency Codes	Schyns, P. G., G. Thut and J. Gross (2011). “Cracking the code of oscillatory activity.” PloS Biol 9(5): e1001064. de la Prida, L. M. (2019). “The Theta Stone: 3 to 10 Hz Oscillations to Decipher the Human Brain Code.” Epilepsy Curr 19(2): 126-128.
272	Osteoarthritis code	The Osteoarthritis Codes	Cen, X., X. Q. Huang, W. T. Sun, Q. Liu and J. Liu (2017). "Long noncoding RNAs: a new regulatory code in osteoarthritis." Am J Transl Res 9(11): 4747-4755.
273	Osteoporosis code	The Osteoporosis Code	Wu, Q. Y., X. Li, Z. N. Miao, J. X. Ye, B. Wang, F. Zhang, R. S. Xu, D. L. Jiang, M. D. Zhao and F. L. Yuan (2018). "Long Non-coding RNAs: A New Regulatory Code for Osteoporosis." Front Endocrinol (Lausanne) 9: 587.
274	p53 codes	P53 Associated Codes	Appella, E., & Anderson, C. W. (2000). Signaling to p53: breaking the posttranslational modification code. Pathol Biol (Paris), 48(3), 227-245. O’Brate, A., & Giannakakou, P. (2003). The importance of p53 location: nuclear or cytoplasmic zip code? Drug Resistance Updates, 6(6), 313-322. Piccinin, S., Tonin, E., Sessa, S., Demontis, S., Rossi, S., Pecciarini, L., . . . Maestro, R. (2012). A "twist box" code of p53 inactivation: twist box: p53 interaction promotes p53 degradation. Cancer Cell, 22(3), 404-415. Ciribilli, Y., Monti, P., Bisio, A., Nguyen, H. T., Ethayathulla, A. S., Ramos, A., . . . Inga, A. (2013). Transactivation specificity is conserved among p53 family proteins and depends on a response element sequence code. Nucleic Acids Res, 41(18), 8637-8653. Joerger, A. C. (2018). Extending the Code of Sequence Readout by Gene Regulatory Proteins: The Role of Hoogsteen Base Pairing in p53-DNA Recognition. Structure, 26(9), 1163-1165. Wen, J., & Wang, D. (2021). Deciphering the PTM codes of the tumor suppressor p53. J Mol Cell Biol, 13(11), 774-785.

			Armour-Garb, I., Han, I. S. M., Cowan, B. S., & Thayer, K. M. (2022). Variable Regions of p53 Isoforms Allosterically Hard Code DNA Interaction. The Journal of Physical Chemistry B, 126(42), 8495-8507. Wylie, A., Jones, A. E., Das, S., Lu, W.-J., & Abrams, J. M. (2022). Distinct p53 isoforms code for opposing transcriptional outcomes. Dev Cell, 57(15), 1833-1846.e1836. Xia, Z., Kon, N., Gu, A. P., Tavana, O., & Gu, W. (2022). Deciphering the acetylation code of p53 in transcription regulation and tumor suppression. Oncogene, 41(22), 3039-3050. Bartolomei, L., Pretto, B., Brugnara, S., Sontacchi, A., Dassi, V., Bousrih, A., . . . Ciribilli, Y. (2026). p53 Isoforms as Modifiers of the p53-Dependent Responses: A Hidden Code? Cancers (Basel), 18(7), 1057.
275	PAR code	The Poly(ADP-Ribosyl) Code	Maluchenko, N. V., Koshkina, D. O., Feofanov, A. V., Studitsky, V. M., & Kirpichnikov, M. P. (2021). Poly(ADP-Ribosyl) Code Functions. Acta Naturae, 13(2), 58-69.
276	Palmitoylation code	The Palmitoylation Codes	Batrouni, A. G., N. Bag, H. T. Phan, B. A. Baird and J. M. Baskin (2022). "A palmitoylation code controls PI4KIIIα complex formation and PI(4,5)P2 homeostasis at the plasma membrane." J Cell Sci 135(5). Kim, B.-I., Yeon, J.-H., & Suh, B.-C. (2025). Palmitoylation Code and Endosomal Sorting Regulate ABHD17A Plasma Membrane Targeting and Activity. Int J Mol Sci, 26(20), 10190. Xiao, H.-x., Li, Z.-z., Li, X.-h., Chen, T., Tang, X.-r., Zhang, Y., . . . Pan, Y.-p. (2026). The palmitoylation code in cell death signaling: from molecular mechanisms to therapeutic opportunities [Review]. Front Cell Dev Biol, Volume 14 - 2026.
277	Pattern code	The Pattern Formation Code	Depew, M. J., C. A. Simpson, M. Morasso and J. L. Rubenstein (2005). “Reassessing the Dlx code: the genetic regulation of branchial arch skeletal pattern and development.” J Anat 207(5): 501-561. Yakoby, N., C. A. Bristow, D. Gong, X. Schafer, J. Lembong, J. J. Zartman, M. S. Halfon, T. Schüpbach and S. Y. Shvartsman (2008). “A combinatorial code for pattern formation in Drosophila oogenesis.” Dev Cell 15(5): 725-737. Balasubramanian, R., X. Min, P. M. J. Quinn, Q. L. Giudice, C. Tao, K. Polanco, N. Makrides, J. Peregrin, M. Bouaziz, Y. Mao, Q. Wang, B. L. da Costa, D. Buenaventura, F. Wang, L. Ma, S. H. Tsang, P. J. Fabre and X. Zhang (2021). "Phase transition specified by a binary code patterns the vertebrate eye cup." Sci Adv 7(46): eabj9846.

			Sagner, A., Zhang, I., Watson, T., Lazaro, J., Melchionda, M., & Briscoe, J. (2021). A shared transcriptional code orchestrates temporal patterning of the central nervous system. PLoS Biol, 19(11), e3001450. Cole, A. G., Hashimshony, T., Du, Z., & Yanai, I. (2024). Gene regulatory patterning codes in early cell fate specification of the C. elegans embryo. Elife, 12, RP87099.
278	Persistence code	The Virus Persistence Codes	Colomb, F., Giron, L. B., Trbojevic-Akmacic, I., Lauc, G., & Abdel-Mohsen, M. (2019). Breaking the Glyco-Code of HIV Persistence and Immunopathogenesis. Current HIV/AIDS Reports, 16(2), 151-168. Saeed, U., Piracha, Z. Z., Khan, M., Tariq, M. N., Gilani, S. S., Raza, M., . . . Nauli, S. M. (2025). Cracking the code of HBV persistence: cutting-edge approaches to targeting cccDNA in chronic hepatitis B with or without pyogenic liver Abscesses [Review]. Frontiers in Medicine, Volume 12 - 2025.
279	Personal code	The Personal Pictorial Code (Art)	Marconi, V. (2025). Titian's mythological paintings: A pictorial personal code. Biosystems, 255, 105543.
280	pH code	The pH Code **SEE also Senescence Codes**	Konishi, A. (2025). Breaking the pH Code: acidification triggers SASP and inflammation in cellular senescence. The Journal of Biochemistry.
281	Phagocytic code	The Phagocytosis Codes	Jubrail, J., N. Kurian and F. Niedergang (2017). "Macrophage phagocytosis cracking the defect code in COPD." Biomed J 40(6): 305-312. Bronte, V. (2019). "Deciphering Macrophage and Monocyte Code to Stratify Human Breast Cancer Patients." Cancer Cell 35(4): 538-539. Cockram, T. O. J., J. M. Dundee, A. S. Popescu and G. C. Brown (2021). "The Phagocytic Code Regulating Phagocytosis of Mammalian Cells." Front Immunol 12: 629979.
282	Pheromone code	The Pheromone Codes	Dulac, C. (2000). Sensory coding of pheromone signals in mammals. Current Opinion in Neurobiology, 10(4), 511-518. Kostal, L., P. Lansky and J.-P. Rospars (2008). “Efficient Olfactory Coding in the Pheromone Receptor Neuron of a Moth.” PLOS Computational Biology 4(4): e1000053. Barrozo, R. B., Jarriault, D., Deisig, N., Gemeno, C., Monsempes, C., Lucas, P., . . . Anton, S. (2011). Mating-induced differential coding of plant odour and sex pheromone in a male moth. European Journal of Neuroscience, 33(10), 1841-1850.

			Kaur, Angeldeep W., Ackels, T., Kuo, T.-H., Cichy, A., Dey, S., Hays, C., . . . Stowers, L. (2014). Murine Pheromone Proteins Constitute a Context-Dependent Combinatorial Code Governing Multiple Social Behaviors. Cell, 157(3), 676-688. Carcaud, J., M. Giurfa and J. C. Sandoz (2015). "Differential combinatorial coding of pheromones in two olfactory subsystems of the honey bee brain." J Neurosci 35(10): 4157-4167. Wang, B., Y. Liu and G. R. Wang (2018). "Proceeding From in vivo Functions of Pheromone Receptors: Peripheral-Coding Perception of Pheromones From Three Closely Related Species, Helicoverpaarmigera, H. assulta, and Heliothisvirescens." Front Physiol 9: 1188. Dekker, T., & Kárpáti, Z. (2020). Coding and Evolution of Pheromone Preference in Moths. In Y. Ishikawa (Ed.), Insect Sex Pheromone Research and Beyond: From Molecules to Robots (pp. 265-286). Springer Singapore. Tirindelli, R. (2021). "Coding of pheromones by vomeronasal receptors." Cell and Tissue Research 383(1): 367-386. Wang, C., Li, Y.-H., Wang, L., Yang, B., & Wang, G.-R. (2023). Development of a New Sex Attractant via the Peripheral Coding of Pheromones in Mythimna loreyi. Journal of Agricultural and Food Chemistry, 71(6), 2795-2803. Hu, X., Tang, R., Song, L., Li, G., Gao, T., Chen, L., & Guo, H. (2024). Peripheral Coding of Sex Pheromones in the Tomato Leaf Miner, Phthorimaea absoluta (Meyrick). Journal of Agricultural and Food Chemistry, 72(48), 26809-26819. Ke, H., D. Bohbot, J., Chi, Y., Duan, S., Ma, X., Ren, B., & Wang, Y. (2024). The dual coding of a single sex pheromone receptor in Asian honeybee Apis cerana. Commun Biol, 7(1), 502. Clémençon, P., Bárta, T., Monsempès, C., Renou, M., & Lucas, P. (2026). Diversity of pheromone temporal coding disruptions by plant volatiles. bioRxiv, 2026.2003.2024.713794.
283	Phenotype code	The Phenotype Codes	Yotsukura, S., Karasuyama, M., Takigawa, I., & Mamitsuka, H. (2017). Exploring phenotype patterns of breast cancer within somatic mutations: a modicum in the intrinsic code. Brief Bioinform, 18(4), 619-633. Myers, R., Cembran, A., & Fernandez-Funez, P. (2020). Insight From Animals Resistant to Prion Diseases: Deciphering the Genotype – Morphotype – Phenotype Code for the Prion Protein [Review]. Front Cell Neurosci, Volume 14 - 2020.

			Westerman, E. L., S. E. J. Bowman, B. Davidson, M. C. Davis, E. R. Larson and C. P. J. Sanford (2020). "Deploying Big Data to Crack the Genotype to Phenotype Code." Integr Comp Biol 60(2): 385-396. Luce, L., Kocak, G. S., Verdú-Díaz, J., Alonso-Pérez, J., Claeys, K. G., Stojkovic, T., . . . Díaz-Manera, J. (2026). Cracking the Code: Genotype-Phenotype Correlation Models in Sarcoglycanopathies. Ann Clin Transl Neurol.
284	Phonological code	The Phonological Codes	Foss, D. J. and M. A. Gernsbacher (1983). "Cracking the Dual Code: Toward a Unitary Model of Phoneme Identification." J Verbal Learning Verbal Behav 22(6): 609-632. Brysbaert, M. and C. Praet (1992). “Reading isolated words: no evidence for automatic incorporation of the phonetic code.” Psychol Res 54(2): 91-102. Reynolds, M. and D. Besner (2006). “Reading aloud is not automatic: processing capacity is required to generate a phonological code from print.” J Exp Psychol Hum Percept Perform 32(6): 1303-1323. Jacquemot, C., E. Dupoux and A.-C. Bachoud-Lévi (2007). “Breaking the mirror: Asymmetrical disconnection between the phonological input and output codes.” Cognitive Neuropsychology 24(1): 3-22. Denis-Noël, A., C. Pattamadilok, É. Castet and P. Colé (2020). "Activation time-course of phonological code in silent word recognition in adult readers with and without dyslexia." Ann Dyslexia 70(3): 313-338.
285	Phosphate code	The Phosphate Signalling Codes	Jia, X., Wang, L., Nussaume, L., & Yi, K. (2023). Cracking the code of plant central phosphate signaling. Trends Plant Sci, 28(3), 267-270.
286	Phosphatase code	The Phosphatase Code	Roy, J. and M. S. Cyert (2009). “Cracking the phosphatase code: docking interactions determine substrate specificity.” Sci Signal 2(100): re9. Heroes, E., B. Lesage, J. Görnemann, M. Beullens, L. Van Meervelt and M. Bollen (2013). "The PP1 binding code: a molecular-lego strategy that governs specificity." Febs j 280(2): 584-595. Choy, M. S., M. Hieke, G. S. Kumar, G. R. Lewis, K. R. Gonzalez-DeWhitt, R. P. Kessler, B. J. Stein, M. Hessenberger, A. C. Nairn, W. Peti and R. Page (2014). "Understanding the antagonism of retinoblastoma protein dephosphorylation by PNUTS provides insights into the PP1 regulatory code." Proc Natl Acad Sci U S A 111(11): 4097-4102. Masaki, T. and M. Shimada (2022). “Decoding the Phosphatase Code: Regulation of Cell Proliferation by Calcineurin.” Int J Mol Sci 23(3).

287	Phosphoinositide code	The Phosphoinositide Code	Overduin, M., & and Kervin, T. A. (2021). The phosphoinositide code is read by a plethora of protein domains. Expert Review of Proteomics, 18(7), 483-502.
288	Phospholipid code	The Phospholipid Code	Baxter, A. A., M. D. Hulett and I. K. Poon (2015). "The phospholipid code: a key component of dying cell recognition, tumor progression and host-microbe interactions." Cell Death Differ 22(12): 1893-1905.
289	Phosphorylation code	The Phosphorylation Code	Mercier, J. C. (1981). Phosphorylation of caseins, present evidence for an amino acid triplet code posttranslationally recognized by specific kinases. Biochimie, 63(1), 1-17. Wang, Z., Frederick, J., & Garabedian, M. J. (2002). Deciphering the Phosphorylation "Code" of the Glucocorticoid Receptor in Vivo *210. Journal of Biological Chemistry, 277(29), 26573-26580. Skliris, G. P., Nugent, Z. J., Rowan, B. G., Penner, C. R., Watson, P. H., & Murphy, L. C. (2010). A phosphorylation code for oestrogen receptor-alpha predicts clinical outcome to endocrine therapy in breast cancer. Endocr Relat Cancer, 17(3), 589-597. Ganguly, A. and H. T. Cho (2012). "The phosphorylation code is implicated in cell type-specific trafficking of PIN-FORMEDs." Plant Signal Behav 7(10): 1215-1218. Lippens, G., Amniai, L., Wieruszeski, J.-M., Sillen, A., Leroy, A., & Landrieu, I. (2012). Towards understanding the phosphorylation code of tau. Biochem Soc Trans, 40(4), 698-703. Chen, Y. and J. Jiang (2013). "Decoding the phosphorylation code in Hedgehog signal transduction." Cell Res 23(2): 186-200. Rauscher, S., Pacher, S., Hedtke, M., Kniemeyer, O., & Fischer, R. (2016). A phosphorylation code of the Aspergillus nidulans global regulator VelvetA (VeA) determines specific functions. Mol Microbiol, 99(5), 909-924. Kimura, T., Sharma, G., Ishiguro, K., & Hisanaga, S.-i. (2018). Phospho-Tau Bar Code: Analysis of Phosphoisotypes of Tau and Its Application to Tauopathy [Review]. Frontiers in Neuroscience, Volume 12 - 2018. Örd, M., K. Möll, A. Agerova, R. Kivi, I. Faustova, R. Venta, E. Valk and M. Loog (2019). "Multisite phosphorylation code of CDK." Nature Structural & Molecular Biology 26(7): 649-658. Arif, A., J. Jia, B. Willard, X. Li and P. L. Fox (2019). "Multisite Phosphorylation of S6K1 Directs a Kinase Phospho-code that Determines Substrate Selection." Mol Cell 73(3): 446-457.e446.

			Murakami, Y. (2019). "Phosphorylation of repressive histone code readers by casein kinase 2 plays diverse roles in heterochromatin regulation." J Biochem 166(1): 3-6. Wang, B., A. N. Kettenbach, X. Zhou, J. J. Loros and J. C. Dunlap (2019). "The Phospho-Code Determining Circadian Feedback Loop Closure and Output in Neurospora." Mol Cell 74(4): 771-784.e773. Sluchanko, N. N. (2020). "Reading the phosphorylation code: binding of the 14-3-3 protein to multivalent client phosphoproteins." Biochem J 477(7): 1219-1225. Kervin, T. A. and M. Overduin (2021). “Regulation of the Phosphoinositide Code by Phosphorylation of Membrane Readers.” Cells 10(5). Lee, H., A. Ganguly, S. Baik and H. T. Cho (2021). "Calcium-dependent protein kinase 29 modulates PIN-FORMED polarity and Arabidopsis development via its own phosphorylation code." Plant Cell 33(11): 3513-3531. Zhou, M. and J. Jiang (2022). “Gli Phosphorylation Code in Hedgehog Signal Transduction.” Front Cell Dev Biol 10: 846927. Conti, M. M., Li, R., Narváez Ramos, M. A., Zhu, L. J., Fazzio, T. G., & Benanti, J. A. (2023). Phosphosite Scanning reveals a complex phosphorylation code underlying CDK-dependent activation of Hcm1. Nat Commun, 14(1), 310. Kapitonova, A. A., Perfilova, K. V., Cooley, R. B., & Sluchanko, N. N. (2024). Phosphorylation Code of Human Nucleophosmin Includes Four Cryptic Sites for Hierarchical Binding of 14-3-3 Proteins. J Mol Biol, 436(12), 168592. Lee, J., & Pak, D. T. S. (2024). Amyloid precursor protein combinatorial phosphorylation code regulates AMPA receptor removal during distinct forms of synaptic plasticity. Biochem Biophys Res Commun, 709, 149803. Martínez Báez, A., Ayala, G., Pedroza-Saavedra, A., González-Sánchez, H. M., & Chihu Amparan, L. (2024). Phosphorylation Codes in IRS-1 and IRS-2 Are Associated with the Activation/Inhibition of Insulin Canonical Signaling Pathways. Curr Issues Mol Biol, 46(1), 634-649. Yang, J., Li, B., Pan, Y. T., Wang, P., Sun, M. L., Kim, K. T., . . . Huang, L. (2024). Phospho-code of a conserved transcriptional factor underpins fungal virulence. BMC Biol, 22(1), 179. Chen, H., Lou, J., & Chen, W. (2025). Lipid-Gated "Phosphorylation Code" for TCR Graded Signaling and T-cell exhaustion. Protein Cell.

			Wang, Z., Dong, L., Liu, H., & Song, Y. (2025). EGFR affinity and selectivity for the phosphorylation codes of pseudo triad tyrosine (YYY) motif and its extensions in lung cancer-related substrate-inhibitor alignment: an integrated molecular simulation-QSAR modelling–in vitro assay approach. SAR and QSAR in Environmental Research, 36(12), 1263-1282.
290	Phosphoserine code	The Phosphoserine Code	Aragón, E., N. Goerner, A. I. Zaromytidou, Q. Xi, A. Escobedo, J. Massagué and M. J. Macias (2011). "A Smad action turnover switch operated by WW domain readers of a phosphoserine code." Genes Dev 25(12): 1275-1288.
291	PI3K code	The Phosphatidyl-Inositol 3´OH Kinase Code	Tengholm, A., & Meyer, T. (2002). A PI3-Kinase Signaling Code for Insulin-Triggered Insertion of Glucose Transporters into the Plasma Membrane. Current Biology, 12(21), 1871-1876. Madsen, R. R. and B. Vanhaesebroeck (2020). "Cracking the context-specific PI3K signaling code." Science Signaling 13(613): eaay2940.
292	Placenta code	The Placenta Codes	Balu, U. R., Vasantharekha, R., Priyanka, H. P., Nair, R. S., Mudgal, G., & Barathi, S. (2025). The Placental Stress Code: Lymphocyte Proliferation, Immune and Metabolic Enzyme Shifts Reveal Oxidative Stress in Preeclampsia and Preeclampsia with Gestational Diabetes Mellitus. Reproductive Medicine, 6(4), 43.
293	Polarity code	The Cell Polarity Code	Macara, I. G. (2004). "Parsing the polarity code." Nat Rev Mol Cell Biol 5(3): 220-231.
294	Poly(A) code	The Poly(Adenylation) Code	Weng, L., Y. Li, X. Xie and Y. Shi (2016). "Poly(A) code analyses reveal key determinants for tissue-specific mRNA alternative polyadenylation." Rna 22(6): 813-821.
295	Polyketide code	The Polyketide Code	Hopwood, D. A. (2004). "Cracking the polyketide code." PloSBiol 2(2): E35.
296	Population codes	The Neuronal Population Codes	Tsai, J. J. and J. D. Victor (2003). "Reading a population code: a multi-scale neural model for representing binocular disparity." Vision Res 43(4): 445-466. Bensmaia, S. J. (2008). "Tactile intensity and population codes." Behavioural Brain Research 190(2): 165-173. Schwartz, G., Macke, J., Amodei, D., Tang, H., & Berry, M. J., 2nd. (2012). Low error discrimination using a correlated population code. J Neurophysiol, 108(4), 1069-1088. London, D., A. Fazl, K. Katlowitz, M. Soula, M. H. Pourfar, A. Y. Mogilner and R. Kiani (2021). "Distinct population code for movement kinematics and changes of ongoing movements in human subthalamic nucleus." Elife 10.

			Panzeri, S., Moroni, M., Safaai, H., & Harvey, C. D. (2022). The structures and functions of correlations in neural population codes. Nature Reviews Neuroscience, 23(9), 551-567. Nagelhus, A., Andersson, S. O., Cogno, S. G., Moser, E. I., & Moser, M.-B. (2023). Object-centered population coding in CA1 of the hippocampus. Neuron, 111(13), 2091-2104.e2014. Nocon, J. C., Witter, J., Gritton, H., Han, X., Houghton, C., & Sen, K. (2023). A robust and compact population code for competing sounds in auditory cortex. J Neurophysiol, 130(3), 775-787. Failor, S. W., Carandini, M., & Harris, K. D. (2025). Visual experience orthogonalizes visual cortical stimulus responses via population code transformation. Cell Rep, 44(2).
297	Positional code	The Positional (Pattern) Codes **SEE also Pattern Formation Code**	Cooke, J. (1982). Vitamin A, limb patterns and the search for the positional code. Nature, 296(5858), 603-605.
298	Posttranslational codes	The Post-translational Modification (PTM) Codes	Appella, E. and C. W. Anderson (2000). "Signaling to p53: breaking the posttranslational modification code." Pathol Biol (Paris) 48(3): 227-245. O'Malley, B. W., Qin, J., & Lanz, R. B. (2008). Cracking the coregulator codes. Curr Opin Cell Biol, 20(3), 310-315. Benayoun, B. A. and R. A. Veitia (2009). "A post-translational modification code for transcription factors: sorting through a sea of signals." Trends Cell Biol 19(5): 189-197. York, B., C. Yu, J. V. Sagen, Z. Liu, B. C. Nikolai, R. C. Wu, M. Finegold, J. Xu and B. W. O'Malley (2010). "Reprogramming the posttranslational code of SRC-3 confers a switch in mammalian systems biology." Proc Natl Acad Sci U S A 107(24): 11122-11127. Holdermann, I., N. H. Meyer, A. Round, K. Wild, M. Sattler and I. Sinning (2012). "Chromodomains read the arginine code of post-translational targeting." Nat Struct Mol Biol 19(2): 260-263. Creixell, P. and R. Linding (2012). "Cells, shared memory and breaking the PTM code." Mol Syst Biol 8: 598. Stojkovic, K., S. S. Wing and N. Cermakian (2014). "A central role for ubiquitination within a circadian clock protein modification code." Front Mol Neurosci 7: 69. Pankow, S., C. Bamberger and J. R. Yates, 3rd (2019). "A posttranslational modification code for CFTR maturation is altered in cystic fibrosis." Sci Signal 12(562).

			Wen, J. and D. Wang (2022). “Deciphering the PTM codes of the tumor suppressor p53.” J Mol Cell Biol 13(11): 774-785. Mammeri, N. E., Dregni, A. J., Duan, P., & Hong, M. (2024). Structures of AT8 and PHF1 phosphomimetic tau: Insights into the posttranslational modification code of tau aggregation. Proceedings of the National Academy of Sciences, 121(10), e2316175121.
299	Praxis codes	The codes of social practices	Gahrn-Andersen, R. (2025). Codes of praxis: How recursivity constitutes human social practices. Biosystems, 251, 105429.
300	Prion code	The Prion Code	Lesné, S. E. (2013). “Breaking the Code of Amyloid-β Oligomers.” Int J Cell Biol 2013: 950783. Yahi, N. and J. Fantini (2014). "Deciphering the glycolipid code of Alzheimer's and Parkinson's amyloid proteins allowed the creation of a universal ganglioside-binding peptide." PLoS One 9(8): e104751. Ahmed, A. B. and A. V. Kajava (2013). “Breaking the amyloidogenicity code: methods to predict amyloids from amino acid sequence.” FEBS Lett 587(8): 1089-1095. Myers, R., A. Cembran and P. Fernandez-Funez (2020). "Insight From Animals Resistant to Prion Diseases: Deciphering the Genotype - Morphotype - Phenotype Code for the Prion Protein." Front Cell Neurosci 14: 254. Coca, J. R., H. Eraña and J. Castilla (2021). “Biosemiotics comprehension of PrP code and prion disease.” Biosystems 210: 104542.
301	Proliferation code	The (cell) Proliferation Code	Marleen Gloger, Marle Kraft, Di Peng et al. (2026) Lineage-enriched cell proliferation code underlies spatio-temporal regulation of cell cycle dynamics in lymphatic vessels, PREPRINT (Version 1) available at Research Square
302	Protein folding code	The Protein Folding Code	Epstein, C. J. (1966). "Role of the amino-acid "code" and of selection for conformation in the evolution of proteins." Nature 210(5031): 25-28. Liquori, A. M., P. De Santis, A. L. Kovacs and L. Mazzarella (1966). "Stereochemical code of amino-acid residues: the molecular conformation of gramicidine S." Nature 211(5053): 1039-1041. Robson, B. and R. H. Pain (1971). "Analysis of the code relating sequence to conformation in proteins: possible implications for the mechanism of formation of helical regions." J Mol Biol 58(1): 237-259.

			Robson, B. and R. H. Pain (1974). "Analysis of the code relating sequence to conformation in globular proteins. Development of a stereochemical alphabet on the basis of intra-residue information." Biochem J 141(3): 869-882. Robson, B. and R. H. Pain (1974). "Analysis of the code relating sequence to conformation in globular proteins. An informational analysis of the role of the residue in determining the conformation of its neighbours in the primary sequence." Biochem J 141(3): 883-897. Robson, B. and R. H. Pain (1974). "Analysis of the code relating sequence to conformation in globular proteins. The distribution of residue pairs in turns and kinks in the backbone chain." Biochem J 141(3): 899-904. Garnier, J. and J. M. Levin (1991). "The protein structure code: what is its present status?" Comput Appl Biosci 7(2): 133-142. Goldstein, R. A., Luthey-Schulten, Z. A., & Wolynes, P. G. (1992). Optimal protein-folding codes from spin-glass theory. Proceedings of the National Academy of Sciences, 89(11), 4918-4922. Rackovsky, S. (1993). On the nature of the protein folding code. Proceedings of the National Academy of Sciences, 90(2), 644-648. Negrete, J. A., Y. Viñuales and J. Palau (1998). “Deciphering the structural code for proteins: helical propensities in domain classes and statistical multiresidue information in alpha-helices.” Protein Sci 7(6): 1368-1379. Rumbley, J., L. Hoang, L. Mayne and S. W. Englander (2001). "An amino acid code for protein folding." Proc Natl Acad Sci U S A 98(1): 105-112. Uversky, V. N. (2002). “Cracking the folding code. Why do some proteins adopt partially folded conformations, whereas other don’t?” FEBS Lett 514(2-3): 181-183. Štambuk, N., & Konjevoda, P. (2003). Prediction of secondary protein structure with binary coding patterns of amino acid and nucleotide physicochemical properties. International Journal of Quantum Chemistry, 92(2), 123-134. Goldbeck, R. A., R. M. Esquerra, J. M. Holt, G. K. Ackers and D. S. Kliger (2004). "The molecular code for hemoglobin allostery revealed by linking the thermodynamics and kinetics of quaternary structural change. 1. Microstate linear free energy relations." Biochemistry 43(38): 12048-12064. Hodges, J. A. and R. T. Raines (2005). "Stereoelectronic and steric effects in the collagen triple helix: toward a code for strand association." J Am Chem Soc 127(45): 15923-15932.

			Shestopalov, B. V. (2007). "The code-based physics of formation of alpha-helices and beta-hairpins in water-soluble proteins." Dokl Biochem Biophys 416: 245-247. Wallace, R. (2011). "Structure and dynamics of the 'protein folding code' inferred using Tlusty's topological rate distortion approach." Biosystems 103(1): 18-26. Banach, M., Prudhomme, N., Carpentier, M., Duprat, E., Papandreou, N., Kalinowska, B., . . . Roterman, I. (2015). Contribution to the prediction of the fold code: application to immunoglobulin and flavodoxin cases. PLoS One, 10(4), e0125098. Grison, C. M., S. Robin and D. J. Aitken (2015). "The discovery of 9/8-ribbons, β/γ-peptides with curved shapes governed by a combined configuration-conformation code." Chem Commun (Camb) 51(90): 16233-16236. Joo, H., A. G. Chavan, K. J. Fraga and J. Tsai (2015). "An amino acid code for irregular and mixed protein packing." Proteins 83(12): 2147-2161. Fraga, K. J., H. Joo and J. Tsai (2016). "An amino acid code to define a protein's tertiary packing surface." Proteins 84(2): 201-216. Komar, A. A. (2021). “A Code Within a Code: How Codons Fine-Tune Protein Folding in the Cell.” Biochemistry (Moscow) 86(8): 976-991. Balasco, N., Esposito, L., & Vitagliano, L. (2025). Structural Biology in the AlphaFold Era: How Far Is Artificial Intelligence from Deciphering the Protein Folding Code? Biomolecules, 15(5). Ke, L., Yang, Y., Meng, X., Zhu, G., Yang, J., Wang, Y., . . . Cheng, W. (2026). Predicting the protein target of cucurbitacin E through a novel approach of protein folding shape code. Guidelines and Standards in Chinese Medicine, 4(1).
303	Protein-protein interaction code	The Protein-Protein Interaction Codes	Träger, T., & Kastritis, P. L. (2023). Cracking the code of cellular protein–protein interactions: Alphafold and whole-cell crosslinking to the rescue. Molecular Systems Biology, 19(4), MSB202311587.
304	Proteolipid code	The Proteolipid Code	Kervin, T. A., & Overduin, M. (2024). Membranes are functionalized by a proteolipid code. *BMC Biol*, *22*(1), 46. https://doi.org/10.1186/s12915-024-01849-6 Overduin, M., Bhat, R., Dieudonné, T., Zhang, P., & Kervin, T. A. (2025). Deciphering the language of mingling lipids and proteins. Curr Opin Struct Biol, 92, 103061.
305	Proteomic code	The Proteomic Code	Trifonov, E. N. and I. N. Berezovsky (2002). “Proteomic Code.” Molecular Biology 36(2): 239-243.

			Biro, J. C. (2008). "Discovery of proteomic code with mRNA assisted protein folding." Int J Mol Sci 9(12): 2424-2446. Miller, A. D. (2015). "Sense-antisense (complementary) peptide interactions and the proteomic code; potential opportunities in biology and pharmaceutical science." Expert Opin Biol Ther 15(2): 245-267. Hameduh, T., Miller, A. D., Heger, Z., & Haddad, Y. (2025). The proteomic code: Novel amino acid residue pairing models “encode” protein folding and protein-protein interactions. Computers in Biology and Medicine, 190, 110033.
306	Psychosomatic code	The Psychosomatic Codes	Li, Y., Ng, S., Kong, K., Jin, M., Fan, W., Zhou, W., . . . Li, H. (2026). Brain–bone axis dysregulation: Biological code underlying the bidirectional association between depression and musculoskeletal disorders. Journal of Orthopaedic Translation, 56, 101044.
307	QTY code	The QTY (glutamine, threonine, tyrosine) Code	Zhang, S., Tao, F., Qing, R., Tang, H., Skuhersky, M., Corin, K., . . . Maertens, B. (2018). QTY code enables design of detergent-free chemokine receptors that retain ligand-binding activities. Proceedings of the National Academy of Sciences, 115(37), E8652-E8659. Qing, R., Han, Q., Skuhersky, M., Chung, H., Badr, M., Schubert, T., & Zhang, S. (2019). QTY code designed thermostable and water-soluble chimeric chemokine receptors with tunable ligand affinity. Proc Natl Acad Sci U S A, 116(51), 25668-25676. Mustafa, M. I., A. H. Abdelmoneim, E. M. Mahmoud and A. M. Makhawi (2020). “Cytokine Storm in COVID-19 Patients, Its Impact on Organs and Potential Treatment by QTY Code-Designed Detergent-Free Chemokine Receptors.” Mediators Inflamm 2020: 8198963. Hao, S., D. Jin, S. Zhang and R. Qing (2020). “QTY Code-designed Water-soluble Fc-fusion Cytokine Receptors Bind to their Respective Ligands.” QRB Discov 1: e4. Tegler, L., Corin, K., Pick, H., Brookes, J., Skuhersky, M., Vogel, H., & Zhang, S. (2020). The G protein coupled receptor CXCR4 designed by the QTY code becomes more hydrophilic and retains cell signaling activity. Sci Rep, 10(1), 21371. Li, M., Tang, H., Qing, R., Wang, Y., Liu, J., Wang, R., . . . Tao, F. (2024). Design of a water-soluble transmembrane receptor kinase with intact molecular function by QTY code. Nat Commun, 15(1), 4293.
308	Quantum code	The Biological Quantum Coherence Codes	Petoukhov, S. V. (2021). “Algebraic harmony and probabilities in genomes. Long-range coherence in quantum code biology.” Biosystems 209: 104503.

309	Quasi-cyclic codes	The Regulatory Network Codes	Ravanmehr, V. and B. Vasić (2012). Quasi-cyclic codes exhibiting the gene regulatory network of the cell cycle. 2012 IEEE Symposium on Computational Intelligence in Bioinformatics and Computational Biology (CIBCB).
310	Quorum sensing code	The Quorum Sensing Codes	Hofmeyr, Jan-Hendrik S. (2023) The Quorum-Sensing Codes. *Ninth International Conference in Code Biology* – Guimarães (Portugal) 6-10 June 2023 Chen, C., Yang, Y., Choo, K.-H., Ng, H. Y., Takizawa, S., & Hou, L.-a. (2024). Cracking the code of seasonal seawater biofouling: enhanced biofouling control with quorum sensing inhibitor-functionalized membranes. npj Clean Water, 7(1), 12. Chowdhury, S., Kumar, M., Rawat, S., Singh, S., & Kaur, P. (2025). From code to cure: computational identification of LasR inhibitors to combat quorum sensing in P. aeruginosa. Molecular Diversity.
311	Rag GTPase dimer code	The GTPase Code	Gollwitzer, P., N. Grützmacher, S. Wilhelm, D. Kümmel and C. Demetriades (2022). "A Rag GTPase dimer code defines the regulation of mTORC1 by amino acids." Nat Cell Biol 24(9): 1394-1406.
312	Reading code	The Neuronal Code for Reading	Zecker, S. G. (1991). "The orthographic code: Developmental trends in reading-disabled and normally-achieving children." Ann Dyslexia 41(1): 178-192. Dehaene, S., L. Cohen, M. Sigman and F. Vinckier (2005). "The neural code for written words: a proposal." Trends Cogn Sci 9(7): 335-341. Goswami, U. and J. C. Ziegler (2006). "A developmental perspective on the neural code for written words." Trends in Cognitive Sciences 10: 142-143. Houghton, G. (2018). "Action and perception in literacy: A common-code for spelling and reading." Psychol Rev 125(1): 83-116. Agrawal, A., K. Hari and S. P. Arun (2020). "A compositional neural code in high-level visual cortex can explain jumbled word reading." Elife 9.
313	Recognition code	The Molecular Recognition Code	Freist, W. and F. Cramer (1976). "A binary code model for substrate recognition of aminoacyl-tRNA ligases." J Theor Biol 58(2): 401-416. Fellouse, F. A., B. Li, D. M. Compaan, A. A. Peden, S. G. Hymowitz and S. S. Sidhu (2005). "Molecular recognition by a binary code." J Mol Biol 348(5): 1153-1162. Hessa, T., N. M. Meindl-Beinker, A. Bernsel, H. Kim, Y. Sato, M. Lerch-Bader, I. Nilsson, S. H. White and G. von Heijne (2007). "Molecular code for transmembrane-helix recognition by the Sec61 translocon." Nature 450(7172): 1026-1030.

			Park, Y. and V. Helms (2008). "MINS2: revisiting the molecular code for transmembrane-helix recognition by the Sec61 translocon." Bioinformatics 24(16): 1819-1820.
314	Recombination codes	The Genetic Recombination Codes	Jabbari, K., J. Wirtz, M. Rauscher and T. Wiehe (2019). "A common genomic code for chromatin architecture and recombination landscape." PloS One 14(3): e0213278. Paulet, L., A. Trecourt, A. Leary, J. Peron, F. Descotes, M. Devouassoux-Shisheboran, K. Leroy, B. You and J. Lopez (2022). "Cracking the homologous recombination deficiency code: how to identify responders to PARP inhibitors." Eur J Cancer 166: 87-99.
315	Regeneration code	The Regeneration Codes	Bayascas, J. R., E. Castillo and E. Saló (1998). "Platyhelminthes have a hox code differentially activated during regeneration, with genes closely related to those of spiralian protostomes." Dev Genes Evol 208(8): 467-473. Cencioni, C., F. Spallotta, A. Farsetti, A. M. Zeiher and C. Gaetano (2017). "Deciphering Histone Code Enigmas Sheds New Light on Cardiac Regeneration." Circ Res 120(9): 1370-1372. de Jong, D. M. and E. C. Seaver (2016). "A Stable Thoracic Hox Code and Epimorphosis Characterize Posterior Regeneration in Capitella teleta." PLoS One 11(2): e0149724. Mercader, N. and F. Serras (2018). "Models to crack the code of organ regeneration." Int J Dev Biol 62(6-7-8): 347-350. Steinhoff, G. (2021). "Deciphering the Code: Stem Cell-Immune Function and Cardiac Regeneration." Cells 10(3).
316	Redox code	The Redox Code	Helmann, J. D. (2002). "OxyR: a molecular code for redox sensing?" Sci STKE 2002(157): pe46. Jones, D. P. and H. Sies (2015). "The Redox Code." Antioxid Redox Signal 23(9): 734-746. Zuo, J., Zhang, Z., Li, M., Yang, Y., Zheng, B., Wang, P., . . . Zhou, S. (2022). The crosstalk between reactive oxygen species and noncoding RNAs: from cancer code to drug role. Molecular Cancer, 21(1), 30. Mittler, R., & Jones, D. P. (2024). The redox code of plants. Plant, Cell & Environment, 47(8), 2821-2829. Percio, A., Cicchinelli, M., Masci, D., Summo, M., Urbani, A., & Greco, V. (2024). Oxidative Cysteine Post Translational Modifications Drive the Redox Code Underlying Neurodegeneration and Amyotrophic Lateral Sclerosis. Antioxidants, 13(8), 883.

			Thorley, J. (2024). Unraveling the redox code to improve physiological research in human health and disease. Physiological Reports, 12(21), e70105.
317	Renal code	The Renal Codes	Gawlik, A. and S. E. Quaggin (2004). "Deciphering the renal code: advances in conditional gene targeting." Physiology (Bethesda) 19: 245-252. Endre, Z. H. and M. Fernando (2016). "Unlocking the code: mining the urinary proteome after renal transplantation." Kidney Int 89(6): 1183-1185.
318	Repair code	The DNA Repair / Damage Codes	Hassa, P. O. and M. O. Hottiger (2005). "An epigenetic code for DNA damage repair pathways?" Biochem Cell Biol 83(3): 270-285. van Attikum, H. and S. M. Gasser (2005). “The histone code at DNA breaks: a guide to repair?” Nature Reviews Molecular Cell Biology 6(10): 757-765. Loizou, J. I., R. Murr, M. G. Finkbeiner, C. Sawan, Z.-Q. Wang and Z. Herceg (2006). “Epigenetic Information in Chromatin: the Code of Entry for DNA Repair.” Cell Cycle 5(7): 696-701. Escargueil, A. E., D. G. Soares, M. Salvador, A. K. Larsen and J. A. P. Henriques (2008). “What histone code for DNA repair?” Mutation Research/Reviews in Mutation Research 658(3): 259-270. Corpet, A. and G. Almouzni (2009). "A histone code for the DNA damage response in mammalian cells?" Embo j 28(13): 1828-1830. DeMicco, A. and C. H. Bassing (2010). "Deciphering the DNA damage histone code." Cell Cycle 9(19): 3845. Vaissière, T. and Z. Herceg (2010). "Histone code in the cross-talk during DNA damage signaling." Cell Res 20(2): 113-115. Sartori, A. A. and M. Steger (2013). “Prolyl isomerization: A new PIN code for DSB repair.” Cell Cycle 12(17): 2717-2718. Paquin, K. L. and N. G. Howlett (2018). “Understanding the Histone DNA Repair Code: H4K20me2 Makes Its Mark.” Molecular Cancer Research 16(9): 1335-1345. Singh, J. K., S. M. Noordermeer, J. Jimenez-Sainz, D. G. Maranon and M. Altmeyer (2022). "Editorial: Protecting the code: DNA double-strand break repair pathway choice." Front Genet 13: 993889.
319	Representation code	The Representation Codes	Floyd, B., T. Santander and W. Weimer (2017). Decoding the Representation of Code in the Brain: An fMRI Study of Code Review and Expertise. 2017 IEEE/ACM 39th International Conference on Software Engineering (ICSE).

320	Retina code	The Retinal Codes	Easter, S. S., Jr. (1968). "Excitation in the goldfish retina: evidence for a non-linear intensity code." J Physiol 195(2): 253-271. Bäckström, A. C., Hemilä, S., & Reuter, T. (1978). Directional selectivity and colour coding in the frog retina. Medical biology, 56(2), 72-83. Meister, M. (1996). Multineuronal codes in retinal signaling. Proceedings of the National Academy of Sciences, 93(2), 609-614. Meister, M. and M. J. Berry, 2nd (1999). "The neural code of the retina." Neuron 22(3): 435-450. Victor, J. D. (1999). Temporal aspects of neural coding in the retina and lateral geniculate. Network: Computation in Neural Systems, 10(4), R1-R66. Balasubramanian, V., & Michael J. Berry, I. (2002). A test of metabolically efficient coding in the retina. Network: Computation in Neural Systems, 13(4), 531. Mausfeld, R. (2003). The dual coding of colour. In R. Mausfeld & D. Heyer (Eds.), Colour Perception: Mind and the Physical World (pp. 381--430). Oxford University Press. Puchalla, J. L., E. Schneidman, R. A. Harris and M. J. Berry (2005). "Redundancy in the population code of the retina." Neuron 46(3): 493-504. Frechette, E. S., A. Sher, M. I. Grivich, D. Petrusca, A. M. Litke and E. J. Chichilnisky (2005). "Fidelity of the ensemble code for visual motion in primate retina." J Neurophysiol 94(1): 119-135. Segev, R., Schneidman, E., Goodhouse, J., & Berry, M. J. (2007). Role of Eye Movements in the Retinal Code for a Size Discrimination Task. J Neurophysiol, 98(3), 1380-1391. Vasserman, G., Shamir, M., Ben Simon, A., & Segev, R. (2010). Coding “What” and “When” in the Archer Fish Retina. PLOS Computational Biology, 6(11), e1000977. Yamagata, M. and J. R. Sanes (2012). "Expanding the Ig superfamily code for laminar specificity in retina: expression and role of contactins." J Neurosci 32(41): 14402-14414. Prentice, J. S., Marre, O., Ioffe, M. L., Loback, A. R., Tkačik, G., & Berry, M. J., II. (2016). Error-Robust Modes of the Retinal Population Code. PLOS Computational Biology, 12(11), e1005148. Ioffe, M. L. and M. J. Berry, 2nd (2017). "The structured 'low temperature' phase of the retinal population code." PLoS Comput Biol 13(10): e1005792.

			Sabbah, S., Gemmer, J. A., Bhatia-Lin, A., Manoff, G., Castro, G., Siegel, J. K., . . . Berson, D. M. (2017). A retinal code for motion along the gravitational and body axes. Nature, 546(7659), 492-497. Berry Ii, M. J., F. Lebois, A. Ziskind and R. A. da Silveira (2019). "Functional Diversity in the Retina Improves the Population Code." Neural Comput 31(2): 270-311. Yang, X., B. Gong and J. W. Lu (2015). "Frequency spectrum might act as communication code between retina and visual cortex I." Int J Ophthalmol 8(6): 1107-1111. Karamanlis, D., Schreyer, H. M., & Gollisch, T. (2022). Retinal Encoding of Natural Scenes. Annual Review of Vision Science, 8(Volume 8, 2022), 171-193. Kovács-Öller, T., Dedek, K., & Hillier, D. (2022). Editorial: Visual code: From the retina to the brain [Editorial]. Front Cell Neurosci, Volume 16 - 2022. Maheswaranathan, N., McIntosh, L. T., Tanaka, H., Grant, S., Kastner, D. B., Melander, J. B., . . . Baccus, S. A. (2023). Interpreting the retinal neural code for natural scenes: From computations to neurons. Neuron, 111(17), 2742-2755.e2744. Warwick, R. A., Heukamp, A. S., Riccitelli, S., & Rivlin-Etzion, M. (2023). Dopamine differentially affects retinal circuits to shape the retinal code. J Physiol, 601(7), 1265-1286. Hoshal, B. D., Holmes, C. M., Bojanek, K., Salisbury, J. M., Berry, M. J., Marre, O., & Palmer, S. E. (2024). Stimulus-invariant aspects of the retinal code drive discriminability of natural scenes. Proceedings of the National Academy of Sciences, 121(52), e2313676121. Karamanlis, D., Khani, M. H., Schreyer, H. M., Zapp, S. J., Mietsch, M., & Gollisch, T. (2025). Nonlinear receptive fields evoke redundant retinal coding of natural scenes. Nature, 637(8045), 394-401. Warwick, R. A., Riccitelli, S., Heukamp, A. S., Yaakov, H., Swain, B. P., Ankri, L., . . . Rivlin-Etzion, M. (2024). Top-down modulation of the retinal code via histaminergic neurons of the hypothalamus. Sci Adv, 10(35), eadk4062. Allen, A. E., Hahn, J., Richardson, R., Pantiru, A., Mouland, J., Babu, A., . . . Lucas, R. J. (2025). Altered proportions of retinal cell types and distinct visual codes in rodents occupying divergent ecological niches. Current Biology, 35(7), 1446-1458.e1445. Laniado, D. D., Maron, Y., Gemmer, J. A., & Sabbah, S. (2025). A spherical code of retinal orientation selectivity enables decoding in ensembled and retinotopic operation. Cell Rep, 44(3).

321	Retinoblastoma code	The pRb (Retinoblastoma) Code	Munro, S., S. M. Carr and N. B. La Thangue (2012). "Diversity within the pRb pathway: is there a code of conduct?" Oncogene 31(40): 4343-4352. Rubin, S. M. (2013). Deciphering the retinoblastoma protein phosphorylation code. Trends Biochem Sci, 38(1), 12-19. Sanidas, I., Morris, R., Fella, K. A., Rumde, P. H., Boukhali, M., Tai, E. C., . . . Dyson, N. J. (2019). A Code of Mono-phosphorylation Modulates the Function of RB. Molecular Cell, 73(5), 985-1000.e1006.
322	RNA code -A (miscellaneous)	The RNA Codes	Schimmel, P., R. Giegé, D. Moras and S. Yokoyama (1993). "An operational RNA code for amino acids and possible relationship to genetic code." Proceedings of the National Academy of Sciences 90(19): 8763-8768. José, M. V., E. R. Morgado and T. Govezensky (2006). "An Extended RNA Code and its Relationship to the Standard Genetic Code: An Algebraic and Geometrical Approach." Bulletin of Mathematical Biology 69(1): 215. Shaul, S., D. Berel, Y. Benjamini and D. Graur (2010). "Revisiting the operational RNA code for amino acids: Ensemble attributes and their implications." Rna 16(1): 141-153. Müller, S. (2010). "Reading the code of single RNA molecules." Angew Chem Int Ed Engl 49(7): 1197-1199. Agris, P. F. (2015). "The importance of being modified: an unrealized code to RNA structure and function." Rna 21(4): 552-554. Brannan, K. W. and G. W. Yeo (2016). "From Protein-RNA Predictions toward a Peptide-RNA Code." Mol Cell 64(3): 437-438. Chi, K. R. (2017). "The RNA code comes into focus." Nature 542(7642): 503-506. Witzany, G. (2017). "Two genetic codes: Repetitive syntax for active non-coding RNAs; non-repetitive syntax for the DNA archives." Communicative & Integrative Biology 10(2): e1297352. Kleiner, R. E. (2018). "Reading the RNA Code." Biochemistry 57(1): 11-12. Štambuk, N., Konjevoda, P., Turčić, P., Kövér, K., Kujundžić, R. N., Manojlović, Z., & Gabričević, M. (2018). Genetic coding algorithm for sense and antisense peptide interactions. Biosystems, 164, 199-216.

			Ribeiro, D. R., Nunes, A., Ribeiro, D., & Soares, A. R. (2023). The hidden RNA code: implications of the RNA epitranscriptome in the context of viral infections [Mini Review]. Front Genet, Volume 14 - 2023. Zhang, Y., Shi, J., & Chen, Q. (2023). Towards the understanding of “Herbal RNA Code” for traditional medicine. Cell Res, 33(12), 900-901. The International Human RNome Project Consortium. (2025). Unlocking the regulatory code of RNA: launching the Human RNome Project. Genome Biol, 26(1), 367. Plank, H. B., Zhang, X., Rawal, H. C., Yu, J., Zhou, C., Chen, Q., & Zhou, T. (2026). Dissecting the small RNA code of inflammatory bowel disease. Molecular Medicine, 32(1), 21. Sun, Y., Wu, J., Chen, G., Ma, H., Li, W., Tan, H., & Yang, K. (2026). Rewriting the RNA code: an m(6)a-centric framework to classify tumors and guide combination therapies. Front Immunol, 17, 1749911.
323	RNA code -B (lnc)	The lncRNA Codes	Aprea, J., & Calegari, F. (2015). Long non-coding RNAs in corticogenesis: deciphering the non-coding code of the brain. Embo j, 34(23), 2865-2884. Zhang, A., Zhang, J., Kaipainen, A., Lucas, J. M., & Yang, H. (2016). Long non-coding RNA: A newly deciphered “code” in prostate cancer. Cancer Letters, 375(2), 323-330. Wu, D., Poddar, A., Ninou, E., Hwang, E., Cole, M. A., Liu, S. J., . . . Lim, D. A. (2022). Dual genome-wide coding and lncRNA screens in neural induction of induced pluripotent stem cells. Cell Genomics, 2(11). Chen, W., Pan, Z., Feng, Z., Wang, X., & Zhu, S. (2024). Deciphering the code: the pivotal role of lncRNAs in advancing TNBC therapy [Review]. Frontiers in Oncology, Volume 14 - 2024. Yonis, N., Mousa, A., Yousef, M. H., Ghouneimy, A. M., Dabbish, A. M., Abdelzaher, H., . . . Abdelnaser, A. (2025). Cracking the code: lncRNA-miRNA-mRNA integrated network analysis unveiling lncRNAs as promising non-invasive NAFLD biomarkers toward precision diagnosis. Comput Biol Chem, 115, 108325.
324	RNA code -C (sno)	The snoRNA Code	Li, Y., Chen, X., Xiao, S., Wang, H., Li, B., Zhang, M., & Wang, K. (2025). Unlocking the life code: a review of SnoRNA functional diversity and disease relevance. Cell Communication and Signaling, 23(1), 266.
325	RNA degradation code	The RNA Degradations Codes	Soles, L. V., Liu, L., Zou, X., Yoon, Y., Li, S., Tian, L., . . . Shi, Y. (2025). A nuclear RNA degradation code is recognized by PAXT for eukaryotic transcriptome surveillance. Molecular Cell, 85(8), 1575-1588.e1579.

326	RNA editing/modification code	The RNA Editing/Modification Codes	Flamand, M. N., Tegowski, M., & Meyer, K. D. (2023). The Proteins of mRNA Modification: Writers, Readers, and Erasers. Annu Rev Biochem, 92(Volume 92, 2023), 145-173. Xuan, J., Chen, L., Chen, Z., Pang, J., Huang, J., Lin, J., . . . Yang, J. (2023). RMBase v3.0: decode the landscape, mechanisms and functions of RNA modifications. Nucleic Acids Res, 52(D1), D273-D284. Yang, Y., Ritzenhofen, K., Otrzonsek, J., Xie, J., Schallenberg-Rüdinger, M., & Knoop, V. (2023). Beyond a PPR-RNA recognition code: Many aspects matter for the multi-targeting properties of RNA editing factor PPR56. PLoS Genet, 19(8), e1010733. Sachse, M., & Stellos, K. (2024). Unraveling the RNA code: a uridine RNA modification drives glycoRNA biogenesis. Signal Transduction and Targeted Therapy, 9(1), 334. Fang, H., He, J., Du, D., Wang, X., Xu, X., Lu, L., . . . Zhou, M. (2025). Deciphering the secret codes in N7-methylguanosine modification: Context-dependent function of methyltransferase-like 1 in human diseases. Clin Transl Med, 15(2), e70240. Yu, H., Ma, Z., Su, S., Xu, Z., & Yi, H. (2025). RNA modification: a promising code to unravel the puzzle of autoimmune diseases and CD4(+) T cell differentiation. Front Immunol, 16, 1563150. Min, D. J., Lee, S., Lee, Y.-s., & Cho, J. (2026). Two codes of RNA editing by deamination in human diseases. Experimental & Molecular Medicine, 58(2), 382-395.
327	RNAi code	The RNA-Interference Codes	Faria, M. (2007). RNA As Code Makers: A Biosemiotic View Of RNAi And Cell Immunity. Introduction to Biosemiotics: The New Biological Synthesis. M. Barbieri. Dordrecht, Springer Netherlands: 347-364. Siomi, H. and M. C. Siomi (2009). “On the road to reading the RNA-interference code.” Nature 457(7228): 396-404. Wright, J. E., D. Gaidatzis, M. Senften, B. M. Farley, E. Westhof, S. P. Ryder and R. Ciosk (2011). "A quantitative RNA code for mRNA target selection by the germline fate determinant GLD-1." Embo j 30(3): 533-545.
328	RNA recognition code	The RNA Recognition Code	Pitici, F., D. L. Beveridge and A. M. Baranger (2002). "Molecular dynamics simulation studies of induced fit and conformational capture in U1A-RNA binding: do molecular substates code for specificity?" Biopolymers 65(6): 424-435. Yeo, G. W., N. G. Coufal, T. Y. Liang, G. E. Peng, X. D. Fu and F. H. Gage (2009). "An RNA code for the FOX2 splicing regulator revealed by mapping RNA-protein interactions in stem cells." Nat Struct Mol Biol 16(2): 130-137.

			Yarus, M., J. J. Widmann and R. Knight (2009). "RNA-amino acid binding: a stereochemical era for the genetic code." J Mol Evol 69(5): 406-429. Filipovska, A., M. F. Razif, K. K. Nygård and O. Rackham (2011). "A universal code for RNA recognition by PUF proteins." Nat Chem Biol 7(7): 425-427. Chen, Y. and G. Varani (2011). "Finding the missing code of RNA recognition by PUF proteins." Chem Biol 18(7): 821-823. Barkan, A., M. Rojas, S. Fujii, A. Yap, Y. S. Chong, C. S. Bond and I. Small (2012). "A combinatorial amino acid code for RNA recognition by pentatricopeptide repeat proteins." PLoS Genet 8(8): e1002910. Cléry, A., J. Boudet and F. H. Allain (2013). "Single-stranded nucleic acid recognition: is there a code after all?" Structure 21(1): 4-6. Yagi, Y., Hayashi, S., Kobayashi, K., Hirayama, T., & Nakamura, T. (2013). Elucidation of the RNA Recognition Code for Pentatricopeptide Repeat Proteins Involved in Organelle RNA Editing in Plants. PLoS One, 8(3), e57286. Yin, P., Li, Q., Yan, C., Liu, Y., Liu, J., Yu, F., . . . Yan, N. (2013). Structural basis for the modular recognition of single-stranded RNA by PPR proteins. Nature, 504(7478), 168-171. Hennig, J., F. Gebauer and M. Sattler (2014). "Breaking the protein-RNA recognition code." Cell Cycle 13(23): 3619-3620. Campbell, Z. T., C. T. Valley and M. Wickens (2014). "A protein-RNA specificity code enables targeted activation of an endogenous human transcript." Nat Struct Mol Biol 21(8): 732-738. Nahalka, J. (2014). Protein–RNA recognition: Cracking the code. J Theor Biol, 343, 9-15. Nawy, T. (2014). "A protein code to target RNA." Nat Methods 11(9): 888-889. Hall, T. M. T. (2016). De-coding and re-coding RNA recognition by PUF and PPR repeat proteins. Curr Opin Struct Biol, 36, 116-121. Carter, C. W., Jr. and P. R. Wills (2018). "Hierarchical groove discrimination by Class I and II aminoacyl-tRNA synthetases reveals a palimpsest of the operational RNA code in the tRNA acceptor-stem bases." Nucleic Acids Res 46(18): 9667-9683. Yan, J., Yao, Y., Hong, S., Yang, Y., Shen, C., Zhang, Q., . . . Yin, P. (2019). Delineation of pentatricopeptide repeat codes for target RNA prediction. Nucleic Acids Res, 47(7), 3728-3738.

			Nahalka, J. (2022). Transcription of the Envelope Protein by 1-L Protein–RNA Recognition Code Leads to Genes/Proteins That Are Relevant to the SARS-CoV-2 Life Cycle and Pathogenesis. Curr Issues Mol Biol, 44(2), 791-816. Roca-Martínez, J., Dhondge, H., Sattler, M., & Vranken, W. F. (2023). Deciphering the RRM-RNA recognition code: A computational analysis. PLOS Computational Biology, 19(1), e1010859.
329	RNA Structure code	The RNA Structure Codes	Hou, Y. M. and P. Schimmel (1988). "A simple structural feature is a major determinant of the identity of a transfer RNA." Nature 333(6169): 140-145. Izumi, H., Nafie, L. A., & Dukor, R. K. (2025). Supersecondary Structure Code for RNA: Trace of Conformational Change on the Mycoplasma pneumoniae Ribosome and the R-Loop Formation of Cas9. ACS Omega, 10(5), 4998-5005.
330	R-Spondin code	The R-Spondin Signalling Code	Niehrs, C., Seidl, C., & Lee, H. (2024). An 'R-spondin code' for multimodal signaling ON-OFF states. Bioessays, 46(10), 2400144.
331	Scent codes	The Mammalian Scent Codes **SEE also Olfactory codes**	Wright, G. A. and F. P. Schiestl (2009). "The evolution of floral scent: the influence of olfactory learning by insect pollinators on the honest signalling of floral rewards." Functional Ecology 23(5): 841-851. Ferrero, D. M. and S. D. Liberles (2010). "The secret codes of mammalian scents." WIREs Systems Biology and Medicine 2(1): 23-33.
332	Second messenger code	The Second Messenger Codes	Nicol, X., Hong, K. P., & Spitzer, N. C. (2011). Spatial and temporal second messenger codes for growth cone turning. Proceedings of the National Academy of Sciences, 108(33), 13776-13781.
333	Secretory code	The Neutrophil Secretory Code	Weissmann, G., Korchak, H. M., Perez, H. D., Smolen, J. E., Goldstein, I. M., & Hoffstein, S. T. (1979). The secretory code of the neutrophil. J Reticuloendothel Soc, 26(Suppl), 687-700. Smolen, J. E., Korchak, H. M., & Weissmann, G. (1981). The "secretory code" of the neutrophil. Methods Cell Biol, 23, 461-481.
334	Seed code	The Seed Germination Code **SEE also Dormancy Codes**	Kamble, N. U. (2025). Cracking the seed code: How nitrate directly breaks ABA signaling for germination. Plant Cell, 37(6).
335	Segregation code	The Chromosome Segregation Code	Monda, J. K. and I. M. Cheeseman (2015). "Chromosome Segregation: A Spatial Code to Correct Kinetochore-Microtubule Attachments." Curr Biol 25(14): R601-603.

336	Semaphorin code	The Semaphoring Codes	Cohen, S., L. Funkelstein, J. Livet, G. Rougon, C. E. Henderson, V. Castellani and F. Mann (2005). "A semaphorin code defines subpopulations of spinal motor neurons during mouse development." Eur J Neurosci 21(7): 1767-1776. Berke, B. and H. Keshishian (2011). "Cracking the combinatorial semaphorin code." Neuron 70(2): 175-177. Wu, Z., L. B. Sweeney, J. C. Ayoob, K. Chak, B. J. Andreone, T. Ohyama, R. Kerr, L. Luo, M. Zlatic and A. L. Kolodkin (2011). "A combinatorial semaphorin code instructs the initial steps of sensory circuit assembly in the Drosophila CNS." Neuron 70(2): 281-298.
337	Senescence code	The (Molecular) Senescence Codes	Paluvai, H., E. Di Giorgio and C. Brancolini (2020). "The Histone Code of Senescence." Cells 9(2). Suter, T., Friedman, M. J., Tazearslan, C., Gamliel, A., Merkurjev, D., Ohgi, K., . . . Suh, Y. (2026). A Histone Code Functionally Linked to Replicative Senescence. Aging Cell, 25(1), e70343.
338	Sensory code	The Photoreceptor Sensory Code	Felsten, G. and G. S. Wasserman (1979). "The photoreceptor sensory code for pattern identification during visual masking." Sens Processes 3(3): 230-239.
339	SeqCode	The Nomenclatural Code	Hedlund, B. P., M. Chuvochina, P. Hugenholtz, K. T. Konstantinidis, A. E. Murray, M. Palmer, D. H. Parks, A. J. Probst, A. L. Reysenbach, R. L. Rodriguez, R. Rossello-Mora, I. C. Sutcliffe, S. N. Venter and W. B. Whitman (2022). "SeqCode: a nomenclatural code for prokaryotes described from sequence data." Nat Microbiol 7(10): 1702-1708.
340	Sequence codes	The Nucleotide Sequence Codes	Trifonov, E. N. (1987). "Translation framing code and frame-monitoring mechanism as suggested by the analysis of mRNA and 16 S rRNA nucleotide sequences." Journal of Molecular Biology 194(4): 643-652. Trifonov, E. N. (1988). "Codes of nucleotide sequences." Mathematical Biosciences 90(1): 507-517. Trifonov, E. N. (1989). "The multiple codes of nucleotide sequences." Bulletin of Mathematical Biology 51(4): 417-432. Vogt, P. (1990). "Potential genetic functions of tandem repeated DNA sequence blocks in the human genome are based on a highly conserved "chromatin folding code"." Hum Genet 84(4): 301-336. Trifonov, E. N. (1999). "Elucidating sequence codes: three codes for evolution." Ann N Y Acad Sci 870: 330-338. Sotolongo, B. and W. S. Ward (2000). "DNA loop domain organization: the three-dimensional genomic code." J Cell Biochem Suppl Suppl 35: 23-26.

			Trifonov, E. N. (2008). Codes of Biosequences. The Codes of Life: The Rules of Macroevolution. M. Barbieri and J. Hoffmeyer. Dordrecht, Springer Netherlands: 3-14. Trifonov, E. N. (2011). “Thirty years of multiple sequence codes.” Genomics Proteomics Bioinformatics 9(1-2): 1-6. Trifonov, E. N. (2011). "Cracking the chromatin code: precise rule of nucleosome positioning." Phys Life Rev 8(1): 39-50. Ciribilli, Y., P. Monti, A. Bisio, H. T. Nguyen, A. S. Ethayathulla, A. Ramos, G. Foggetti, P. Menichini, D. Menendez, M. A. Resnick, H. Viadiu, G. Fronza and A. Inga (2013). “Transactivation specificity is conserved among p53 family proteins and depends on a response element sequence code.” Nucleic Acids Res 41(18): 8637-8653. Durán, E., S. Djebali, S. González, O. Flores, J. M. Mercader, R. Guigó, D. Torrents, M. Soler-López and M. Orozco (2013). "Unravelling the hidden DNA structural/physical code provides novel insights on promoter location." Nucleic Acids Res 41(15): 7220-7230. Herbert, A. (2019). "A Genetic Instruction Code Based on DNA Conformation." Trends Genet 35(12): 887-890. Ling, J., K. Y. Umezawa, T. Scott and S. Small (2019). "Bicoid-Dependent Activation of the Target Gene hunchback Requires a Two-Motif Sequence Code in a Specific Basal Promoter." Mol Cell 75(6): 1178-1187.e1174. Marzec, M. (2021). "Uncovering the Mechanical Code of DNA Using 'Loop-seq'." Trends Genet 37(6): 494-495. Esposito, A., S. Bianco, A. M. Chiariello, A. Abraham, L. Fiorillo, M. Conte, R. Campanile and M. Nicodemi (2022). "Polymer physics reveals a combinatorial code linking 3D chromatin architecture to 1D chromatin states." Cell Rep 38(13): 110601. Pflughaupt, P., Abdullah, Adib A., Masuda, K., & Sahakyan, Aleksandr B. (2024). Towards the genomic sequence code of DNA fragility for machine learning. Nucleic Acids Res, 52(21), 12798-12816.
341	Serin code	The Serin Code	Su, P., Yang, Y., & Zheng, H. (2026). The "serine code" of metabolic reprogramming: multidimensional roles of the serine synthesis pathway in tumors and novel breakthroughs for targeted therapy. Front Immunol, 17, 1779543.
342	Serotonin code	The Serotonin Code	Tchenio, A., Valentinova, K., & Mameli, M. (2016). Can the Lateral Habenula Crack the Serotonin Code? [Mini Review]. Front Synaptic Neurosci, Volume 8 - 2016.

			Harkin, E. F., Grossman, C. D., Cohen, J. Y., Béïque, J.-C., & Naud, R. (2023). Serotonin predictively encodes value. bioRxiv, 2023.2009.2019.558526. Harkin, E. F., Béïque, J.-C., & Naud, R. (2025). Extracting Value Coding Features from Individual Serotonin Neurons. bioRxiv, 2025.2007.2028.667134. Harkin, E. F., Grossman, C. D., Cohen, J. Y., Béïque, J.-C., & Naud, R. (2025). A prospective code for value in the serotonin system. Nature, 641(8064), 952-959.
343	Signal integration code	The Signal Integration Codes	Kim, J. H., J. M. Lee, H. J. Nam, H. J. Choi, J. W. Yang, J. S. Lee, M. H. Kim, S. I. Kim, C. H. Chung, K. I. Kim and S. H. Baek (2007). "SUMOylation of pontin chromatin-remodeling complex reveals a signal integration code in prostate cancer cells." Proc Natl Acad Sci U S A 104(52): 20793-20798.
344	Signal transduction code	The Signal Transduction Code	Prank, K., F. Gabbiani and G. Brabant (2000). "Coding efficiency and information rates in transmembrane signaling." Biosystems 55(1): 15-22. Barbieri, M. (2003). The organic codes. An introduction to semantic biology., Cambridge University Press. Bruni, L. E. (2007). Cellular Semiotics And Signal Transduction. Introduction to Biosemiotics: The New Biological Synthesis. M. Barbieri. Dordrecht, Springer Netherlands: 365-408. Faria, M. (2008). Signal Transduction Codes and Cell Fate. The Codes of Life: The Rules of Macroevolution. M. Barbieri and J. Hoffmeyer. Dordrecht, Springer Netherlands: 265-283. Bengtsson, F. and H. Jörntell (2009). "Sensory transmission in cerebellar granule cells relies on similarly coded mossy fiber inputs." Proc Natl Acad Sci U S A 106(7): 2389-2394. Maraldi, N. M. (2019). "In search of a primitive signaling code." Biosystems 183: 103984.
345	Sirtuin code	The Sirtuin Code	Zhao, Y., Han, Y., Wang, B., & Wang, T. (2025). Sirtuins in Osteosarcoma: Cracking the Code and Opening Up New Treatment Options. Current Pharmaceutical Biotechnology.
346	Social information code	The Neural, Social Information Code	Knutson, B. and G. E. Wimmer (2007). "Splitting the difference: how does the brain code reward episodes?" Ann N Y Acad Sci 1104: 54-69. Kahnt, T., J. Heinzle, S. Q. Park and J. D. Haynes (2010). "The neural code of reward anticipation in human orbitofrontal cortex." Proc Natl Acad Sci U S A 107(13): 6010-6015. Hale, L. A., E. S. Lee, A. K. Pantazis, N. Chronis and S. H. Chalasani (2016). "Altered Sensory Code Drives Juvenile-to-Adult Behavioral Maturation in Caenorhabditis elegans." eNeuro 3(6).

			Ponsot, E., J. J. Burred, P. Belin and J. J. Aucouturier (2018). “Cracking the social code of speech prosody using reverse correlation.” Proc Natl Acad Sci U S A 115(15): 3972-3977. Dabney, W., Z. Kurth-Nelson, N. Uchida, C. K. Starkweather, D. Hassabis, R. Munos and M. Botvinick (2020). "A distributional code for value in dopamine-based reinforcement learning." Nature 577(7792): 671-675. Salazar, V. and A. Silva (2022). “Neural processing: Cracking the code to extract relevant social information.” Curr Biol 32(1): R32-r34.
347	Socio-chemical codes	The Socio-Chemical Codes	Mardon, J., S. M. Saunders, M. J. Anderson, C. Couchoux and F. Bonadonna (2010). “Species, gender, and identity: cracking petrels’ sociochemical code.” Chem Senses 35(4): 309-321.
348	Sodium/calcium code	The Sodium/Calcium Channel Gating Code	Lariccia, V., S. Piccirillo, A. Preziuso, S. Amoroso and S. Magi (2020). “Cracking the code of sodium/calcium exchanger (NCX) gating: Old and new complexities surfacing from the deep web of secondary regulations.” Cell Calcium 87: 102169.
349	Spatial code	The Neuronal, Spatial Codes	Bertera, J. H. (1992). "Spatial code interference on directional responses." Spat Vis 6(2): 81-88. O’Keefe, J. and N. Burgess (1996). “Geometric determinants of the place fields of hippocampal neurons.” Nature 381(6581): 425-428. Hafting, T., M. Fyhn, S. Molden, M. B. Moser and E. I. Moser (2005). “Microstructure of a spatial map in the entorhinal cortex.” Nature 436(7052): 801-806. O’Keefe, J. and N. Burgess (2005). “Dual phase and rate coding in hippocampal place cells: theoretical significance and relationship to entorhinal grid cells.” Hippocampus 15(7): 853-866. Brandon, M. P. and M. E. Hasselmo (2009). “Sources of the spatial code within the hippocampus.” F1000 Biol Rep 1: 3. Rochefort, C., A. Arabo, M. André, B. Poucet, E. Save and L. Rondi-Reig (2011). “Cerebellum Shapes Hippocampal Spatial Code.” Science 334(6054): 385-389. Gombköto, P., A. Rokszin, A. Berényi, G. Braunitzer, G. Utassy, G. Benedek and A. Nagy (2011). "Neuronal code of spatial visual information in the caudate nucleus." Neuroscience 182: 225-231. Baj, G., V. D'Alessandro, L. Musazzi, A. Mallei, C. R. Sartori, M. Sciancalepore, D. Tardito, F. Langone, M. Popoli and E. Tongiorgi (2012). "Physical exercise and antidepressants enhance BDNF targeting in hippocampal CA3 dendrites: further evidence of a spatial code for BDNF splice variants." Neuropsychopharmacology 37(7): 1600-1611.

			Weber, A. I., H. P. Saal, J. D. Lieber, J. W. Cheng, L. R. Manfredi, J. F. Dammann, 3rd and S. J. Bensmaia (2013). "Spatial and temporal codes mediate the tactile perception of natural textures." Proc Natl Acad Sci U S A 110(42): 17107-17112. Chen, G., J. A. King, N. Burgess and J. O'Keefe (2013). "How vision and movement combine in the hippocampal place code." Proc Natl Acad Sci U S A 110(1): 378-383. Wilms, C. D. and M. Häusser (2015). "Reading out a spatiotemporal population code by imaging neighbouring parallel fibre axons in vivo." Nat Commun 6: 6464. Peyrache, A., N. Schieferstein and G. Buzsáki (2017). "Transformation of the head-direction signal into a spatial code." Nat Commun 8(1): 1752. Jeffery, K. J. (2021). "How environmental movement constraints shape the neural code for space." Cogn Process 22(Suppl 1): 97-104. Armingol, E., Ghaddar, A., Joshi, C. J., Baghdassarian, H., Shamie, I., Chan, J., . . . Lewis, N. E. (2022). Inferring a spatial code of cell-cell interactions across a whole animal body. PLOS Computational Biology, 18(11), e1010715. Tomar, A. and T. J. McHugh (2022). "The impact of stress on the hippocampal spatial code." Trends Neurosci 45(2): 120-132. Brann, D. H., Tsukahara, T., Tau, C., Kalloor, D., Lubash, R., Kannan, L. T., . . . Datta, S. R. (2026). A spatial code governs olfactory receptor choice and aligns sensory maps in the nose and brain. Cell.
350	Speech code	The Speech Code	Liberman, A. M., Cooper, F. S., Shankweiler, D. P., & Studdert-Kennedy, M. (1967). Perception of the speech code. Psychological Review, 74(6), 431–461. Kuhl, P. K. (2004). "Early language acquisition: cracking the speech code." Nature Reviews Neuroscience 5(11): 831-843. Papoutsi, M., J. A. de Zwart, J. M. Jansma, M. J. Pickering, J. A. Bednar and B. Horwitz (2009). "From Phonemes to Articulatory Codes: An fMRI Study of the Role of Broca's Area in Speech Production." Cerebral Cortex 19(9): 2156-2165. Sato, M., K. Grabski, M. Garnier, L. Granjon, J. L. Schwartz and N. Nguyen (2013). "Converging toward a common speech code: imitative and perceptuo-motor recalibration processes in speech production." Front Psychol 4: 422.

			Fowler, C. A., Shankweiler, D., & Studdert-Kennedy, M. (2016). "Perception of the speech code" revisited: Speech is alphabetic after all. Psychological Review, 123(2), 125–150. Schuerman, W. L., A. S. Meyer and J. M. McQueen (2017). "Mapping the Speech Code: Cortical Responses Linking the Perception and Production of Vowels." Front Hum Neurosci 11: 161. Briglia, A., Mucciardi, M., & Sauvage, J. (2020, 2020-06-23). Identify the speech code through statistics: adata-driven approach [Proceedings SIS 2020]. 50th Scientific Meeting of the Italian Statistical Society, Pisa, Italy Penikis, K. B., & Sanes, D. H. (2023). A Redundant Cortical Code for Speech Envelope. The Journal of Neuroscience, 43(1), 93-112. Esparza, J., Quintanilla, J. P., Cid, E., Medeiros, A. C., Gallego, J. A., & de la Prida, L. M. (2025). Cell-type-specific manifold analysis discloses independent geometric transformations in the hippocampal spatial code. Neuron, 113(7), 1098-1109.e1096.
351	Sperm code	The Spermatogenesis Code	Zhang, Y., J. Shi, M. Rassoulzadegan, F. Tuorto and Q. Chen (2019). "Sperm RNA code programmes the metabolic health of offspring." Nat Rev Endocrinol 15(8): 489-498. Zhang, Y. and Q. Chen (2020). "Human sperm RNA code senses dietary sugar." Nat Rev Endocrinol 16(4): 200-201. Zhao, Z., Yang, T., & Li, F. (2024). Sperm RNA code in spermatogenesis and male infertility. Reproductive BioMedicine Online, 49(6), 104375. Hong, Z., Huang, S., Li, L., Gao, Y., Ma, B., Fan, Q., . . . Wang, M. (2025). Cracking the code: how piRNA pathway shapes spermatogenesis and combats male infertility [Review]. Front Cell Dev Biol, Volume 13 - 2025.
352	Spike code	The Neuronal Spike-Rate Code	Eyherabide, H. G., A. Rokem, A. V. Herz and I. Samengo (2009). “Bursts generate a non-reducible spike-pattern code.” Front Neurosci 3(1): 8-14. Li, M. and J. Z. Tsien (2017). “Neural Code—Neural Self-information Theory on How Cell-Assembly Code Rises from Spike Time and Neuronal Variability.” Frontiers in Cellular Neuroscience 11. Hunt, T., & Jones, M. (2023). Fields or firings? Comparing the spike code and the electromagnetic field hypothesis [Hypothesis and Theory]. Frontiers in psychology, Volume 14 - 2023. Panzeri, S., Engel, N. M., & Celotto, M. (2026). Contribution of spike timing to the neural code: from fast to slow timescales. Biol Cybern, 120(2).

353	Spindle code	The Chromosome Spindle Code	Kiyomitsu, T., & Cheeseman, I. M. (2012). Chromosome- and spindle-pole-derived signals generate an intrinsic code for spindle position and orientation. Nat Cell Biol, 14(3), 311-317.
354	Splicing code	The Splicing Codes	Manet, E., H. Gruffat, M. C. Trescol-Biemont, N. Moreno, P. Chambard, J. F. Giot and A. Sergeant (1989). "Epstein-Barr virus bicistronic mRNAs generated by facultative splicing code for two transcriptional trans-activators." Embo j 8(6): 1819-1826. Agorio, A., C. Chalar, S. Cardozo and G. Salinas (2003). "Alternative mRNAs arising from trans-splicing code for mitochondrial and cytosolic variants of Echinococcus granulosus thioredoxin Glutathione reductase." J Biol Chem 278(15): 12920-12928. Barbieri, M. (2003). The organic codes. An introduction to semantic biology., Cambridge University Press. Fu, X. D. (2004). “Towards a splicing code.” Cell 119(6): 736-738. Grabowski, P. J. (2004). “A molecular code for splicing silencing: configurations of guanosine-rich motifs.” Biochem Soc Trans 32(Pt 6): 924-927. Boucard, A. A., A. A. Chubykin, D. Comoletti, P. Taylor and T. C. Südhof (2005). "A splice code for trans-synaptic cell adhesion mediated by binding of neuroligin 1 to alpha- and beta-neurexins." Neuron 48(2): 229-236. Han, K., G. Yeo, P. An, C. B. Burge and P. J. Grabowski (2005). “A combinatorial code for splicing silencing: UAGG and GGGG motifs.” PloS Biol 3(5): e158. Matlin, A. J., F. Clark and C. W. J. Smith (2005). “Understanding alternative splicing: towards a cellular code.” Nature Reviews Molecular Cell Biology 6(5): 386-398. Wang, G. S. and T. A. Cooper (2007). “Splicing in disease: disruption of the splicing code and the decoding machinery.” Nat Rev Genet 8(10): 749-761. Wang, Z. and C. B. Burge (2008). “Splicing regulation: from a parts list of regulatory elements to an integrated splicing code.” Rna 14(5): 802-813. Dhir, A., E. Buratti, M. A. van Santen, R. Lührmann and F. E. Baralle (2010). “The intronic splicing code: multiple factors involved in ATM pseudoexon definition.” Embo j 29(4): 749-760. Wei, Z. and M. Zhang (2010). “A structural approach to decipher the neurexin and neuroligin splice isoform code.” Neuron 67(1): 1-2.

			Liu, Y. and D. J. Elliott (2010). “Coupling genetics and post-genomic approaches to decipher the cellular splicing code at a systems-wide level.” Biochem Soc Trans 38(Pt 1): 237-241. Barash, Y., J. A. Calarco, W. Gao, Q. Pan, X. Wang, O. Shai, B. J. Blencowe and B. J. Frey (2010). “Deciphering the splicing code.” Nature 465(7294): 53-59. Luco, R. F., & Misteli, T. (2011). More than a splicing code: integrating the role of RNA, chromatin and non-coding RNA in alternative splicing regulation. Curr Opin Genet Dev, 21(4), 366-372. Baj, G., D'Alessandro, V., Musazzi, L., Mallei, A., Sartori, C. R., Sciancalepore, M., . . . Tongiorgi, E. (2012). Physical Exercise and Antidepressants Enhance BDNF Targeting in Hippocampal CA3 Dendrites: Further Evidence of a Spatial Code for BDNF Splice Variants. Neuropsychopharmacology, 37(7), 1600-1611. Reddy, A. S., M. F. Rogers, D. N. Richardson, M. Hamilton and A. Ben-Hur (2012). “Deciphering the plant splicing code: experimental and computational approaches for predicting alternative splicing and splicing regulatory elements.” Front Plant Sci 3: 18. Xiong, H. Y., B. Alipanahi, L. J. Lee, H. Bretschneider, D. Merico, R. K. Yuen, Y. Hua, S. Gueroussov, H. S. Najafabadi, T. R. Hughes, Q. Morris, Y. Barash, A. R. Krainer, N. Jojic, S. W. Scherer, B. J. Blencowe and B. J. Frey (2015). “RNA splicing. The human splicing code reveals new insights into the genetic determinants of disease.” Science 347(6218): 1254806. Greenwald, S. H., J. A. Kuchenbecker, J. S. Rowlan, J. Neitz and M. Neitz (2017). "Role of a Dual Splicing and Amino Acid Code in Myopia, Cone Dysfunction and Cone Dystrophy Associated with L/M Opsin Interchange Mutations." Transl Vis Sci Technol 6(3): 2. Baralle, M. and F. E. Baralle (2018). “The splicing code.” Biosystems 164: 39-48. Bao, S., D. F. Moakley and C. Zhang (2019). “The Splicing Code Goes Deep.” Cell 176(3): 414-416. Rong, S., Buerer, L., Rhine, C. L., Wang, J., Cygan, K. J., & Fairbrother, W. G. (2020). Mutational bias and the protein code shape the evolution of splicing enhancers. Nat Commun, 11(1), 2845. Colliva, A. and E. Tongiorgi (2021). "Distinct role of 5'UTR sequences in dendritic trafficking of BDNF mRNA: additional mechanisms for the BDNF splice variants spatial code." Mol Brain 14(1): 10. Neitz, M. and J. Neitz (2021). "Intermixing the OPN1LW and OPN1MW Genes Disrupts the Exonic Splicing Code Causing an Array of Vision Disorders." Genes (Basel) 12(8).

			Saha, K., M. M. Fernandez, T. Biswas, S. Joseph and G. Ghosh (2021). "Discovery of a pre-mRNA structural scaffold as a contributor to the mammalian splicing code." Nucleic Acids Res 49(12): 7103-7121. Gaiteiro, C., Soares, J., Relvas-Santos, M., Peixoto, A., Ferreira, D., Paulo, P., . . . Ferreira, J. A. (2022). Glycoproteogenomics characterizes the CD44 splicing code associated with bladder cancer invasion. Theranostics, 12(7), 3150-3177. Pengelly, R. J., Bakhtiar, D., Borovská, I., Královičová, J., & Vořechovský, I. (2022). Exonic splicing code and protein binding sites for calcium. Nucleic Acids Res, 50(10), 5493-5512. Sarkar, A., K. Panati and V. R. Narala (2022). "Code inside the codon: The role of synonymous mutations in regulating splicing machinery and its impact on disease." Mutat Res Rev Mutat Res 790: 108444. Apostolidi, M., & Stamatopoulou, V. (2023). Aberrant splicing in human cancer: An RNA structural code point of view [Mini Review]. Front Pharmacol, Volume 14. Trotter, J. H., Wang, C. Y., Zhou, P., Nakahara, G., & Südhof, T. C. (2023). A combinatorial code of neurexin-3 alternative splicing controls inhibitory synapses via a trans-synaptic dystroglycan signaling loop. Nat Commun, 14(1), 1771. Bakhtiar, D., Vondraskova, K., Pengelly, R. J., Chivers, M., Kralovicova, J., & Vorechovsky, I. (2024). Exonic splicing code and coordination of divalent metals in proteins. Nucleic Acids Res, 52(3), 1090-1106. Capitanchik, C., Wilkins, O. G., Wagner, N., Gagneur, J., & Ule, J. (2025). From computational models of the splicing code to regulatory mechanisms and therapeutic implications. Nature Reviews Genetics, 26(3), 171-190. Nomura, T., Kim, J.-S., Iwata, O., Yamada, K., Atsuji, K., Uehara-Yamaguchi, Y., . . . Mochida, K. (2025). Genetic dissection of nonconventional introns reveals codominant noncanonical splicing code in *Euglena*. Proceedings of the National Academy of Sciences, 122(39), e2509937122. Burgardt, R., Walter, H., & Wachter, A. (2026). Review: Specificity determinants of the plant splicing code. J Exp Bot. Imai, A., Izumi, H., Ito, N., Ogiso, H., Kitajima, Y., Kawase, S., . . . Yoshida, T. (2026). Alternative microexon splicing code for a four-amino acid peptide of PTPRD governs behavioral development. Proc Natl Acad Sci U S A, 123(15), e2515310123.

355	Stem cell code	The (Cancer) Stem Cell Code	Richard, V. and M. R. Pillai (2010). “The stem cell code in oral epithelial tumorigenesis: ‘the cancer stem cell shift hypothesis’.” Biochim Biophys Acta 1806(2): 146-162. Chaker, Z., Makarouni, E., & Doetsch, F. (2024). The Organism as the Niche: Physiological States Crack the Code of Adult Neural Stem Cell Heterogeneity. Annu Rev Cell Dev Biol, 40(Volume 40, 2024), 381-406.
356	Story code	The Innate Story Code	Goodwyn, E. (2024). The innate story code. Biosystems, 244, 105285.
357	Stress code	The Neural Stress Code	Xia, F., Fascianelli, V., Vishwakarma, N., Ghinger, F. G., Kwon, A., Gergues, M. M., . . . Kheirbek, M. A. (2025). Understanding the neural code of stress to control anhedonia. Nature, 637(8046), 654-662.
358	Stromal code	The Stromal Address Code	Parsonage, G., Filer, A. D., Haworth, O., Nash, G. B., Rainger, G. E., Salmon, M., & Buckley, C. D. (2005). A stromal address code defined by fibroblasts. Trends in Immunology, 26(3), 150-156.
359	Substrate specificity code	The Substrate Specificity Code	Schneider, K., K. Hövel, K. Witzel, B. Hamberger, D. Schomburg, E. Kombrink and H. P. Stuible (2003). “The substrate specificity-determining amino acid code of 4-coumarate:CoA ligase.” Proc Natl Acad Sci U S A 100(14): 8601-8606.
360	Succinylation code	The Succinylation Codes	Cong, Y., Zhang, X., Wang, Z., Cui, Z., Li, C., Han, Y., . . . Wu, G. (2025). Succinylation – encoded metabolic codes: cracking the molecular logic of cellular adaptation. International Journal of Surgery, 111(12).
361	Sugar code	The Sugar Code	Gabius, H. J. (2000). “Biological information transfer beyond the genetic code: the sugar code.” Naturwissenschaften 87(3): 108-121. Gabius, H.-J., S. André, H. Kaltner and H.-C. Siebert (2002). “The sugar code: functional lectinomics.” Biochimica et Biophysica Acta (BBA) – General Subjects 1572(2): 165-177. Gabius, H. J. (2004). "The sugar code in drug delivery." Adv Drug Deliv Rev 56(4): 421-424. Gabius, H. J., H. C. Siebert, S. André, J. Jiménez-Barbero and H. Rüdiger (2004). "Chemical biology of the sugar code." Chembiochem 5(6): 740-764. Holt, C. E. and B. J. Dickson (2005). “Sugar Codes for Axons?” Neuron 46(2): 169-172. Gabius, H.-J. (2008). Biological Information Transfer Beyond the Genetic Code: The Sugar Code. The Codes of Life: The Rules of Macroevolution. M. Barbieri and J. Hoffmeyer. Dordrecht, Springer Netherlands: 223-246.

			Lawrence, R., H. Lu, R. D. Rosenberg, J. D. Esko and L. Zhang (2008). "Disaccharide structure code for the easy representation of constituent oligosaccharides from glycosaminoglycans." Nat Methods 5(4): 291-292. Gabius H-J, ed. (2009) The Sugar Code. Fundamentals of Glycosciences. Wiley-Blackwell. Gabius, H. J., S. André, J. Jiménez-Barbero, A. Romero and D. Solís (2011). "From lectin structure to functional glycomics: principles of the sugar code." Trends Biochem Sci 36(6): 298-313. Murphy, P. V., S. André and H. J. Gabius (2013). "The third dimension of reading the sugar code by lectins: design of glycoclusters with cyclic scaffolds as tools with the aim to define correlations between spatial presentation and activity." Molecules 18(4): 4026-4053. Langford-Smith, A., A. J. Day, P. N. Bishop and S. J. Clark (2015). "Complementing the Sugar Code: Role of GAGs and Sialic Acid in Complement Regulation." Front Immunol 6: 25. Solís, D., Bovin, N. V., Davis, A. P., Jiménez-Barbero, J., Romero, A., Roy, R., . . . Gabius, H.-J. (2015). A guide into glycosciences: How chemistry, biochemistry and biology cooperate to crack the sugar code. Biochimica et Biophysica Acta (BBA) - General Subjects, 1850(1), 186-235. Cerliani, J. P., Blidner, A. G., Toscano, M. A., Croci, D. O., & Rabinovich, G. A. (2017). Translating the Sugar Code into Immune and Vascular Signaling Programs. Trends Biochem Sci, 42(4), 255-273. Gabius, H.-J. and J. Roth (2017). “An introduction to the sugar code.” Histochemistry and Cell Biology 147(2): 111-117. Taubenschmid, J., J. Stadlmann, M. Jost, T. I. Klokk, C. D. Rillahan, A. Leibbrandt, K. Mechtler, J. C. Paulson, J. Jude, J. Zuber, K. Sandvig, U. Elling, T. Marquardt, C. Thiel, C. Koerner and J. M. Penninger (2017). "A vital sugar code for ricin toxicity." Cell Res 27(11): 1351-1364. Gabius, H. J. (2018). “The sugar code: Why glycans are so important.” Biosystems 164: 102-111. Mirgorodskaya, E., Karlsson, N. G., Sihlbom, C., Larson, G., & Nilsson, C. L. (2018). Cracking the Sugar Code by Mass Spectrometry. Journal of the American Society for Mass Spectrometry, 29(6), 1065-1074. Kaltner, H. and H. J. Gabius (2019). “Sensing Glycans as Biochemical Messages by Tissue Lectins: The Sugar Code at Work in Vascular Biology.” Thromb Haemost 119(4): 517-533.

			Kaltner, H., J. Abad-Rodríguez, A. P. Corfield, J. Kopitz and H. J. Gabius (2019). "The sugar code: letters and vocabulary, writers, editors and readers and biosignificance of functional glycan-lectin pairing." Biochem J 476(18): 2623-2655. Özdemir, V., Arga, K. Y., Aziz, R. K., Bayram, M., Conley, S. N., Dandara, C., . . . Wang, W. (2020). Digging Deeper into Precision/Personalized Medicine: Cracking the Sugar Code, the Third Alphabet of Life, and Sociomateriality of the Cell. OMICS: A Journal of Integrative Biology, 24(2), 62-80. Habermann, F. A., H. Kaltner, A. M. Higuero, G. García Caballero, A. K. Ludwig, C. M. J, J. Abad-Rodríguez and H. J. Gabius (2021). "What Cyto- and Histochemistry Can Do to Crack the Sugar Code." Acta Histochem Cytochem 54(2): 31-48. Strasser, R., G. Seifert, M. S. Doblin, K. L. Johnson, C. Ruprecht, F. Pfrengle, A. Bacic and J. M. Estevez (2021). "Cracking the "Sugar Code": A Snapshot of N- and O-Glycosylation Pathways and Functions in Plants Cells." Front Plant Sci 12: 640919. Wanke, A., M. Malisic, S. Wawra and A. Zuccaro (2021). "Unraveling the sugar code: the role of microbial extracellular glycans in plant-microbe interactions." J Exp Bot 72(1): 15-35. Gabius, H. J., M. Cudic, T. Diercks, H. Kaltner, J. Kopitz, K. H. Mayo, P. V. Murphy, S. Oscarson, R. Roy, A. Schedlbauer, S. Toegel and A. Romero (2022). "What is the Sugar Code?" Chembiochem 23(13): e202100327. Bondar, A.-C., Iordache, M. P., Coroescu, M., Buliman, A., Rusu, E., Budișteanu, M., & Tanase, C. (2025). Unlocking the Sugar Code: Implications and Consequences of Glycosylation in Alzheimer's Disease and Other Tauopathies. Biomedicines, 13(12), 2884. Cao, W., Hu, F., Li, Y., & Wang, W. (2025) Orthodox vs. Paradox: Supporting the Central Dogma With Sugar Code. Proteomics, n/a(n/a), e70080. Wan, Y. Z., Zheng, X., Zhang, Y., Liu, L., Zhang, B., Wang, T., & Qian, W. (2026). Biomimetic Formation and Tuning of a Cell Surface Heparan Sulfate Network: Approach on Deciphering the Glycosaminoglycans Code. Analytical chemistry, 98(6), 4810-4822.
362	Sulfation code	The Sulfation Code	Habuchi, H., O. Habuchi and K. Kimata (2004). "Sulfation pattern in glycosaminoglycan: does it have a code?" Glycoconj J 21(1-2): 47-52. Gama, C. I., S. E. Tully, N. Sotogaku, P. M. Clark, M. Rawat, N. Vaidehi, W. A. Goddard, A. Nishi and L. C. Hsieh-Wilson (2006). "Sulfation patterns of glycosaminoglycans encode molecular recognition and activity." Nature Chemical Biology 2(9): 467-473.

			Lamanna, W. C., Kalus, I., Padva, M., Baldwin, R. J., Merry, C. L. R., & Dierks, T. (2007). The heparanome—The enigma of encoding and decoding heparan sulfate sulfation. J Biotechnol, 129(2), 290-307. Yamada, M. and T. Hamaguchi (2018). "The sulfation code for propagation of neurodegeneration." J Biol Chem 293(27): 10841-10842. Mah, D., J. Zhao, X. Liu, F. Zhang, J. Liu, L. Wang, R. Linhardt and C. Wang (2021). "The Sulfation Code of Tauopathies: Heparan Sulfate Proteoglycans in the Prion Like Spread of Tau Pathology." Front Mol Biosci 8: 671458. Holmes, S. G., B. Nagarajan and U. R. Desai (2022). "3-O-Sulfation induces sequence-specific compact topologies in heparan sulfate that encode a dynamic sulfation code." Computational and Structural Biotechnology Journal 20: 3884-3898. Samsonov, S. A., & Marcisz, M. P. (2025) Decrypting Glycosaminoglycan "sulfation code" with Computational Approaches. In (pp. 1-23). Springer Berlin Heidelberg.
363	Sulfur code	The Sulfur Code	Shim, H. S. and V. D. Longo (2015). "A protein restriction-dependent sulfur code for longevity." Cell 160(1-2): 15-17. Azam, F., Anwar, M. J., Kahfi, J., Almahmoud, S. A., & Emwas, A.-H. (2025). Cracking the Sulfur Code: Garlic Bioactive Molecules as Multi-Target Blueprints for Drug Discovery. Pharmaceuticals, 18(11), 1766.
364	SUMO code	The SUMOylation Codes	Kim, K. I. and S. H. Baek (2006). "SUMOylation code in cancer development and metastasis." Mol Cells 22(3): 247-253. Yang, Z., Y. Zhang and S. Sun (2019). "Deciphering the SUMO code in the kidney." J Cell Mol Med 23(2): 711-719.
365	Surface code	The Cell Surface Codes	Biermann, M., Maueröder, C., Brauner, J. M., Chaurio, R., Janko, C., Herrmann, M., & Muñoz, L. E. (2013). Surface code—biophysical signals for apoptotic cell clearance. Physical Biology, 10(6), 065007. Xie, Q., J. Li, H. Li, N. D. Udeshi, T. Svinkina, D. Orlin, S. Kohani, R. Guajardo, D. R. Mani, C. Xu, T. Li, S. Han, W. Wei, S. A. Shuster, D. J. Luginbuhl, S. R. Quake, S. E. Murthy, A. Y. Ting, S. A. Carr and L. Luo (2022). "Transcription factor Acj6 controls dendrite targeting via a combinatorial cell-surface code." Neuron 110(14): 2299-2314.e2298.

			Lyu, C. (2025). Respecifying partners: Neural circuits are rewired by manipulating cell surface combinatorial code. Science, 390(6772), 482-483. Lyu, C., Li, Z., Xu, C., Kalai, J., & Luo, L. (2026). Rewiring an olfactory circuit by altering cell-surface combinatorial code. Nature, 649(8097), 677-684.
366	Survival code	The Survival/Autophagy Codes	Füllgrabe, J., N. Heldring, O. Hermanson and B. Joseph (2014). "Cracking the survival code: autophagy-related histone modifications." Autophagy 10(4): 556-561. Mengying Yu, Zhao Peng, Zhichuan Huang et al. (2026) Metabolic Reprogramming by Lactate Unlocks a Pro-Survival Code in MSCs: The miR-195-3p/Oct4/VEGF Axis in Heart Repair, 25 March 2026, PREPRINT (Version 1) available at Research Square Liu, X., & Ma, Y. (2026). Genomic insights into the survival code of karst plants. Plant Diversity, 48(2), 227-230.
367	Synaptic code	The Synaptic / Adhesive Code	Redies, C. and M. Takeichi (1996). "Cadherins in the developing central nervous system: an adhesive code for segmental and functional subdivisions." Dev Biol 180(2): 413-423. Shapiro, L. and D. R. Colman (1999). "The diversity of cadherins and implications for a synaptic adhesive code in the CNS." Neuron 23(3): 427-430. Boudkkazi, S., E. Carlier, N. Ankri, O. Caillard, P. Giraud, L. Fronzaroli-Molinieres and D. Debanne (2007). "Release-dependent variations in synaptic latency: a putative code for short- and long-term synaptic dynamics." Neuron 56(6): 1048-1060. Berretta, N., R. Nisticò, G. Bernardi and N. B. Mercuri (2008). "Synaptic plasticity in the basal ganglia: a similar code for physiological and pathological conditions." Prog Neurobiol 84(4): 343-362. Itzkovitz, S., L. Baruch, E. Shapiro and E. Segal (2008). "Geometric constraints on neuronal connectivity facilitate a concise synaptic adhesive code." Proc Natl Acad Sci U S A 105(27): 9278-9283. Szabo, G. G. and I. Soltesz (2015). "Pass-Through Code of Synaptic Integration." Neuron 87(6): 1124-1126. Südhof, T. C. (2017). "Synaptic Neurexin Complexes: A Molecular Code for the Logic of Neural Circuits." Cell 171(4): 745-769. Diering, G. H. and R. L. Huganir (2018). "The AMPA Receptor Code of Synaptic Plasticity." Neuron 100(2): 314-329.

			Wu, Q. and Z. Jia (2021). "Wiring the Brain by Clustered Protocadherin Neural Codes." Neurosci Bull 37(1): 117-131. Connor, S. A., & Siddiqui, T. J. (2023). Synapse organizers as molecular codes for synaptic plasticity. Trends Neurosci, 46(11), 971-985. Gershman, S. J. (2023). The molecular memory code and synaptic plasticity: A synthesis. Biosystems, 224, 104825. Trotter, J. H., Wang, C. Y., Zhou, P., Nakahara, G., & Südhof, T. C. (2023). A combinatorial code of neurexin-3 alternative splicing controls inhibitory synapses via a trans-synaptic dystroglycan signaling loop. Nat Commun, 14(1), 1771. Lorente-Echeverría, B., Daaboul, D., Vandensteen, J., Marcassa, G., Naert, W., Vandenbempt, J., . . . de Wit, J. (2025). A dynamic gene regulatory code drives synaptic development of hippocampal granule cells. Sci Adv, 11(43), eadx5140.
368	TAD code	The TAD domain code	Chang, L.-H., Ghosh, S., Papale, A., Miranda, M., Piras, V., Degrouard, J., . . . Noordermeer, D. (2021). A complex CTCF binding code defines TAD boundary structure and function. bioRxiv, 2021.2004.2015.440007. Huang, H., & Wu, Q. (2024). Pushing the TAD boundary: Decoding insulator codes of clustered CTCF sites in 3D genomes. Bioessays, 46(10), 2400121.
369	TALE code	The transcription activator-like effectors (TALE) code **SEE also The HOX Code**	De Kumar, B., H. J. Parker, A. Paulson, M. E. Parrish, I. Pushel, N. P. Singh, Y. Zhang, B. D. Slaughter, J. R. Unruh, L. Florens, J. Zeitlinger and R. Krumlauf (2017). "HOXA1 and TALE proteins display cross-regulatory interactions and form a combinatorial binding code on HOXA1 targets." Genome Res 27(9): 1501-1512. Perez-Quintero, A. L., & Szurek, B. (2019). A Decade Decoded: Spies and Hackers in the History of TAL Effectors Research. Annu Rev Phytopathol, 57, 459-481. Mariani, L., Guo, X., Menezes, N. A., Drozd, A. M., Çakal, S. D., Wang, Q., & Ferretti, E. (2021). A TALE/HOX code unlocks WNT signalling response towards paraxial mesoderm. Nat Commun, 12(1), 5136. Nagel, S., Pommerenke, C., Meyer, C., MacLeod, R. A. F., & Drexler, H. G. (2021). Establishment of the TALE-code reveals aberrantly activated homeobox gene PBX1 in Hodgkin lymphoma. PLoS One, 16(2), e0246603.

			Nagel, S., Pommerenke, C., Meyer, C., & MacLeod, R. A. F. (2022). The Hematopoietic TALE-Code Shows Normal Activity of IRX1 in Myeloid Progenitors and Reveals Ectopic Expression of IRX3 and IRX5 in Acute Myeloid Leukemia. Int J Mol Sci, 23(6).
370	Targeting code	The (Genome) Targeting / Integration Codes	Santoni, F. A., O. Hartley and J. Luban (2010). "Deciphering the code for retroviral integration target site selection." PLoS Comput Biol 6(11): e1001008.
371	Taste code	The Neuronal Taste Code	Di Lorenzo, P. M. (2000). "The neural code for taste in the brain stem: Response profiles." Physiology & Behavior 69(1): 87-96. Di Lorenzo, P. M. and C. H. Lemon (2000). "The neural code for taste in the nucleus of the solitary tract of the rat: effects of adaptation." Brain Res 852(2): 383-397. Bradbury, J. (2004). "Taste perception: cracking the code." PloS Biol 2(3): E64. Hallock, R. M. and P. M. Di Lorenzo (2006). "Temporal coding in the gustatory system." Neurosci Biobehav Rev 30(8): 1145-1160. Escanilla, O. D., A. Hajnal, K. Czaja and P. M. Di Lorenzo (2022). "The Neural Code for Taste in the Nucleus of the Solitary Tract of Rats with Obesity Following Roux-En-Y Gastric Bypass Surgery." Nutrients 14(19). Hellekant, G. (2024). Neuroscience of taste: unlocking the human taste code. BMC Neuroscience, 25(1), 19.
372	T-cell code	The Immune T-cell Codes	Boothby, M. (2010). "CRACking the code without Rosetta: molecular regulation of calcium-stimulated gene transcription after T cell activation." J Immunol 185(9): 4969-4971. Engelhardt, B. and R. M. Ransohoff (2012). "Capture, crawl, cross: the T cell code to breach the blood–brain barriers." Trends in Immunology 33(12): 579-589. Harvey, C. J. and K. W. Wucherpfennig (2013). "Cracking the code of human T-cell immunity." Nature Biotechnology 31(7): 609-610. Dustin, M. L. and L. C. Kam (2016). "Tapping out a mechanical code for T cell triggering." J Cell Biol 213(5): 501-503. Wu, J. and H. Shi (2017). "Unlocking the epigenetic code of T cell exhaustion." Transl Cancer Res 6(Suppl 2): S384-s387. Rodrigues, P. M., Sousa, L. G., & Alves, N. L. (2025). Cortical Thymic Epithelial Cells: Key Developers of the Code of T-Cell Selection and TCR Repertoire Diversity. Immunological Reviews, 332(1), e70049.

373	Temporal codes	The Temporal Signalling Codes	Ahissar, E. (1998). "Temporal-code to rate-code conversion by neuronal phase-locked loops." Neural Comput 10(3): 597-650. Behar, M. and A. Hoffmann (2010). "Understanding the temporal codes of intra-cellular signals." Curr Opin Genet Dev 20(6): 684-693. Cheemalavagu, N. and R. A. Gottschalk (2021). "Time will tell: The temporal code of immune threats." Immunity 54(5): 845-847. Cachero, S., Mitletton, M., Beckett, I. R., Marin, E. C., Serratosa Capdevila, L., Gkantia, M., . . . Donà, E. (2026). A Developmental Atlas of the Drosophila Nerve Cord Uncovers a Global Temporal Code for Neuronal Identity. bioRxiv, 2025.2007.2016.664682.
374	Tension code	The Tension (Morphogenesis) Code	Narain, R., Muncie-Vasic, J. M., & Weaver, V. M. (2025). Forcing the code: tension modulates signaling to drive morphogenesis and malignancy. Genes Dev, 39(1-2), 163-181.
375	Terpene code	The Terpene Biosynthesis Code	Oldfield, E., & Lin, F.-Y. (2012). Terpene Biosynthesis: Modularity Rules. Angewandte Chemie International Edition, 51(5), 1124-1137. Ignea, C., M. H. Raadam, A. Koutsaviti, Y. Zhao, Y. T. Duan, M. Harizani, K. Miettinen, P. Georgantea, M. Rosenfeldt, S. E. Viejo-Ledesma, M. A. Petersen, W. L. P. Bredie, D. Staerk, V. Roussis, E. Ioannou and S. C. Kampranis (2022). "Expanding the terpene biosynthetic code with non-canonical 16 carbon atom building blocks." Nat Commun 13(1): 5188.
376	Thermal code	The Thermal / Temperature Neuronal Codes	Schingnitz, G. and J. Werner (1980). "Thalamic burst firing--a neuronal code for temperature information." Brain Res 195(2): 467-470. Nagel, M. and C. J. Kleineidam (2015). "Two cold-sensitive neurons within one sensillum code for different parameters of the thermal environment in the ant Camponotus rufipes." Front Behav Neurosci 9: 240.
377	Thyroid code	The Thyroid Code	Bianco, A. C. (2011). Minireview: cracking the metabolic code for thyroid hormone signaling. Endocrinology, 152(9), 3306-3311. Bianco, A. C. (2013). Cracking the code for thyroid hormone signaling. Trans Am Clin Climatol Assoc, 124, 26-35. Russo, S. C., F. Salas-Lucia and A. C. Bianco (2021). "Deiodinases and the Metabolic Code for Thyroid Hormone Action." Endocrinology 162(8).

378	Tight junction code	Tight Junction Codes	Gupta, I. R. and A. K. Ryan (2010). "Claudins: unlocking the code to tight junction function during embryogenesis and in disease." Clin Genet 77(4): 314-325.
379	Time code	The Time Codes	Mankin, E. A., F. T. Sparks, B. Slayyeh, R. J. Sutherland, S. Leutgeb and J. K. Leutgeb (2012). "Neuronal code for extended time in the hippocampus." Proc Natl Acad Sci U S A 109(47): 19462-19467. Andres, D. S., D. Cerquetti and M. Merello (2015). "Neural code alterations and abnormal time patterns in Parkinson's disease." J Neural Eng 12(2): 026004. Mello, G. B., S. Soares and J. J. Paton (2015). "A scalable population code for time in the striatum." Curr Biol 25(9): 1113-1122. Takehara-Nishiuchi, K. (2022). "Neuronal Code for Episodic Time in the Lateral Entorhinal Cortex." Front Integr Neurosci 16: 899412.
380	Tissue code	The Tissue Code	Irwin, D. and I. D. Dauphinais (1979). "A tissue-specific code based on the abundance of SDS-solubilized proteins." Anal Biochem 92(1): 193-198. Boman, B. M., T.-N. Dinh, K. Decker, B. Emerick, S. Modarai, L. Opdenaker, J. Z. Fields, C. Raymond and G. Schleiniger (2023). "Beyond the Genetic Code: A Tissue Code?" bioRxiv: 2023.2003.2005.531161.
381	Tissue memory code	The Tissue Memory Code	Berlanga-Acosta, J., M. Fernandez-Mayola, Y. Mendoza-Mari, A. Garcia-Ojalvo, I. Martinez-Jimenez, N. Rodriguez-Rodriguez, D. Garcia Del Barco Herrera and G. Guillén-Nieto (2022). "Cell-Free Filtrates (CFF) as Vectors of a Transmissible Pathologic Tissue Memory Code: A Hypothetical and Narrative Review." Int J Mol Sci 23(19).
382	Toll-like receptor codes	The Toll-like Receptor Codes	Cunha, C., L. Romani and A. Carvalho (2010). "Cracking the Toll-like receptor code in fungal infections." Expert Rev Anti Infect Ther 8(10): 1121-1137. Paré, A. C., Vichas, A., Fincher, C. T., Mirman, Z., Farrell, D. L., Mainieri, A., & Zallen, J. A. (2014). A positional Toll receptor code directs convergent extension in Drosophila. Nature, 515(7528), 523-527.
383	Toxin code	The (Saxi)Toxin Code	Chen, Z., S. Zakrzewska, H. S. Hajare, A. Alvarez-Buylla, F. Abderemane-Ali, M. Bogan, D. Ramirez, L. A. O'Connell, J. Du Bois and D. L. Minor, Jr. (2022). "Definition of a saxitoxin (STX) binding code enables discovery and characterization of the anuran saxiphilin family." Proc Natl Acad Sci U S A 119(44): e2210114119.
384	Toxin resistance code	The Toxin Resistance Codes	Tabashnik, B. E. (2001). "Breaking the code of resistance." Nat Biotechnol 19(10): 922-924.

385	Transcription factor code	The Transcription Factor Code	Jessell, T. M. (2000). "Neuronal specification in the spinal cord: inductive signals and transcriptional codes." Nature Reviews Genetics 1(1): 20-29. Kobayashi, A., H. Yamagiwa, H. Hoshino, A. Muto, K. Sato, M. Morita, N. Hayashi, M. Yamamoto and K. Igarashi (2000). "A combinatorial code for gene expression generated by transcription factor Bach2 and MAZR (MAZ-related factor) through the BTB/POZ domain." Mol Cell Biol 20(5): 1733-1746. Marquardt, T. and S. L. Pfaff (2001). "Cracking the Transcriptional Code for Cell Specification in the Neural Tube." Cell 106(6): 651-654. Allan, D. W., S. E. St Pierre, I. Miguel-Aliaga and S. Thor (2003). "Specification of neuropeptide cell identity by the integration of retrograde BMP signaling and a combinatorial transcription factor code." Cell 113(1): 73-86. Ness, S. A. (2003). "Myb protein specificity: evidence of a context-specific transcription factor code." Blood Cells Mol Dis 31(2): 192-200. Okamura, H., K. Yokoyama, H. Koike, M. Yamada, A. Shimowasa, M. Kabasawa, T. Kawashima and M. Suzuki (2007). "A structural code for discriminating between transcription signals revealed by the feast/famine regulatory protein DM1 in complex with ligands." Structure 15(10): 1325-1338. Rothbächer, U., V. Bertrand, C. Lamy and P. Lemaire (2007). "A combinatorial code of maternal GATA, Ets and beta-catenin-TCF transcription factors specifies and patterns the early ascidian ectoderm." Development 134(22): 4023-4032. Bhati, M., C. Lee, A. L. Nancarrow, M. Lee, V. J. Craig, I. Bach, J. M. Guss, J. P. Mackay and J. M. Matthews (2008). "Implementing the LIM code: the structural basis for cell type-specific assembly of LIM-homeodomain complexes." Embo j 27(14): 2018-2029. Hochstim, C., B. Deneen, A. Lukaszewicz, Q. Zhou and D. J. Anderson (2008). "Identification of positionally distinct astrocyte subtypes whose identities are specified by a homeodomain code." Cell 133(3): 510-522. Pimanda, J. E., W. Y. Chan, N. K. Wilson, A. M. Smith, S. Kinston, K. Knezevic, M. E. Janes, J. R. Landry, A. Kolb-Kokocinski, J. Frampton, D. Tannahill, K. Ottersbach, G. A. Follows, G. Lacaud, V. Kouskoff and B. Göttgens (2008). "Endoglin expression in blood and endothelium is differentially regulated by modular assembly of the Ets/Gata hemangioblast code." Blood 112(12): 4512-4522. Megraw, M., F. Pereira, S. T. Jensen, U. Ohler and A. G. Hatzigeorgiou (2009). "A transcription factor affinity-based code for mammalian transcription initiation." Genome Res 19(4): 644-656.

			Pearson, J. C., M. T. Juarez, M. Kim, Drivenes and W. McGinnis (2009). "Multiple transcription factor codes activate epidermal wound-response genes in Drosophila." Proceedings of the National Academy of Sciences 106(7): 2224-2229. Kowenz-Leutz, E., O. Pless, G. Dittmar, M. Knoblich and A. Leutz (2010). "Crosstalk between C/EBPbeta phosphorylation, arginine methylation, and SWI/SNF/Mediator implies an indexing transcription factor code." Embo j 29(6): 1105-1115. Hester, M. E., Murtha, M. J., Song, S., Rao, M., Miranda, C. J., Meyer, K., . . . Kaspar, B. K. (2011). Rapid and Efficient Generation of Functional Motor Neurons From Human Pluripotent Stem Cells Using Gene Delivered Transcription Factor Codes. Molecular Therapy, 19(10), 1905-1912. Sevvana, M., C. Goetz, D. Goeke, C. Wimmer, C. Berens, W. Hillen and Y. A. Muller (2012). "An exclusive α/β code directs allostery in TetR-peptide complexes." J Mol Biol 416(1): 46-56. Aranguren, X. L., X. Agirre, M. Beerens, G. Coppiello, M. Uriz, I. Vandersmissen, M. Benkheil, J. Panadero, N. Aguado, A. Pascual-Montano, V. Segura, F. Prósper and A. Luttun (2013). "Unraveling a novel transcription factor code determining the human arterial-specific endothelial cell signature." Blood 122(24): 3982-3992. Del Barrio, M. G., S. Bourane, K. Grossmann, R. Schüle, S. Britsch, D. D. O'Leary and M. Goulding (2013). "A transcription factor code defines nine sensory interneuron subtypes in the mechanosensory area of the spinal cord." PLoS One 8(11): e77928. Dubois, L., J. L. Frendo, H. Chanut-Delalande, M. Crozatier and A. Vincent (2016). "Genetic dissection of the Transcription Factor code controlling serial specification of muscle identities in Drosophila." Elife 5. Guo, X., C. Yin, F. Yang, Y. Zhang, H. Huang, J. Wang, B. Deng, T. Cai, Y. Rao and R. Xi (2019). "The Cellular Diversity and Transcription Factor Code of Drosophila Enteroendocrine Cells." Cell Rep 29(12): 4172-4185.e4175. Hörmann, N., T. Schilling, A. H. Ali, E. Serbe, C. Mayer, A. Borst and J. Pujol-Martí (2020). "A combinatorial code of transcription factors specifies subtypes of visual motion-sensing neurons in Drosophila." Development 147(9). Deng, W., E. C. Jacobson, A. J. Collier and K. Plath (2021). "The transcription factor code in iPSC reprogramming." Curr Opin Genet Dev 70: 89-96.

			Torcal Garcia, G. and T. Graf (2021). "The transcription factor code: a beacon for histone methyltransferase docking." Trends Cell Biol 31(10): 792-800. Trerotola, M., L. Antolini, L. Beni, E. Guerra, M. Spadaccini, D. Verzulli, A. Moschella and S. Alberti (2022). "A deterministic code for transcription factor-DNA recognition through computation of binding interfaces." NAR Genom Bioinform 4(1): lqac008. Käppel, S., Rümpler, F., & Theißen, G. (2023). Cracking the Floral Quartet Code: How Do Multimers of MIKCC-Type MADS-Domain Transcription Factors Recognize Their Target Genes? Int J Mol Sci, 24(9), 8253. Xie, Z., Sokolov, I., Osmala, M., Yue, X., Bower, G., Pett, J. P., . . . Taipale, J. (2025). DNA-guided transcription factor interactions extend human gene regulatory code. Nature, 641(8065), 1329-1338. Lavický, J., Lopez, M. G., Chochola, V., Kompaníková, P., Rakultsev, V., Raška, J., . . . Krivanek, J. (2026). Unraveling the Transcription Factor Code of Odontoblast Differentiation. Journal of Dental Research, 105(2), 256-266.
386	Transcriptional codes	The Transcription Codes	Beato, M. (1985). "Modulation of gene expression through DNA-binding proteins: is there a regulatory code?" Haematol Blood Transfus 29: 217-223. Harbison, C. T., D. B. Gordon, T. I. Lee, N. J. Rinaldi, K. D. Macisaac, T. W. Danford, N. M. Hannett, J. B. Tagne, D. B. Reynolds, J. Yoo, E. G. Jennings, J. Zeitlinger, D. K. Pokholok, M. Kellis, P. A. Rolfe, K. T. Takusagawa, E. S. Lander, D. K. Gifford, E. Fraenkel and R. A. Young (2004). "Transcriptional regulatory code of a eukaryotic genome." Nature 431(7004): 99-104. Markstein, M., R. Zinzen, P. Markstein, K. P. Yee, A. Erives, A. Stathopoulos and M. Levine (2004). "A regulatory code for neurogenic gene expression in the Drosophila embryo." Development 131(10): 2387-2394. Barrera, L. O. and B. Ren (2006). "The transcriptional regulatory code of eukaryotic cells--insights from genome-wide analysis of chromatin organization and transcription factor binding." Curr Opin Cell Biol 18(3): 291-298. Flames, N., R. Pla, D. M. Gelman, J. L. Rubenstein, L. Puelles and O. Marín (2007). "Delineation of multiple subpallial progenitor domains by the combinatorial expression of transcriptional codes." J Neurosci 27(36): 9682-9695.

			Gillespie, M. N. and G. L. Wilson (2007). "Bending and breaking the code: dynamic changes in promoter integrity may underlie a new mechanism regulating gene expression." Am J Physiol Lung Cell Mol Physiol 292(1): L1-3. Walther, D., R. Brunnemann and J. Selbig (2007). "The regulatory code for transcriptional response diversity and its relation to genome structural properties in A. thaliana." PLoS Genet 3(2): e11. Frith, M. C., E. Valen, A. Krogh, Y. Hayashizaki, P. Carninci and A. Sandelin (2008). "A code for transcription initiation in mammalian genomes." Genome Res 18(1): 1-12. Stark, A. (2009). "Learning the transcriptional regulatory code." Mol Syst Biol 5: 329. Fakhouri, W. D., A. Ay, R. Sayal, J. Dresch, E. Dayringer and D. N. Arnosti (2010). "Deciphering a transcriptional regulatory code: modeling short-range repression in the Drosophila embryo." Mol Syst Biol 6: 341. Ford, E. and D. Thanos (2010). "The transcriptional code of human IFN-beta gene expression." Biochim Biophys Acta 1799(3-4): 328-336. Kulakovskiy, I. V., A. A. Belostotsky, A. S. Kasianov, N. G. Esipova, Y. A. Medvedeva, I. A. Eliseeva and V. J. Makeev (2011). "A deeper look into transcription regulatory code by preferred pair distance templates for transcription factor binding sites." Bioinformatics 27(19): 2621-2624. Siegert, S., E. Cabuy, B. G. Scherf, H. Kohler, S. Panda, Y. Z. Le, H. J. Fehling, D. Gaidatzis, M. B. Stadler and B. Roska (2012). "Transcriptional code and disease map for adult retinal cell types." Nat Neurosci 15(3): 487-495, s481-482. Batut, P. J. and T. R. Gingeras (2017). "Conserved noncoding transcription and core promoter regulatory code in early Drosophila development." Elife 6. Ezer, D., S. J. K. Shepherd, A. Brestovitsky, P. Dickinson, S. Cortijo, V. Charoensawan, M. S. Box, S. Biswas, K. E. Jaeger and P. A. Wigge (2017). "The G-Box Transcriptional Regulatory Code in Arabidopsis." Plant Physiol 175(2): 628-640. Cohen, E., Z. Zafrir and T. Tuller (2018). "A code for transcription elongation speed." RNA Biol 15(1): 81-94. Zrimec, J., F. Buric, M. Kokina, V. Garcia and A. Zelezniak (2021). "Learning the Regulatory Code of Gene Expression." Front Mol Biosci 8: 673363.

			Fan, J., Chaudhri, V. K., Bisht, D., Pease, N. A., Hall, D. R., Gerges, P., . . . Singh, H. (2025). Expanding the DNA Motif Lexicon of the Transcriptional Regulatory Code. bioRxiv. Stephenson, R., Zhang, Q., & Zhang, Y. J. (2025). Chapter One - Unmasking a hidden code during transcription: A practical strategy to reveal Thr4 phosphorylation in RNA polymerase II. In K. F. Liu (Ed.), Methods in Enzymology (Vol. 725, pp. 3-31). Academic Press.
387	Transfection code	The (Drug/Gene) Transfection Codes	Reijneveld, J. F., Ruvalcaba, A., Afzal, S., & Suliman, S. (2025). Cracking the Code: Optimizing Ribonucleoprotein Delivery for Gene Editing in Human Myeloid Cells 4298. The Journal of Immunology, 214(Supplement_1).
388	Translation code	The Translation Codes	Ito, K., L. Frolova, A. Seit-Nebi, A. Karamyshev, L. Kisselev and Y. Nakamura (2002). "Omnipotent decoding potential resides in eukaryotic translation termination factor eRF1 of variant-code organisms and is modulated by the interactions of amino acid sequences within domain 1." Proc Natl Acad Sci U S A 99(13): 8494-8499. Piqué, M., J. M. López, S. Foissac, R. Guigó and R. Méndez (2008). "A combinatorial code for CPE-mediated translational control." Cell 132(3): 434-448. Richter, J. D. (2008). "Breaking the code of polyadenylation-induced translation." Cell 132(3): 335-337. Burke, P. C., H. Park and A. R. Subramaniam (2022). "A nascent peptide code for translational control of mRNA stability in human cells." Nat Commun 13(1): 6829. Kawamoto, N., & Iwasaki, S. (2026). Translating the green code: Ribo-Seq for photosynthetic eukaryotes in focus. The Journal of Biochemistry, 179(3), 163-176.
389	Translocation code	The Protein Translocation Code	Shental-Bechor, D., S. J. Fleishman and N. Ben-Tal (2006). "Has the code for protein translocation been broken?" Trends Biochem Sci 31(4): 192-196. Nilsson, I., P. Lara, T. Hessa, A. E. Johnson, G. von Heijne and A. L. Karamyshev (2015). "The code for directing proteins for translocation across ER membrane: SRP cotranslationally recognizes specific features of a signal sequence." J Mol Biol 427(6 Pt A): 1191-1201. Hoernes, T. P., N. Clementi, K. Faserl, H. Glasner, K. Breuker, H. Lindner, A. Hüttenhofer and M. D. Erlacher (2016). "Nucleotide modifications within bacterial messenger RNAs regulate their translation and are able to rewire the genetic code." Nucleic Acids Res 44(2): 852-862.

390	Transport codes	The Transport / Trafficking Codes	Zhu, J., B. Gomez, I. Watanabe and W. B. Thornhill (2005). "Amino acids in the pore region of Kv1 potassium channels dictate cell-surface protein levels: a possible trafficking code in the Kv1 subfamily." Biochem J 388(Pt 1): 355-362. Marelli-Berg, F. M., L. Cannella, F. Dazzi and V. Mirenda (2008). "The highway code of T cell trafficking." J Pathol 214(2): 179-189. Roy, G., E. M. Chalfin, A. Saxena and X. Wang (2010). "Interplay between ER exit code and domain conformation in CFTR misprocessing and rescue." Mol Biol Cell 21(4): 597-609. Drepper, C. and M. Sendtner (2011). "A new postal code for dendritic mRNA transport in neurons." EMBO Rep 12(7): 614-616. Muslimov, I. A., M. V. Patel, A. Rose and H. Tiedge (2011). "Spatial code recognition in neuronal RNA targeting: role of RNA-hnRNP A2 interactions." J Cell Biol 194(3): 441-457. Ellis, B. E. (2012). "Postal code for a plant MAPK." Biochem J 446(2): e5-7. Carambia, A. and J. Herkel (2014). "Deciphering the highway code for lymphocyte traffic along the gut - liver axis." J Hepatol 60(6): 1110-1111. Lecona, E. and O. Fernandez-Capetillo (2016). "A SUMO and ubiquitin code coordinates protein traffic at replication factories." Bioessays 38(12): 1209-1217. Nie, C., H. Wang, R. Wang, D. Ginsburg and X. W. Chen (2018). "Dimeric sorting code for concentrative cargo selection by the COPII coat." Proc Natl Acad Sci U S A 115(14): E3155-e3162. Monroy, B. Y., T. C. Tan, J. M. Oclaman, J. S. Han, S. Simó, S. Niwa, D. W. Nowakowski, R. J. McKenney and K. M. Ori-McKenney (2020). "A Combinatorial MAP Code Dictates Polarized Microtubule Transport." Dev Cell 53(1): 60-72.e64. Paolillo, M., S. Comincini and S. Schinelli (2021). "Fostering "Education": Do Extracellular Vesicles Exploit Their Own Delivery Code?" Cells 10(7).
391	Trans-regulatory	The Trans-Regulatory Code	Beccari, L., R. Marco-Ferreres, N. Tabanera, A. Manfredi, M. Souren, B. Wittbrodt, I. Conte, J. Wittbrodt and P. Bovolenta (2015). "A trans-Regulatory Code for the Forebrain Expression of Six3.2 in the Medaka Fish." J Biol Chem 290(45): 26927-26942.
392	tRNA code	The tRNA Codes	Sanbonmatsu, K. Y. (2014). Flipping through the genetic code: new developments in discrimination between cognate and near-cognate tRNAs and the effect of antibiotics. J Mol Biol, 426(19), 3197-3200.

			Krutyhołowa, R., Zakrzewski, K., & Glatt, S. (2019). Charging the code - tRNA modification complexes. Curr Opin Struct Biol, 55, 138-146. Demongeot, J. and H. Seligmann (2020). "The primordial tRNA acceptor stem code from theoretical minimal RNA ring clusters." BMC Genet 21(1): 7. Gogoi, J., Bhatnagar, A., Ann, K. J., Pottabathini, S., Singh, R., Mazeed, M., . . . Sankaranarayanan, R. (2022). Switching a conflicted bacterial DTD-tRNA code is essential for the emergence of mitochondria. Sci Adv, 8(2), eabj7307. Kuhle, B., Hirschi, M., Doerfel, L. K., Lander, G. C., & Schimmel, P. (2023). Structural basis for a degenerate tRNA identity code and the evolution of bimodal specificity in human mitochondrial tRNA recognition. Nat Commun, 14(1), 4794. Carter, C. (2024). tRNA: The operational RNA code and protein folding. Adjacent Digital Politics, 41(1), 228-229. Masuda, I., & Hou, Y. M. (2024). A tRNA modification pattern that facilitates interpretation of the genetic code. Front Microbiol, 15, 1415100.
393	Tubulin code	The Tubulin Code	Verhey, K. J. and J. Gaertig (2007). "The tubulin code." Cell Cycle 6(17): 2152-2160. Janke, C. (2014). The tubulin code: Molecular components, readout mechanisms, and functions. Journal of Cell Biology, 206(4), 461-472. Yu, I., C. P. Garnham and A. Roll-Mecak (2015). "Writing and Reading the Tubulin Code." J Biol Chem 290(28): 17163-17172. Barisic, M. and H. Maiato (2016). "The Tubulin Code: A Navigation System for Chromosomes during Mitosis." Trends Cell Biol 26(10): 766-775. Strzyz, P. (2016). Post-translational modifications: Extension of the tubulin code. Nat Rev Mol Cell Biol, 17(10), 609. Chakraborti, S., K. Natarajan, J. Curiel, C. Janke and J. Liu (2016). "The emerging role of the tubulin code: From the tubulin molecule to neuronal function and disease." Cytoskeleton (Hoboken) 73(10): 521-550. Gadadhar, S., S. Bodakuntla, K. Natarajan and C. Janke (2017). "The tubulin code at a glance." J Cell Sci 130(8): 1347-1353.

			Ferreira, L. T., A. C. Figueiredo, B. Orr, D. Lopes and H. Maiato (2018). "Dissecting the role of the tubulin code in mitosis." Methods Cell Biol 144: 33-74. Park, J. H. and A. Roll-Mecak (2018). "The tubulin code in neuronal polarity." Curr Opin Neurobiol 51: 95-102. Amargant, F., M. Barragan, R. Vassena and I. Vernos (2019). "Insights of the tubulin code in gametes and embryos: from basic research to potential clinical applications in humans†." Biol Reprod 100(3): 575-589. Janke, C. and M. M. Magiera (2020). "The tubulin code and its role in controlling microtubule properties and functions." Nat Rev Mol Cell Biol 21(6): 307-326. Roll-Mecak, A. (2020). "The Tubulin Code in Microtubule Dynamics and Information Encoding." Dev Cell 54(1): 7-20. Lopes, D. and H. Maiato (2020). "The Tubulin Code in Mitosis and Cancer." Cells 9(11). Akella, J. S. and M. M. Barr (2021). "The tubulin code specializes neuronal cilia for extracellular vesicle release." Dev Neurobiol 81(3): 231-252. Gadadhar, S., T. Hirschmugl and C. Janke (2022). "The tubulin code in mammalian sperm development and function." Semin Cell Dev Biol. Magiera, M. M. (2022). "The tubulin code: Empowering microtubules." Semin Cell Dev Biol. S1084-9521(22)00250-6. Müller, M., L. Gorek, N. Kamm and R. Jacob (2022). "Manipulation of the Tubulin Code Alters Directional Cell Migration and Ciliogenesis." Front Cell Dev Biol 10: 901999. O'Hagan, R., A. Avrutis and E. Ramicevic (2022). "Functions of the tubulin code in the C. elegans nervous system." Mol Cell Neurosci 123: 103790. Phyo, S. A., Uchida, K., Chen, C. Y., Caporizzo, M. A., Bedi, K., Griffin, J., . . . Prosser, B. L. (2022). Transcriptional, Post-Transcriptional, and Post-Translational Mechanisms Rewrite the Tubulin Code During Cardiac Hypertrophy and Failure [Original Research]. Front Cell Dev Biol, Volume 10 - 2022. Trisciuoglio, D., & Degrassi, F. (2022). The Tubulin Code and Tubulin-Modifying Enzymes in Autophagy and Cancer. Cancers (Basel), 14(1), 6. Wethekam, L. C. and J. K. Moore (2022). "Microtubule cytoskeleton: Revealing new readers of the tubulin code." Curr Biol 32(18): R960-r962.

			Zheng, P., Obara, C. J., Szczesna, E., Nixon-Abell, J., Mahalingan, K. K., Roll-Mecak, A., . . . Blackstone, C. (2022). ER proteins decipher the tubulin code to regulate organelle distribution. Nature, 601(7891), 132-138. Gadadhar, S., Hirschmugl, T., & Janke, C. (2023). The tubulin code in mammalian sperm development and function. Semin Cell Dev Biol, 137, 26-37. Kimmerlin, Q., Strassel, C., Eckly, A., & Lanza, F. (2023). The tubulin code in platelet biogenesis. Semin Cell Dev Biol, 137, 63-73. McKenna, E. D., Sarbanes, S. L., Cummings, S. W., & Roll-Mecak, A. (2023). The Tubulin Code, from Molecules to Health and Disease. Annu Rev Cell Dev Biol, 39(Volume 39, 2023), 331-361. Viar, G. A., Klena, N., Martino, F., Nievergelt, A., & Pigino, G. (2023). The Tubulin Nano-Code: a protofilament-specific pattern of tubulin post-translational modifications regulates ciliary beating mechanics. bioRxiv, 2023.2006.2028.546853. Zocchi, R., Compagnucci, C., Bertini, E., & Sferra, A. (2023). Deciphering the Tubulin Language: Molecular Determinants and Readout Mechanisms of the Tubulin Code in Neurons. Int J Mol Sci, 24(3), 2781. Bromley, A., Hammer, N. I., Fortenberry, R. C., & Reinemann, D. N. (2024). Constructing a library of E-hook peptide structures to aid in deciphering the tubulin code. Biophysical Journal, 123(3), 274a. Chen, J., Zehr, E. A., Gruschus, J. M., Szyk, A., Liu, Y., Tanner, M. E., . . . Roll-Mecak, A. (2024). Tubulin code eraser CCP5 binds branch glutamates by substrate deformation. Nature, 631(8022), 905-912. Karpov, P. A., Ozheredov, S. P., Steshenko, A. O., Spivak, S. I., & Blume, Y. B. (2024). Bioinformatical View on the Contribution of MAST/IRE-Dependent Phosphorylation in the Tubulin Code. Cytology and Genetics, 58(3), 202-213. Campbell, J., Vosahlikova, M., Ismail, S., Volnikova, M., Motlova, L., Kudlacova, J., . . . Barinka, C. (2025). Expanding the Tubulin Code: TTLL11 Polyglutamylase Drives Elongation of Primary Tubulin Chains. bioRxiv, 2025.2002.2024.639257. Chen, J., Zehr, E. A., Gruschus, J. M., Szyk, A., Liu, Y., Tanner, M. E., . . . Roll-Mecak, A. (2025). BPS2025 - Tubulin code eraser CCP5 binds branch glutamates by substrate deformation. Biophysical Journal, 124(3), 141a. Simoes-da-Silva, M. M., & Barisic, M. (2025). How does the tubulin code facilitate directed cell migration? Biochem Soc Trans, 53(01), 337-352.

			Campbell, J., & Barinka, C. (2026). C-Terminal Tail Elongation Adds a New Dimension to the Tubulin Code. Cytoskeleton, n/a(n/a).
394	Tumor microenvironment code	The Tumor Microenvironment Codes **SEE also The Collagen Code**	Jin, J., Cong, J., Lei, S., Zhang, Q., Zhong, X., Su, Y., . . . Yang, J. (2023). Cracking the code: Deciphering the role of the tumor microenvironment in osteosarcoma metastasis. International Immunopharmacology, 121, 110422. Bregenzer, M. E., Mehta, P., Burkhard, K. M., & Mehta, G. (2025). Cracking the code: predicting tumor microenvironment enabled chemoresistance with machine learning in the human tumoroid models. npj Biomedical Innovations, 2(1), 28. Yu, S., & Chen, S. (2025). Unraveling the complex code of tumor microenvironment and heterogeneity by comparing multiple primary lung adenocarcinomas and intrapulmonary metastasis: A multidimensional exploration. Journal of Clinical Oncology, 43(16_suppl), e20542-e20542.
395	Twist box code	The Twist Box p53 code	Bialek, P., Kern, B., Yang, X., Schrock, M., Sosic, D., Hong, N., . . . Karsenty, G. (2004). A Twist Code Determines the Onset of Osteoblast Differentiation. Dev Cell, 6(3), 423-435. Piccinin, S., E. Tonin, S. Sessa, S. Demontis, S. Rossi, L. Pecciarini, L. Zanatta, F. Pivetta, A. Grizzo, M. Sonego, C. Rosano, A. P. Dei Tos, C. Doglioni and R. Maestro (2012). "A "twist box" code of p53 inactivation: twist box: p53 interaction promotes p53 degradation." Cancer Cell 22(3): 404-415.
396	Ubiquitin code	The Ubiquitin Code	Woelk, T., Sigismund, S., Penengo, L., & Polo, S. (2007). The ubiquitination code: a signalling problem. Cell Division, 2(1), 11. Lauwers, E., Z. Erpapazoglou, R. Haguenauer-Tsapis and B. André (2010). "The ubiquitin code of yeast permease trafficking." Trends Cell Biol 20(4): 196-204. Trempe, J. F. (2011). "Reading the ubiquitin postal code." Curr Opin Struct Biol 21(6): 792-801. Komander, D. and M. Rape (2012). "The ubiquitin code." Annu Rev Biochem 81: 203-229. Tanno, H. and M. Komada (2013). "The ubiquitin code and its decoding machinery in the endocytic pathway." J Biochem 153(6): 497-504. Williamson, A., A. Werner and M. Rape (2013). "The Colossus of ubiquitylation: decrypting a cellular code." Mol Cell 49(4): 591-600. Heride, C., S. Urbé and M. J. Clague (2014). "Ubiquitin code assembly and disassembly." Curr Biol 24(6): R215-220.

			Stanley, M. and S. Virdee (2016). "Chemical ubiquitination for decrypting a cellular code." Biochem J 473(10): 1297-1314. Kwon, Y. T. and A. Ciechanover (2017). "The Ubiquitin Code in the Ubiquitin-Proteasome System and Autophagy." Trends Biochem Sci 42(11): 873-886. Chatr-aryamontri, A., van der Sloot, A., & Tyers, M. (2018). At Long Last, a C-Terminal Bookend for the Ubiquitin Code. Molecular Cell, 70(4), 568-571. Jerabkova, K., & Sumara, I. (2019). Cullin 3, a cellular scripter of the non-proteolytic ubiquitin code. Semin Cell Dev Biol, 93, 100-110. Martínez-Torres, R. J., & Chamaillard, M. (2019). The Ubiquitin Code of NODs Signaling Pathways in Health and Disease. Front Immunol, 10, 2648. Mattern, M., J. Sutherland, K. Kadimisetty, R. Barrio and M. S. Rodriguez (2019). "Using Ubiquitin Binders to Decipher the Ubiquitin Code." Trends Biochem Sci 44(7): 599-615. Sewduth, R. N., M. F. Baietti and A. A. Sablina (2020). "Cracking the Monoubiquitin Code of Genetic Diseases." Int J Mol Sci 21(9). Ji, L., Wang, Y., Zhou, L., Lu, J., Bao, S., Shen, Q., . . . Zhang, W. (2022). E3 Ubiquitin Ligases: The Operators of the Ubiquitin Code That Regulates the RLR and cGAS-STING Pathways. Int J Mol Sci, 23(23), 14601. Nguyen, K. T., Ju, S., Kim, S.-Y., Lee, C.-S., Lee, C., & Hwang, C.-S. (2022). N-Terminal Modifications of Ubiquitin via Methionine Excision, Deamination, and Arginylation Expand the Ubiquitin Code. Mol Cells, 45(3), 158-167. Ohtake, F. (2022). Branched ubiquitin code: from basic biology to targeted protein degradation. The Journal of Biochemistry, 171(4), 361-366. Orosa-Puente, B. and S. H. Spoel (2022). "Harnessing the ubiquitin code to respond to environmental cues." Essays Biochem 66(2): 111-121. Dikic, I., & Schulman, B. A. (2023). An expanded lexicon for the ubiquitin code. Nature Reviews Molecular Cell Biology, 24(4), 273-287. Matsuo, Y., Uchihashi, T., & Inada, T. (2023). Decoding of the ubiquitin code for clearance of colliding ribosomes by the RQT complex. Nat Commun, 14(1), 79.

			Rodriguez, M. S. and R. Barrio, Eds. (2023). The Ubiquitin Code. Methods in Molecular Biology (MIMB, Volume 2602), Springer. Sheng, X., Xia, Z., Yang, H., & Hu, R. (2023). The ubiquitin codes in cellular stress responses. Protein & Cell, 15(3), 157-190. Wanka, V., Fottner, M., Cigler, M., & Lang, K. (2024). Genetic Code Expansion Approaches to Decipher the Ubiquitin Code. Chemical Reviews, 124(20), 11544-11584. Kiss, L., James, L. C., & Schulman, B. A. (2025). UbiREAD deciphers proteasomal degradation code of homotypic and branched K48 and K63 ubiquitin chains. Molecular Cell, 85(7), 1467-1476.e1466. Morita, M., Takao, M., Tokuhisa, H., Chiba, R., Tomomatsu, S., Akizuki, Y., . . . Ohtake, F. (2025). Combinatorial ubiquitin code degrades deubiquitylation-protected substrates. Nat Commun, 16(1), 2496 Shi, Y., Shen, Y., Zhang, X., Zhu, N., Ding, Y., Yuan, Y., & Wang, J. (2025). The ubiquitin code of RAS proteins: Decoding its role in cancer progression. iScience, 28(8). Liu, X., Liu, J., Chen, W., Zhang, J., Wei, Y., & Sun, L. (2026). Ubiquitin regulatory code: unraveling tumor cell ferroptosis. Critical Reviews in Oncology/Hematology, 220, 105172. Yang, Y., Ren, J., Qiu, X., Liu, Y., Yuan, S., Hu, R., . . . Li, C. (2026). RNF126 writes a non-canonical ubiquitin code on midnolin to tune protein stability. Acta biochimica et biophysica Sinica. Zheng, Y., Zhang, M., Xie, W., Niu, X., Xu, C., Zhai, H. B., & Huang, H. (2026). Lighting up the linear Ubiquitin Code: A Bioluminescent Sensor for M1-Specific Deubiquitinase Activity and Drug Discovery [10.1039/D5CC07195J]. Chemical Communications, 62, 8765-8768. Zhou, Y., Yu, G., & Lu, D. (2026). The ubiquitin code of receptor kinases in plants. J Integr Plant Biol.
397	Ubiquitin-like code	The Ubiquitin-like DNA PK Code	Zhao, J., Qin, Z., Hou, J., Lu, M., Guo, J., Wu, J., . . . Ma, T. (2026). Deciphering the Ubiquitin-like Code of DNA-PK: Mechanisms and Therapeutic Opportunities. Biomolecules, 16(4), 498.
398	Ulcer code	The Ulcer Code	Vera-Sanchez, M., Knot, A., Johnson, C., Imran, H., & Marri, P. (2026). Breaking the ulcer code: a diagnostic surprise in cutaneous lymphoproliferation. The American Journal of the Medical Sciences, 371, S290-S291.
399	Uterine code	The Uterine Microbiome Code	Blazheva, S., Pachkova, S., Bodurska, T., Ivanov, P., Blazhev, A., Lukanov, T., & Konova, E. (2024). Unlocking the Uterine Code: Microbiota, Immune Cells, and Therapy for Recurrent Reproductive Failure. Microorganisms, 12(3), 547.

400	UTR CODE	The 3´UTR Code	Dai, X. X., J. C. Jiang, Q. Q. Sha, Y. Jiang, X. H. Ou and H. Y. Fan (2019). "A combinatorial code for mRNA 3'-UTR-mediated translational control in the mouse oocyte." Nucleic Acids Res 47(1): 328-340.
401	Vaginal code	The Vaginal Code	Diamond, M. (1970). "Intromission pattern and species vaginal code in relation to induction of pseudopregnancy." Science 169(3949): 995-997. Mac Cionnaith, C., Gomez-Perales, E., Ismail, H., Pfaus, J., & Brake, W. (2023). (046) Signalling the Vaginal Code: A Dual Role for Oxytocin in Sexual Partner Preference and Reproduction. The Journal of Sexual Medicine, 20(Supplement_3).
402	Valence code	The Valence Code	Jensen, J., Smith, A. J., Willeit, M., Crawley, A. P., Mikulis, D. J., Vitcu, I., & Kapur, S. (2007). Separate brain regions code for salience vs. valence during reward prediction in humans. Hum Brain Mapp, 28(4), 294-302. Chen, Y., Hou, R., Chen, Z., Lu, J., Chen, S., Xiong, S., . . . Xiao, X. (2025). Cracking the Valence Code: Patterned Facial Kinematics and Neural Signatures of Emotional Expressions in Mice. Advanced Science, 12(42), e17156.
403	Vascular code	The Vascular Speed Code	Cybis Pereira, F., Castedo, S. H., Le Meur-Diebolt, S., Ialy-Radio, N., Bhattacharya, S., Ferrier, J., . . . Tanter, M. (2026). A vascular code for speed in the spatial navigation system. Cell Rep, 45(1), 116791.
404	V(D)J code	V(D)J Recombination Codes	Schlissel, M. S., Schulz, D., & Vettermann, C. (2009). A histone code for regulating V(D)J recombination. Mol Cell, 34(6), 639-640. Kim, M.-S., W. Chuenchor, X. Chen, Y. Cui, X. Zhang, Z. H. Zhou, M. Gellert and W. Yang (2018). "Cracking the DNA Code for V(D)J Recombination." Molecular Cell 70(2): 358-370.e354. Chi, X., Y. Li and X. Qiu (2020). "V(D)J recombination, somatic hypermutation and class switch recombination of immunoglobulins: mechanism and regulation." Immunology 160(3): 233-247. Hanout-Chuiko, W., Pachakar, S., Foqara, R., Sibony-Benyamini, H., Peretz, S., Edri, N., . . . Maman, Y. (2025). The nonamer code for RAG-mediated recombination in vivo. Nucleic Acids Res, 53(22).
405	VEGF code	The VEGF Code	Vogrin, A. J., N. I. Bower, M. J. Gunzburg, S. Roufail, K. S. Okuda, S. Paterson, S. J. Headey, S. A. Stacker, B. M. Hogan and M. G. Achen (2019). "Evolutionary Differences in the Vegf/Vegfr Code Reveal Organotypic Roles for the Endothelial Cell Receptor Kdr in Developmental Lymphangiogenesis." Cell Rep 28(8): 2023-2036.e2024.

406	Viral code	Viral Genome Codes	Goz, E., Zur, H., & Tuller, T. (2017). Hidden Silent Codes in Viral Genomes. In P. Pontarotti (Ed.), Evolutionary Biology: Self/Nonself Evolution, Species and Complex Traits Evolution, Methods and Concepts (pp. 87-110). Springer International Publishing. Di Gioacchino, A., Lecce, I., Greenbaum, B. D., Monasson, R., & Cocco, S. (2025). Deciphering the Code of Viral-Host Adaptation Through Maximum-Entropy Nucleotide Bias Models. Mol Biol Evol, 42(6).
407	Visual code	The Visual Code	Todman, J., & Seedhouse, E. (1994). Visual-action code processing by deaf and hearing children. Language and Cognitive Processes, 9(2), 129-141. Chittka, L. (1997). BEE COLOR VISION IS OPTIMAL FOR CODING FLOWER COLOR, BUT FLOWER COLORS ARE NOT OPTIMAL FOR BEING CODED—WHY? Israel Journal of Plant Sciences, 45(2-3), 115-127. Huck, F. O., C. L. Fales, R. E. Davis and R. Alter-Gartenberg (2000). "Visual communication with retinex coding." Appl Opt 39(11): 1711-1730. Hancock, P. and N. Krüger (2005). "Coding of visual information in the brain." Network 16(4): 321-322. Reddy, L. and N. Kanwisher (2006). "Coding of visual objects in the ventral stream." Curr Opin Neurobiol 16(4): 408-414. Durgin, F. H. and K. Gigone (2007). "Enhanced optic flow speed discrimination while walking: contextual tuning of visual coding." Perception 36(10): 1465-1475. Montani, F., A. Kohn, M. A. Smith and S. R. Schultz (2007). "The role of correlations in direction and contrast coding in the primary visual cortex." J Neurosci 27(9): 2338-2348. Zwickel, T., T. Wachtler and R. Eckhorn (2007). "Coding the presence of visual objects in a recurrent neural network of visual cortex." Biosystems 89(1-3): 216-226. Faivre, O. and M. Juusola (2008). "Visual coding in locust photoreceptors." PLoS One 3(5): e2173. Ganel, T., E. Chajut and D. Algom (2008). "Visual coding for action violates fundamental psychophysical principles." Curr Biol 18(14): R599-601. Gutnisky, D. A. and V. Dragoi (2008). "Adaptive coding of visual information in neural populations." Nature 452(7184): 220-224. Martinovic, J., T. Gruber and M. M. Müller (2008). "Coding of visual object features and feature conjunctions in the human brain." PLoS One 3(11): e3781.

			Montemurro, M. A., M. J. Rasch, Y. Murayama, N. K. Logothetis and S. Panzeri (2008). "Phase-of-firing coding of natural visual stimuli in primary visual cortex." Curr Biol 18(5): 375-380. Ostwald, D., J. M. Lam, S. Li and Z. Kourtzi (2008). "Neural coding of global form in the human visual cortex." J Neurophysiol 99(5): 2456-2469. Spratling, M. W. (2008). "Predictive coding as a model of biased competition in visual attention." Vision Res 48(12): 1391-1408. Yao, H., L. Shi, F. Han, H. Gao and Y. Dan (2007). "Rapid learning in cortical coding of visual scenes." Nat Neurosci 10(6): 772-778. Benucci, A., D. L. Ringach and M. Carandini (2009). "Coding of stimulus sequences by population responses in visual cortex." Nat Neurosci 12(10): 1317-1324. Seymour, K., C. W. Clifford, N. K. Logothetis and A. Bartels (2009). "The coding of color, motion, and their conjunction in the human visual cortex." Curr Biol 19(3): 177-183. Davis, C. J. (2010). "The spatial coding model of visual word identification." Psychol Rev 117(3): 713-758. Lehky, S. R. and A. B. Sereno (2011). "Population coding of visual space: modeling." Front Comput Neurosci 4: 155. Vangeneugden, J., P. A. De Mazière, M. M. Van Hulle, T. Jaeggli, L. Van Gool and R. Vogels (2011). "Distinct mechanisms for coding of visual actions in macaque temporal cortex." J Neurosci 31(2): 385-401. Webster, M. A. (2011). "Adaptation and visual coding." J Vis 11(5). Willmore, B. D., J. A. Mazer and J. L. Gallant (2011). "Sparse coding in striate and extrastriate visual cortex." J Neurophysiol 105(6): 2907-2919. Fischer, J. and D. Whitney (2012). "Attention gates visual coding in the human pulvinar." Nat Commun 3: 1051. Guzman-Martinez, E., L. Ortega, M. Grabowecky, J. Mossbridge and S. Suzuki (2012). "Interactive coding of visual spatial frequency and auditory amplitude-modulation rate." Curr Biol 22(5): 383-388. Henry, L. A., D. Messer, S. Luger-Klein and L. Crane (2012). "Phonological, visual, and semantic coding strategies and children's short-term picture memory span." Q J Exp Psychol (Hove) 65(10): 2033-2053.

			Layton, O. W., E. Mingolla and A. Yazdanbakhsh (2012). "Dynamic coding of border-ownership in visual cortex." J Vis 12(13): 8. Shriki, O., A. Kohn and M. Shamir (2012). "Fast coding of orientation in primary visual cortex." PLoS Comput Biol 8(6): e1002536. Ramirez-Villegas, J. F. and D. F. Ramirez-Moreno (2013). "Color coding in the cortex: a modified approach to bottom-up visual attention." Biol Cybern 107(1): 39-47. Rhodes, G., L. Jeffery, A. Boeing and A. J. Calder (2013). "Visual coding of human bodies: perceptual aftereffects reveal norm-based, opponent coding of body identity." J Exp Psychol Hum Percept Perform 39(2): 313-317. Tye-Murray, N., B. P. Spehar, J. Myerson, S. Hale and M. S. Sommers (2013). "Reading your own lips: common-coding theory and visual speech perception." Psychon Bull Rev 20(1): 115-119. Goh, H., N. Thome, M. Cord and J. H. Lim (2014). "Learning deep hierarchical visual feature coding." IEEE Trans Neural Netw Learn Syst 25(12): 2212-2225. Oliveira, G. L., E. R. Nascimento, A. W. Vieira and M. F. Campos (2014). "Sparse spatial coding: a novel approach to visual recognition." IEEE Trans Image Process 23(6): 2719-2731. Stefanics, G., J. Kremláček and I. Czigler (2014). "Visual mismatch negativity: a predictive coding view." Front Hum Neurosci 8: 666. Sterpenich, V., C. Piguet, M. Desseilles, L. Ceravolo, M. Gschwind, D. Van De Ville, P. Vuilleumier and S. Schwartz (2014). "Sleep sharpens sensory stimulus coding in human visual cortex after fear conditioning." Neuroimage 100: 608-618. Dewar, A. D., A. Wystrach, P. Graham and A. Philippides (2015). "Navigation-specific neural coding in the visual system of Drosophila." Biosystems 136: 120-127. Fiscella, M., F. Franke, K. Farrow, J. Müller, B. Roska, R. A. da Silveira and A. Hierlemann (2015). "Visual coding with a population of direction-selective neurons." J Neurophysiol 114(4): 2485-2499. Sauseng, P., M. Conci, B. Wild and T. Geyer (2015). "Predictive coding in visual search as revealed by cross-frequency EEG phase synchronization." Front Psychol 6: 1655. Borghesani, V., F. Pedregosa, M. Buiatti, A. Amadon, E. Eger and M. Piazza (2016). "Word meaning in the ventral visual path: a perceptual to conceptual gradient of semantic coding." Neuroimage 143: 128-140.

			Brown, T. M. (2016). "Using light to tell the time of day: sensory coding in the mammalian circadian visual network." J Exp Biol 219(Pt 12): 1779-1792. Hindy, N. C., F. Y. Ng and N. B. Turk-Browne (2016). "Linking pattern completion in the hippocampus to predictive coding in visual cortex." Nat Neurosci 19(5): 665-667. Liu, R., J. Wang, X. Shang, Y. Wang, Z. Su and Y. Cai (2016). "Sparse Coding and Counting for Robust Visual Tracking." PLoS One 11(12): e0168093. Poirot, J., P. De Luna and G. Rainer (2016). "Neural coding of image structure and contrast polarity of Cartesian, hyperbolic, and polar gratings in the primary and secondary visual cortex of the tree shrew." J Neurophysiol 115(4): 2000-2013. Wamain, Y., F. Gabrielli and Y. Coello (2016). "EEG μ rhythm in virtual reality reveals that motor coding of visual objects in peripersonal space is task dependent." Cortex 74: 20-30. Yue, Y., S. Ke, W. Zhou and J. Chang (2016). "In Vivo Imaging Reveals Composite Coding for Diagonal Motion in the Drosophila Visual System." PLoS One 11(10): e0164020. Adesnik, H. (2017). "Synaptic Mechanisms of Feature Coding in the Visual Cortex of Awake Mice." Neuron 95(5): 1147-1159.e1144. Bonner, M. F. and R. A. Epstein (2017). "Coding of navigational affordances in the human visual system." Proc Natl Acad Sci U S A 114(18): 4793-4798. Cowell, R. A., K. R. Leger and J. T. Serences (2017). "Feature-coding transitions to conjunction-coding with progression through human visual cortex." J Neurophysiol 118(6): 3194-3214. Dewar, A. D. M., A. Wystrach, A. Philippides and P. Graham (2017). "Neural coding in the visual system of Drosophila melanogaster: How do small neural populations support visually guided behaviours?" PLoS Comput Biol 13(10): e1005735. Ginsburg, V., K. Archambeau, J. P. van Dijck, F. Chetail and W. Gevers (2017). "Coding of serial order in verbal, visual and spatial working memory." J Exp Psychol Gen 146(5): 632-650. Julian, J. B., J. Ryan and R. A. Epstein (2017). "Coding of Object Size and Object Category in Human Visual Cortex." Cereb Cortex 27(6): 3095-3109. Mendoza-Halliday, D. and J. C. Martinez-Trujillo (2017). "Neuronal population coding of perceived and memorized visual features in the lateral prefrontal cortex." Nat Commun 8: 15471.

			Muhle-Karbe, P. S., J. Duncan, W. De Baene, D. J. Mitchell and M. Brass (2017). "Neural Coding for Instruction-Based Task Sets in Human Frontoparietal and Visual Cortex." Cereb Cortex 27(3): 1891-1905. Dai, J. and Y. Wang (2018). "Contrast coding in the primary visual cortex depends on temporal contexts." Eur J Neurosci 47(8): 947-958. Kaiser, D. and M. V. Peelen (2018). "Transformation from independent to integrative coding of multi-object arrangements in human visual cortex." Neuroimage 169: 334-341. Lorenc, E. S., K. K. Sreenivasan, D. E. Nee, A. R. E. Vandenbroucke and M. D'Esposito (2018). "Flexible Coding of Visual Working Memory Representations during Distraction." J Neurosci 38(23): 5267-5276. Kong, Q., J. Han, Y. Zeng and B. Xu (2018). "Efficient coding matters in the organization of the early visual system." Neural Netw 105: 218-226. Martin, C. B., D. Douglas, R. N. Newsome, L. L. Man and M. D. Barense (2018). "Integrative and distinctive coding of visual and conceptual object features in the ventral visual stream." Elife 7. Nagy, A. J., Y. Takeuchi and A. Berényi (2018). "Coding of self-motion-induced and self-independent visual motion in the rat dorsomedial striatum." PLoS Biol 16(6): e2004712. Nau, M., T. Navarro Schröder, J. L. S. Bellmund and C. F. Doeller (2018). "Hexadirectional coding of visual space in human entorhinal cortex." Nat Neurosci 21(2): 188-190. Rucci, M., E. Ahissar and D. Burr (2018). "Temporal Coding of Visual Space." Trends Cogn Sci 22(10): 883-895. Sethuramanujam, S., G. B. Awatramani and M. M. Slaughter (2018). "Cholinergic excitation complements glutamate in coding visual information in retinal ganglion cells." J Physiol 596(16): 3709-3724. Bourboulou, R., G. Marti, F. X. Michon, E. El Feghaly, M. Nouguier, D. Robbe, J. Koenig and J. Epsztein (2019). "Dynamic control of hippocampal spatial coding resolution by local visual cues." Elife 8. Grillini, A., R. J. Renken and F. W. Cornelissen (2019). "Attentional Modulation of Visual Spatial Integration: Psychophysical Evidence Supported by Population Coding Modeling." J Cogn Neurosci 31(9): 1329-1342. Hannon, M. A. and R. A. Raymond (2018). "Color Coding of a Sterile Field to Aid in Recognition of Visual Cognition and Learning." Nurs Educ Perspect 39(6): 371-372.

			Heron, J., C. Fulcher, H. Collins, D. Whitaker and N. W. Roach (2019). "Adaptation reveals multi-stage coding of visual duration." Sci Rep 9(1): 3016. Holler, D. E., M. Behrmann and J. C. Snow (2019). "Real-world size coding of solid objects, but not 2-D or 3-D images, in visual agnosia patients with bilateral ventral lesions." Cortex 119: 555-568. Kaminski, J. A., P. Sterzer and A. L. Mishara (2019). ""Seeing Rain": Integrating phenomenological and Bayesian predictive coding approaches to visual hallucinations and self-disturbances (Ichstörungen) in schizophrenia." Conscious Cogn 73: 102757. Monaco, S., G. Malfatti, A. Zendron, E. Pellencin and L. Turella (2019). "Predictive coding of action intentions in dorsal and ventral visual stream is based on visual anticipations, memory-based information and motor preparation." Brain Struct Funct 224(9): 3291-3308. Nigam, S., S. Pojoga and V. Dragoi (2019). "Synergistic Coding of Visual Information in Columnar Networks." Neuron 104(2): 402-411.e404. Oh, B. I., Y. J. Kim and M. S. Kang (2019). "Ensemble representations reveal distinct neural coding of visual working memory." Nat Commun 10(1): 5665. Ponce, C. R., W. Xiao, P. F. Schade, T. S. Hartmann, G. Kreiman and M. S. Livingstone (2019). "Evolving Images for Visual Neurons Using a Deep Generative Network Reveals Coding Principles and Neuronal Preferences." Cell 177(4): 999-1009.e1010. Vasas, V., F. Peng, H. MaBouDi and L. Chittka (2019). "Randomly weighted receptor inputs can explain the large diversity of colour-coding neurons in the bee visual system." Sci Rep 9(1): 8330. Zhao, J., U. Maurer, S. He and X. Weng (2019). "Development of neural specialization for print: Evidence for predictive coding in visual word recognition." PLoS Biol 17(10): e3000474. Cheng, C., Z. Kaldy and E. Blaser (2020). "Coding of featural information in visual working memory in 2.5-year-old toddlers." Cogn Dev 55. Contini, E. W., E. Goddard, T. Grootswagers, M. Williams and T. Carlson (2020). "A humanness dimension to visual object coding in the brain." Neuroimage 221: 117139. Dannenberg, H., H. Lazaro, P. Nambiar, A. Hoyland and M. E. Hasselmo (2020). "Effects of visual inputs on neural dynamics for coding of location and running speed in medial entorhinal cortex." Elife 9. Farzanfar, A., F. Shayegh, B. Nazari and S. Sadri (2020). "Physiological constraints of visual pathway lead to more efficient coding of information in retina." J Theor Biol 506: 110418.

			Guitard, D., & Cowan, N. (2020). Do we use visual codes when information is not presented visually? Mem Cognit, 48(8), 1522-1536. Karimpur, H., S. Eftekharifar, N. F. Troje and K. Fiehler (2020). "Spatial coding for memory-guided reaching in visual and pictorial spaces." J Vis 20(4): 1. Kheradpezhouh, E., M. F. Tang, J. B. Mattingley and E. Arabzadeh (2020). "Enhanced Sensory Coding in Mouse Vibrissal and Visual Cortex through TRPA1." Cell Rep 32(3): 107935. Kumar, S., C. T. Ellis, T. P. O'Connell, M. M. Chun and N. B. Turk-Browne (2020). "Searching through functional space reveals distributed visual, auditory, and semantic coding in the human brain." PLoS Comput Biol 16(12): e1008457. Levy, M., O. Sporns and J. N. MacLean (2020). "Network Analysis of Murine Cortical Dynamics Implicates Untuned Neurons in Visual Stimulus Coding." Cell Rep 31(2): 107483. Nicholls, L. A. B. and B. English (2020). "Multimodal coding and strategic approach in young and older adults' visual working memory performance." Neuropsychol Dev Cogn B Aging Neuropsychol Cogn 27(1): 83-113. Steinmetz, P. N. (2020). "Estimates of distributed coding of visual objects by single neurons in the human brain depend on which spike sorting technique is used." J Neural Eng 17(2): 026030. van Laarhoven, T., J. J. Stekelenburg, M. L. Eussen and J. Vroomen (2020). "Atypical visual-auditory predictive coding in autism spectrum disorder: Electrophysiological evidence from stimulus omissions." Autism 24(7): 1849-1859. Zhang, B., Z. Gao, X. Wang, Z. Yao, G. Xu, Z. Liang and Y. Zhou (2020). "Aging Affects Fine and Coarse Coding of Orientation Information in Macaque Primary Visual Cortex." Neuroscience 438: 50-59. Zhou, H., M. Davidson, P. Kok, L. Y. McCurdy, F. P. de Lange, H. Lau and K. Sandberg (2020). "Spatiotemporal dynamics of brightness coding in human visual cortex revealed by the temporal context effect." Neuroimage 205: 116277. Lehky, S. R., K. Tanaka and A. B. Sereno (2021). "Pseudosparse neural coding in the visual system of primates." Commun Biol 4(1): 50. Stringer, C., M. Michaelos, D. Tsyboulski, S. E. Lindo and M. Pachitariu (2021). "High-precision coding in visual cortex." Cell 184(10): 2767-2778.e2715.

			Strube, A., M. Rose, S. Fazeli and C. Büchel (2021). "Alpha-to-beta- and gamma-band activity reflect predictive coding in affective visual processing." Sci Rep 11(1): 23492. Zatka-Haas, P., N. A. Steinmetz, M. Carandini and K. D. Harris (2021). "Sensory coding and the causal impact of mouse cortex in a visual decision." Elife 10. Zhang, X., S. Ma, S. Wang, J. Zhang, H. Sun and W. Gao (2021). "Divisively Normalized Sparse Coding: Toward Perceptual Visual Signal Representation." IEEE Trans Cybern 51(8): 4237-4250. Zheng, Y., S. Jia, Z. Yu, J. K. Liu and T. Huang (2021). "Unraveling neural coding of dynamic natural visual scenes via convolutional recurrent neural networks." Patterns (N Y) 2(10): 100350. Barnes, L., E. Goddard and A. Woolgar (2022). "Neural Coding of Visual Objects Rapidly Reconfigures to Reflect Subtrial Shifts in Attentional Focus." J Cogn Neurosci 34(5): 806-822. Kovács-Öller, T., K. Dedek and D. Hillier (2022). "Editorial: Visual code: From the retina to the brain." Front Cell Neurosci 16: 1018229. Hu, F., G. Xu, L. Zhang, H. Wang, J. Liu, Z. Chen and Y. Zhou (2022). "Chronic bisphenol A exposure triggers visual perception dysfunction through impoverished neuronal coding ability in the primary visual cortex." Arch Toxicol 96(2): 625-637. Skyberg, R., S. Tanabe, H. Chen and J. Cang (2022). "Coarse-to-fine processing drives the efficient coding of natural scenes in mouse visual cortex." Cell Rep 38(13): 110606. Yang, Y., T. Wang, Y. Li, W. Dai, G. Yang, C. Han, Y. Wu and D. Xing (2022). "Coding strategy for surface luminance switches in the primary visual cortex of the awake monkey." Nat Commun 13(1): 286. Sanchez-Garcia, M., Chauhan, T., Cottereau, B. R., & Beyeler, M. (2023). Efficient multi-scale representation of visual objects using a biologically plausible spike-latency code and winner-take-all inhibition. Biological Cybernetics, 117(1), 95-111. Allen, A. E., Hahn, J., Richardson, R., Pantiru, A., Mouland, J., Baño-Otalora, B., . . . Lucas, R. J. (2024). Reconfiguration of the visual code and retinal cell type complement in closely related diurnal and nocturnal mice. bioRxiv. Rodgers, J., Hughes, S., Ebrahimi, A. S., Allen, A. E., Storchi, R., Lindner, M., . . . Lucas, R. J. (2025). Enhanced restoration of visual code after targeting ON bipolar cells compared with retinal ganglion cells with optogenetic therapy. Molecular Therapy, 33(3), 1264-1281.

408	VOC code	The Plant Volatile Organic Compounds Codes	Arimura, G.-i., & Uemura, T. (2025). Cracking the plant VOC sensing code and its practical applications. Trends Plant Sci, 30(1), 105-115.
409	Vocal code	The Vocal Code	Juslin, P. N., & Laukka, P. (2003). Communication of emotions in vocal expression and music performance: Different channels, same code? Psychological Bulletin, 129(5), 770–814. Robotka, H., Thomas, L., Yu, K., Wood, W., Elie, J. E., Gahr, M., & Theunissen, F. E. (2023). Sparse ensemble neural code for a complete vocal repertoire. Cell Rep, 42(2).
410	Wnt code	The Wnt Embryogenesis Code	Guder, C., I. Philipp, T. Lengfeld, H. Watanabe, B. Hobmayer and T. W. Holstein (2006). "The Wnt code: cnidarians signal the way." Oncogene 25(57): 7450-7460.
411	Wobbling code	The Wobbling Base Pairing Code	Alkatib, S., L. B. Scharff, M. Rogalski, T. T. Fleischmann, A. Matthes, S. Seeger, M. A. Schöttler, S. Ruf and R. Bock (2012). "The contributions of wobbling and superwobbling to the reading of the genetic code." PLoS Genet 8(11): e1003076. Yarus, M. (2021). Crick Wobble and Superwobble in Standard Genetic Code Evolution. Journal of Molecular Evolution, 89(1), 50-61. Zolyan, S. (2023). On the minimal elements of the genetic code and their semiotic functions (degeneracy, complementarity, wobbling). Biosystems, 231, 104962.
412	Word code	The Written Word Code	Hannagan, T., A. Agrawal, L. Cohen and S. Dehaene (2021). "Emergence of a compositional neural code for written words: Recycling of a convolutional neural network for reading." Proc Natl Acad Sci U S A 118(46).
413	Zinc code	The Brain Zinc Code	Sabouri, S., Rostamirad, M., & Dempski, R. E. (2024). Unlocking the brain's zinc code: implications for cognitive function and disease [Review]. Frontiers in Biophysics, Volume 2 - 2024.
414	Zinc finger code	Zinc Finger Protein DNA Recognition Code **SEE also The DNA-Binding Code**	Choo, Y. and A. Klug (1994). "Toward a code for the interactions of zinc fingers with DNA: selection of randomized fingers displayed on phage." Proc Natl Acad Sci U S A 91(23): 11163-11167. Wolfe, S. A., Grant, R. A., Elrod-Erickson, M., & Pabo, C. O. (2001). Beyond the "Recognition Code" Structures of Two Cys2His2 Zinc FingerTATA Box Complexes. Structure, 9(8), 717-723. Nagaoka, M., Shiraishi, Y., Uno, Y., Nomura, W., & Sugiura, Y. (2002). Interconversion between Serine and Aspartic Acid in the α Helix of the N-Terminal Zinc Finger of Sp1: Implication for General Recognition Code and for Design of Novel Zinc Finger Peptide Recognizing Complementary Strand. Biochemistry, 41(28), 8819-8825.

			Sera, T., & Uranga, C. (2002). Rational Design of Artificial Zinc-Finger Proteins Using a Nondegenerate Recognition Code Table. Biochemistry, 41(22), 7074-7081. Liu, J., & Stormo, G. D. (2008). Context-dependent DNA recognition code for C2H2 zinc-finger transcription factors. Bioinformatics, 24(17), 1850-1857. Baxley, R. M., Bullard, J. D., Klein, M. W., Fell, A. G., Morales-Rosado, J. A., Duan, T., & Geyer, P. K. (2017). Deciphering the DNA code for the function of the Drosophila polydactyl zinc finger protein Suppressor of Hairy-wing. Nucleic Acids Res, 45(8), 4463-4478. Zhang, X., Blumenthal, R. M., & Cheng, X. (2024). Updated understanding of the protein–DNA recognition code used by C2H2 zinc finger proteins. Curr Opin Struct Biol, 87, 102836.
415	Zip code -A (DNA)	The DNA Zip Code	Ahmed, S., D. G. Brickner, W. H. Light, I. Cajigas, M. McDonough, A. B. Froyshteter, T. Volpe and J. H. Brickner (2010). "DNA zip codes control an ancient mechanism for gene targeting to the nuclear periphery." Nat Cell Biol 12(2): 111-118. Light, W. H., D. G. Brickner, V. R. Brand and J. H. Brickner (2010). "Interaction of a DNA zip code with the nuclear pore complex promotes H2A.Z incorporation and INO1 transcriptional memory." Mol Cell 40(1): 112-125. Brickner, D. G., S. Ahmed, L. Meldi, A. Thompson, W. Light, M. Young, T. L. Hickman, F. Chu, E. Fabre and J. H. Brickner (2012). "Transcription factor binding to a DNA zip code controls interchromosomal clustering at the nuclear periphery." Dev Cell 22(6): 1234-1246. Puvvula, P. K., Johnson, A., & Bernal-Mizrachi, L. (2024). Unveiling retrotransposon-derived DNA zip code for myeloma cell internalization. Oncoscience, 11, 58-64. Puvvula, P. K., Martinez-Medina, L., Cinar, M., Feng, L., Pisarev, A., Johnson, A., & Bernal-Mizrachi, L. (2024). A retrotransposon-derived DNA zip code internalizes myeloma cells through Clathrin-Rab5a-mediated endocytosis [Original Research]. Frontiers in Oncology, Volume 14 - 2024.
416	Zip code -B (RNA)	The RNA Zip Code	Singer, R. H. (1993). RNA zipcodes for cytoplasmic addresses. Current Biology, 3(10), 719-721. Ross, A. F., Oleynikov, Y., Kislauskis, E. H., Taneja, K. L., & Singer, R. H. (1997). Characterization of a β-Actin mRNA Zipcode-Binding Protein. Mol Cell Biol, 17(4), 2158-2165. Oleynikov, Y., & Singer, R. H. (1998). RNA localization: different zipcodes, same postman? Trends Cell Biol, 8(10), 381-383.

			Eom, T., Antar, L. N., Singer, R. H., & Bassell, G. J. (2003). Localization of a β-Actin Messenger Ribonucleoprotein Complex with Zipcode-Binding Protein Modulates the Density of Dendritic Filopodia and Filopodial Synapses. The Journal of Neuroscience, 23(32), 10433-10444. Hervé, C., Mickleburgh, I., & Hesketh, J. (2004). Zipcodes and postage stamps: mRNA localisation signals and their trans-acting binding proteins. Briefings in Functional Genomics & Proteomics, 3(3), 240-256. Nielsen, J., Kristensen, M. A., Willemoës, M., Nielsen, F. C., & Christiansen, J. (2004). Sequential dimerization of human zipcode-binding protein IMP1 on RNA: a cooperative mechanism providing RNP stability. Nucleic Acids Res, 32(14), 4368-4376. Leask, A. (2009). Hijacking ZIP codes: posttanscriptional regulation of CCN2 by nucleophosmin. Journal of Cell Communication and Signaling, 3(1), 85-86. Chao, J. A., Patskovsky, Y., Patel, V., Levy, M., Almo, S. C., & Singer, R. H. (2010). ZBP1 recognition of beta-actin zipcode induces RNA looping. Genes Dev, 24(2), 148-158. Sasaki, Y., Welshhans, K., Wen, Z., Yao, J., Xu, M., Goshima, Y., . . . Bassell, G. J. (2010). Phosphorylation of zipcode binding protein 1 is required for brain-derived neurotrophic factor signaling of local beta-actin synthesis and growth cone turning. J Neurosci, 30(28), 9349-9358. Drepper, C., & Sendtner, M. (2011). A new postal code for dendritic mRNA transport in neurons. EMBO Rep, 12(7), 614-616. Liao, G., Ma, X., & Liu, G. (2011). An RNA-zipcode-independent mechanism that localizes Dia1 mRNA to the perinuclear ER through interactions between Dia1 nascent peptide and Rho–GTP. J Cell Sci, 124(4), 589-599. Muslimov, I. A., Patel, M. V., Rose, A., & Tiedge, H. (2011). Spatial code recognition in neuronal RNA targeting: Role of RNA–hnRNP A2 interactions. Journal of Cell Biology, 194(3), 441-457. Perry, R. B. T., & Fainzilber, M. (2011). When zip codes are in short supply. Embo j, 30(22), 4520-4522. Perycz, M., Urbanska, A. S., Krawczyk, P. S., Parobczak, K., & Jaworski, J. (2011). Zipcode Binding Protein 1 Regulates the Development of Dendritic Arbors in Hippocampal Neurons. The Journal of Neuroscience, 31(14), 5271-5285.

			Patel, V. L., Mitra, S., Harris, R., Buxbaum, A. R., Lionnet, T., Brenowitz, M., . . . Chao, J. A. (2012). Spatial arrangement of an RNA zipcode identifies mRNAs under post-transcriptional control. Genes Dev, 26(1), 43-53. Sim, S., Yao, J., Weinberg, D. E., Niessen, S., Yates, J. R., 3rd, & Wolin, S. L. (2012). The zipcode-binding protein ZBP1 influences the subcellular location of the Ro 60-kDa autoantigen and the noncoding Y3 RNA. Rna, 18(1), 100-110. Gutierrez, N., Eromobor, I., Petrie, R. J., Vedula, P., Cruz, L., & Rodriguez, A. J. (2014). The β-actin mRNA zipcode regulates epithelial adherens junction assembly but not maintenance. Rna, 20(5), 689-701. Yang, Y., Crofts, A. J., Crofts, N., & Okita, T. W. (2014). Multiple RNA Binding Protein Complexes Interact with the Rice Prolamine RNA Cis-Localization Zipcode Sequences Plant Physiol, 164(3), 1271-1282. Kim, H. H., Lee, S. J., Gardiner, A. S., Perrone-Bizzozero, N. I., & Yoo, S. (2015). Different motif requirements for the localization zipcode element of β-actin mRNA binding by HuD and ZBP1. Nucleic Acids Res, 43(15), 7432-7446. Biswas, J., Nunez, L., Das, S., Yoon, Y. J., Eliscovich, C., & Singer, R. H. (2019). Zipcode Binding Protein 1 (ZBP1; IGF2BP1): A Model for Sequence-Specific RNA Regulation. Cold Spring Harb Symp Quant Biol, 84, 1-10. Das, S., S. Biswas, S. Chaudhuri, A. Bhattacharyya and B. Das (2019). "A Nuclear Zip Code in SKS1 mRNA Promotes Its Slow Export, Nuclear Retention, and Degradation by the Nuclear Exosome/DRN in Saccharomyces cerevisiae." J Mol Biol 431(19): 3626-3646. Chaudhuri, A., S. Das and B. Das (2020). "Localization elements and zip codes in the intracellular transport and localization of messenger RNAs in Saccharomyces cerevisiae." WIREs RNA 11(4): e1591. Tian, L., Doroshenk, K. A., Zhang, L., Fukuda, M., Washida, H., Kumamaru, T., & Okita, T. (2020). Zipcode RNA-Binding Proteins and Membrane Trafficking Proteins Cooperate to Transport Glutelin mRNAs in Rice Endosperm. Plant Cell, 32(8), 2566-2581. Baron, F., Zhang, M., Archer, N., Bellows, E., Knight, H. M., Welham, S., . . . Bodi, Z. (2023). The importance of m(6)A topology in chicken embryo mRNA: a precise mapping of m(6)A at the conserved chicken β-actin zipcode. Rna, 29(6), 777-789.

			Shireman, J. M., Cheng, L., Goel, A., Garcia, D. M., Partha, S., Quiñones-Hinojosa, A., . . . Dey, M. (2023). Spatial transcriptomics in glioblastoma: is knowing the right zip code the key to the next therapeutic breakthrough? [Review]. Frontiers in Oncology, Volume 13 - 2023.
417	Zip code -C (Protein)	The Protein Zip Code	Mauro, L. J., & Dixon, J. E. (1994). "Zip codes" direct intracellular protein tyrosine phosphatases to the correct cellular "address". Trends Biochem Sci, 19(4), 151-155. Renkonen, J., Tynninen, O., Häyry, P., Paavonen, T., & Renkonen, R. (2002). Glycosylation Might Provide Endothelial Zip Codes for Organ-Specific Leukocyte Traffic into Inflammatory Sites. The American Journal of Pathology, 161(2), 543-550. O'Brate, A. and P. Giannakakou (2003). "The importance of p53 location: nuclear or cytoplasmic zip code?" Drug Resist Updat 6(6): 313-322. Conley, M. P., M. K. Jang, J. A. DeGiorgis and E. L. Bearer (2004). "Anterograde Transport of Peptide-Conjugated Fluorescent Beads in the Squid Giant Axon Identifies a Zip-Code for the Synapse." Biol Bull 207(2): 164. Satpute-Krishnan, P., J. A. DeGiorgis, M. P. Conley, M. Jang and E. L. Bearer (2006). "A peptide zipcode sufficient for anterograde transport within amyloid precursor protein." Proc Natl Acad Sci U S A 103(44): 16532-16537. Sixt, M., Bauer, M., Lämmermann, T., & Fässler, R. (2006). β1 integrins: zip codes and signaling relay for blood cells. Curr Opin Cell Biol, 18(5), 482-490. Langford-Smith, A., T. D. Keenan, S. J. Clark, P. N. Bishop and A. J. Day (2014). "The role of complement in age-related macular degeneration: heparan sulphate, a ZIP code for complement factor H?" J Innate Immun 6(4): 407-416. Koike, S., & Jahn, R. (2022). SNARE proteins: zip codes in vesicle targeting? Biochemical Journal, 479(3), 273-288. Bisio, H., R. B. Chaabene, R. Sabitzki, B. Maco, J. B. Marq, T. W. Gilberger, T. Spielmann and D. Soldati-Favre (2020). "The ZIP Code of Vesicle Trafficking in Apicomplexa: SEC1/Munc18 and SNARE Proteins." mBio 11(5). S Mogre, S., A. I. Brown and E. F. Koslover (2020). "Getting around the cell: physical transport in the intracellular world." Physical Biology 17(6): 061003. Chang, C. C. and K. C. Hsia (2021). "More than a zip code: global modulation of cellular function by nuclear localization signals." Febs j 288(19): 5569-5585.

			Ruoslahti, E. (2022). Molecular ZIP codes in targeted drug delivery. Proceedings of the National Academy of Sciences, 119(28), e2200183119. Li, B. (2026). When the liver loses its zip code: Aging blurs zonation and breeds bi-zonal hepatocytes. Hepatology, 83(5), 1025-1026. Smith, T. L., Sidman, R. L., Arap, W., & Pasqualini, R. (2022). Chapter 32 - Targeting vascular zip codes: from combinatorial selection to drug prototypes. In Z. S. Galis (Ed.), The Vasculome (pp. 393-401). Academic Press. Ríos-Barrera, L. D., & Mirouse, V. (2023). In preprints: get to know your neighbours – cell interface surveillance through a molecular zip code. Development, 150(8). Ille, A. M., Markosian, C., Pasqualini, R., & Arap, W. (2026). Decoding and deciphering a subcellular ZIP code system. Trends Cell Biol, 36(5), 339-342.
418	ZFTS code	The ZFTA Ependymoma Code	Kawauchi, D., Xiao, Z., Inagaki, N., & Kanemura, Y. (2025). 10177-CB-5 Cracking the Code of ZFTA Ependymoma: L1CAM-YAP1 Signaling as a Druggable Pathway. Neuro-Oncology Advances, 7(Supplement_6).