

RNA-mediated physics, chemistry, and molecular epigenetics

Physics: Quantum theory links ecological variation and food odors from the supply of specific nutrients to climate change and stress-effected differences in human brain development. [1-3]

- [1] [A quantum theory for the irreplaceable role of docosahexaenoic acid in neural cell signalling throughout evolution](#)
- [2] [Climate warming is predicted to reduce omega-3, long-chain, polyunsaturated fatty acid production in phytoplankton](#)
- [3] [Maternal choline intake alters the epigenetic state of fetal cortisol-regulating genes in humans](#)

Chemistry: Quantized energy from the sun links ultraviolet (UV) light on contact with water to hydrogen-atom transfer in DNA base pairs in solution and RNA-mediated DNA repair via amino acid substitutions. [4-9]

Cryo-electron tomography (cryo-ET) [10-11] and cryo-electron microscopy (cryo -EM) [12] link electron density from angstroms to ecosystems in the context of transgenerational epigenetic inheritance of energy-dependent RNA-amino acid substitutions and/or virus-driven pathology. For example ~10 amino acids surround the Asn154 glycosylation site of the Zika virus. Remarkably similar findings were confined to one generation of mass die-offs in a species of fish. [13]

Transgenerational effects of the Zika virus link the nutrient-dependent RNA-mediated immune system and the physiology of reproduction in vertebrates to supercoiled DNA, which typically prevents virus-driven entropy in all organized genomes. [14-17]

Outside the context of the non-linear links from physics and chemistry to biologically-based cause and effect, the differences in the Zika virus and all living organisms are typically placed into the context of neo-Darwinian evolution via master genes that drift to fixation in the host population. [18-19]

For contrast, everything known about nutrient energy-dependent cell type differentiation links viruses in gut microbes from metabolic networks and genetic networks to invertebrate and vertebrate biodiversity. [20-23]

- [4] [Electrolytes induce long-range orientational order and free energy changes in the H-bond network of bulk water](#)
- [5] [Serial interactome capture of the human cell nucleus](#)
- [6] [Pado, a fluorescent protein with proton channel activity can optically monitor membrane potential, intracellular pH, and map gap junctions](#)
- [7] [Dissipation Bounds All Steady-State Current Fluctuations](#)
- [8] [Physicists prove energy input predicts molecular behavior](#)
- [9] [Metabolic Regulation of Histone Post-Translational Modifications](#)
- [10] [Architecture of the symmetric core of the nuclear pore](#)
- [11] [Structural diversity of supercoiled DNA](#)
- [12] [The 3.8 Å resolution cryo-EM structure of Zika virus](#)
- [13] [Characterization of a Novel Orthomyxo-like Virus Causing Mass Die-Offs of Tilapia](#)
- [14] [Force distribution in a semiflexible loop](#)
- [15] [Mammalian elongation factor 4 regulates mitochondrial translation essential for spermatogenesis](#)
- [16] [The Bull Sperm MicroRNAome and the Effect of Fescue Toxicosis on Sperm MicroRNA Expression](#)
- [17] [Human milk miRNAs primarily originate from the mammary gland resulting in unique miRNA profiles of fractionated milk](#)
- [18] [From Mosquitos to Humans: Genetic Evolution of Zika Virus](#)
- [19] [Comprehensive Transcriptome Profiles of Streptococcus mutans UA159 Map Core Streptococcal Competence Genes](#)
- [20] [A Tunable Mechanism Determines the Duration of the Transgenerational Small RNA Inheritance in C. elegans](#)
- [21] [Resveratrol Attenuates Trimethylamine-N-Oxide \(TMAO\)-Induced Atherosclerosis by Regulating TMAO Synthesis and Bile Acid Metabolism via Remodeling of the Gut Microbiota](#)
- [22] [Wolbachia Blocks Viral Genome Replication Early in Infection without a Transcriptional Response by the Endosymbiont or Host Small RNA Pathways](#)
- [23] [Ancient horizontal transfers of retrotransposons between birds and ancestors of human pathogenic nematodes](#)

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Sunlight	Water	Chemistry
		Energy is INFORMATION
		Hydrogen atom transfer in DNA base pairs in solution
		Photosynthesis
		Nutritional epigenetics
		base pair substitutions
		microRNA flanking sequence
		miRNA/mRNA balance
		RNA/DNA Methylation
		RNA-mediated amino acid substitutions
		Thermodynamic cycles of nutrient-dependent cell type differentiation

Quantum & Classical Physics
innate immune system
de novo creation of nucleic acids
microRNA (miRNA) biogenesis
alternative splicings / pre-mRNA
G protein-coupled receptor gene creation
Molecular Epigenetics
Olfactory receptor genes
Food odors & Pheromones
Feedback loops
Physiology of Reproduction
RNA-mediated DNA repair
Supercoiled DNA
Healthy longevity

Excessive STRESS changes in pH
Virus-driven energy theft
ENTROPY
Altered Brain development
Altered Learning and memory
Altered Life history transitions
Altered Feedback loops
Altered Reproduction & Aging
Transgenerational epigenetic inheritance

Virus-perturbed neural circuitry, odor hedonics, mood, memory, motivation, expressions of affect, cognitive behavioral state, and potentiating responses to other stimuli link energy theft from stress to mutations and all pathology.

Molecular epigenetics
It has become clear to all serious scientists that nutrient-dependent microRNA flanking sequences link RNA-mediated amino acid substitutions to ecological adaption via protection against virus-driven energy theft, which links a single amino acid substitution to increased virulence of viruses. [24-28]

The role of the nutrient-dependent substitution of the achiral amino acid glycine in position six of the gonadotropin releasing hormone (GnRH) decapeptide, established GnRH secretion as the link from the gut microbes of invertebrates to all vertebrate biologically-based cause and effect. GnRH secretion links hormone-organized and hormone-activated behaviors from invertebrates to vertebrates via olfaction and the innate immune system. [29]

This representation of epigenetically-effected genome organization can be compared to theories about mutations in the context of facts about RNA-mediated amino acid substitutions and energy-dependent cell type differentiation. The nutrient-dependent amino acid substitutions differentiate all cell types in all individuals of all genera via what is currently known about biophysically constrained RNA-mediated protein folding chemistry.

- [24] [Identification of Amino Acid Substitutions Supporting Antigenic Change of Influenza A\(H1N1\)pdm09 Viruses](#)
- [25] [Nutrient-dependent/pheromone-controlled adaptive evolution: a model](#)
- [26] [The phylogenetic utility and functional constraint of microRNA flanking sequences](#)
- [27] [Distinct E-cadherin-based complexes regulate cell behaviour through miRNA processing or Src and p120 catenin activity](#)
- [28] [Olfactory organ of Octopus vulgaris: morphology, plasticity, turnover and sensory characterization](#)
- [29] [From Fertilization to Adult Sexual Behavior](#)

Microbiomes, Metabolism, Mitochondria, Mechanisms, and Molecular diagnostics
What is known about Microbiomes, Metabolism, Mitochondria and Molecular diagnostics links any energy-dependent systems approach from -omics to Precision Medicine via the innate immune system. [30] All phenotypic expression starts with the energy-dependent creation of nucleic acids and the creation of G protein-coupled receptors. The receptors allow nutrients to enter cells. For example, see [31]

The energy-dependent creation of olfactory receptor genes links metabolism and mitochondrial function to stress-driven changes in neuroendocrine, metabolic, inflammatory, transcriptional responses and to differences in behavior. [32-33]

Expression of c-fos links gene expression in GnRH neurosecretory neurons from the first step to the final steps of cell type differentiation all vertebrates. [34-36]

Nutrient stress and social stress link changes in hydrogen-atom transfer in DNA base pairs in solution from pH and virus-driven energy theft to mutations and all pathology. [37]

GnRH secretion links nutrient energy-dependent RNA-directed DNA methylation to the stability of organized genomes RNA-mediated amino acid substitutions. [38] See also: [39]

- [30] [Endolysosomal trafficking of viral G protein-coupled receptor functions in innate immunity and control of viral oncogenesis](#)
- [31] [An Epigenetic Signature for Monoallelic Olfactory Receptor Expression](#)
- [32] [Mitochondrial functions modulate neuroendocrine, metabolic, inflammatory, and transcriptional responses to acute psychological stress](#)
- [33] [Stress dynamically regulates behavior and glutamatergic gene expression in hippocampus by opening a window of epigenetic plasticity](#)
- [34] [Evolution of Constrained Gonadotropin-releasing Hormone Ligand Conformation and Receptor Selectivity](#)
- [35] [Induction of FOS immunoreactivity in central accessory olfactory structures of the female rat following exposure to conspecific males](#)
- [36] [Stimulus-specific combinatorial functionality of neuronal c-fos enhancers](#)
- [37] [Allosteric switch regulates protein-protein binding through collective motion](#)
- [38] [Stress-induced gene expression and behavior are controlled by DNA methylation and methyl donor availability in the dentate gyrus](#)
- [39] [Direct evidence for sequence-dependent attraction between double-stranded DNA controlled by methylation](#)