From hydrogen-atom transfer in DNA base pairs to ecosystems

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Thermodynamic cycles of protein biosynthesis and degradation link the biophysically-constrained chemistry of nutrient energy-dependent RNA-mediated alternative splicings and protein folding from receptor-mediated amino acid substitutions to supercoiled DNA. The physiology of reproduction links chromosomal rearrangements to species-specific ecological adaptations. Weekend evolution of the resurrected flagellum [1] appears to be an energy-dependent pheromone-controlled ecological adaptation. Feedback loops facilitate the *resurrection.* It was placed into the context of nutrient energy-dependent immune system function. Two energy-dependent amino acid substitutions were linked to the rapid development of a complex functional structure. The energy-dependent RNA-mediated adaptation was biophysically constrained.

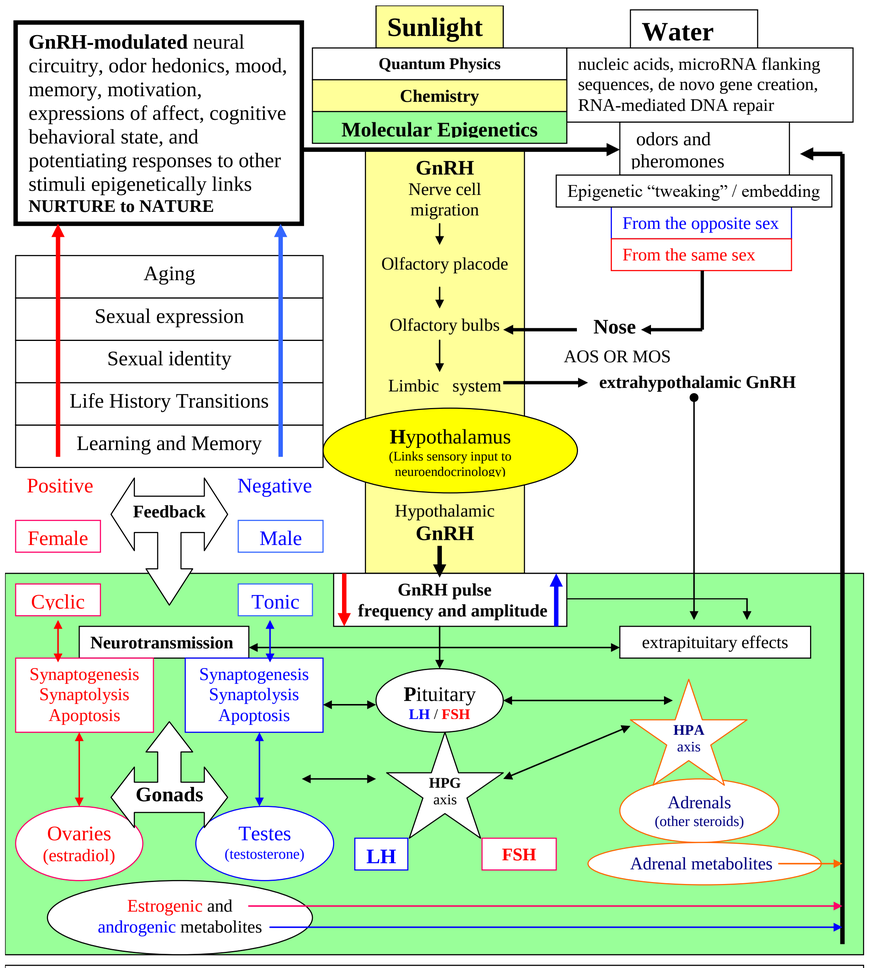
Chemists have since used **femtosecond blasts of UV light** to stimulate DNA repair via hydrogen-atom transfer in the base pairs guanine (G) and cytosine (C), which were in a solution.[2] The reactions appear to link the speed of light [3] on contact with water from an anti-entropic energy source to the de novo creation of nucleic acids [4] and to RNA-mediated DNA repair .[5] An astrobiological representation of top-down causation [6] links what has been reported in the context of molecular epigenetics and RNA-mediated cell type differentiation [7-10]

The speed of the chemical reactions appears to link **Schrodinger's claims about the anti-entropic energy of sunlight** [11] to the nutrient energy-dependent stability of organized genomes via hydrogen-atom transfer in DNA base pairs in solution [12] and to pheromone-controlled RNA-mediated DNA repair in the context of the physiology of reproduction and supercoiled DNA.[13] Chromosomal rearrangements link supercoiled DNA from chemical ecology to organized genomes and biodiversity.[14] Supercoiled DNA appears to protect all living genera from virus-driven pathology in the context of ecological speciation.[15]

That likelihood was reported in the context of an article that links transgenerational epigenetic inheritance in all living genera to what we eat in the context of a yeast model organism.[16] The yeast model organism has repeatedly been linked to human cell type differentiation via nutrient-dependent pheromone-controlled epigenetic effects.[17] The yeast model organism also was linked to ecological speciation in nematodes in the context of splicing variations;[18] neuronal imaging in roaming C. elegans; [19] and "Distinct Circuits for the Formation and Retrieval of an Imprinted **Olfactory Memory**."[20] Feedback loops and circuits link **ecological adaptations** in behavior to predatory nematodes with teeth.[21]

Chemical ecology appears to drive invertebrate and vertebrate species-specific adaptations via ecological, social, neurogenic, and socio-cognitive niche construction. Nutrients are metabolized to pheromones that epigenetically *effect* hormones. The hormones *affect* behavior in the same way food odors classically condition behavior associated with food preferences. In mammals, feedback loops link the epigenetic effects of olfactory/pheromonal input on gonadotropin releasing hormone (GnRH) neurosecretory neurons to changes in brain tissue. For example: glucose and pheromones alter the secretion of GnRH and luteinizing hormone (LH). Secretion of LH is the measurable proxy for genetically predisposed differences in hypothalamic GnRH pulse frequency and amplitude and the downstream effects of GnRH, which is the central regulator of genetically predisposed nutrient-dependent individual survival and pheromone-controlled species survival.

This model of systems biology [22] represents the conservation of top-down causation and bottom-up organization paired with hormone activation of behaviors via the 1) thermodynamics of nutrient stress-induced and social stress-induced intracellular changes in the microRNA / messenger RNA (miRNA/mRNA) balance; 2) alternative splicings linked to intermolecular changes in DNA (e.g., in genes); 3) non-random experience-dependent stochastic variations in de novo gene expression; 4) biosynthesis of odor receptors; 5) the required gene-cell-tissue-organ-organ system pathway that links sensory input directly to gene activation in neurosecretory cells and to miRNA-facilitated learning and memory in the adaptively evolved mammalian brain; and 6) the reciprocity that links the thermodynamics of gene expression to behavior and altered organism-level thermoregulation in species from microbes to man.



The prenatal migration of GnRH neurosecretory neurons allows nutrient chemicals and human pheromones to alter GnRH pulsatility, which modulates energy-dependent hydrogen-atom transfer in DNA base pairs linked from ingestive behavior to metabolic networks and genetic networks during the concurrent maturation of the neuroendocrine, reproductive, and central nervous systems via the physiology of reproduction, sex differences in behavior, and other behavioral differences.

AOS: accessory olfactory system; **FSH:** follicle stimulating hormone; **GnRH:** gonadotropin-releasing hormone; **HPA:** hypothalamic-pituitary-adrenal axis; **HPG:** hypothalamic-pituitary-gonadal axis; **LH:** luteinizing hormone; **MOS:** main olfactory system.
Adapted from Kohl (1992) Luteinizing Hormone: the link between sex and the sense of smell?

The complexity of linking energy-dependent RNA-mediated amino acid substitutions from DNA base pairs in solution to the physiology of reproduction and to biodiversity will probably help others understand why models that link atoms to ecosystems have been virtually ignored for two decades. Now, the models link angstroms to ecosystems. Many behavioral development specialists tend to examine only one or two levels of lineage-specific links. Typically, their levels of examination do not include links from quantum physics to energy-dependent RNA-mediated events or links from chemical ecology to the de novo creation of olfactory receptor genes and links from amino acid substitutions to differences in behavior.

Examples of nutrient-dependent RNA-mediated amino acid substitutions linked to behavior clarify the involvement of *seemingly* futile thermodynamic control of intracellular and intermolecular interactions, which result in de novo creation of olfactory receptor genes. Thermodynamically controlled cycles of RNA transcription and protein degradation are responsible for organism-level changes in pheromone production, which enable accelerated changes in the miRNA/mRNA balance and thermoregulation of controlled nutrient-dependent ecological adaptation.

In this mammalian model, food odors associated with nutrient uptake and species-specific pheromones associated with conspecifics control changes in the miRNA/mRNA balance. Those changes enable differential gene expression in GnRH neurons during developmental transitions required for successful nutrient-dependent pheromone-controlled reproduction, which occurs in species from microbes to man. Recent data extend this mammalian model of conserved molecular mechanisms across the continuum of ecological adaptations to selection for phenotypic expression associated with pheromones in a human population.

Across species comparisons of epigenetic effects on pangenomic microbial nutrient-dependent reproduction and on hormone-controlled invertebrate and vertebrate social and sexual behavior[22] indicate that pheromones alter cytogenetic parameters [23] and the development of the brain and behavior via molecular mechanisms that are conserved in species from microbes to humans.

Mitochondria link nutrient-stress and social stress from epigenetic effects on hormones to affects of hormones on behavior.[24] RNA-mediated amino acid substitutions link stress to behavioral development during life history transitions. Mutations are biophysically constrained by the availability of food and absence of social stress. Biophysically constrained physiological controls are required in the context of ecological adaptation. Others have linked nutrient-dependent changes in the miRNA/mRNA balance, adhesion proteins, and biophysically constrained alternative splicings of RNA to healthy longevity and to virus-driven pathology. [25-26]

Conclusion: An environmental drive links nutrient uptake in unicellular organisms to pheromone-controlled socialization in insects. This *model* makes it clearer that, in mammals, nutrients associated with food odors and pheromones cause biophysically constrained changes in hormones, which have developmental affects on the *control* of behavior [27] in nutrient-dependent reproductively fit individuals that signal their fitness via pheromones.

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[1] Evolutionary resurrection of flagellar motility via rewiring of the nitrogen regulation system
[2] Ultraviolet Absorption Induces Hydrogen-Atom Transfer in G·C Watson–Crick DNA Base Pairs in Solution.
[3] Photonic Maxwell's Demon
[4] Common origins of RNA, protein and lipid precursors in a cyanosulfidic protometabolism
[5] Observation of Gravitational Waves from a Binary Black Hole Merger
[6] Re-criticizing RNA-mediated cell evolution: a radical perspective
[7] From Fertilization to Adult Sexual Behavior
[8] Widespread Expansion of Protein Interaction Capabilities by Alternative Splicing
[9] Long non-coding RNAs in innate and adaptive immunity
[10]Defective control of pre–messenger RNA splicing in human disease
[11] What is Life?
[12] Conditional iron and pH-dependent activity of a non-enzymatic glycolysis and pentose phosphate pathway
[13]Structural diversity of supercoiled DNA
[14] Metabolic Reprogramming with a Long Noncoding RNA
[15] New insights into the hormonal and behavioural correlates of polymorphism in white-throated sparrows, Zonotrichia albicollis
[16] The metabolic background is a global player in Saccharomyces gene expression epistasis
[17]Dynamics of epigenetic regulation at the single-cell level
[18] A new view of transcriptome complexity and regulation through the lens of local splicing variations
[19] Pan-neuronal imaging in roaming Caenorhabditis elegans
[20] Distinct Circuits for the Formation and Retrieval of an Imprinted Olfactory Memory
[21] System-wide Rewiring Underlies Behavioral Differences in Predatory and Bacterial-Feeding Nematodes
[22] Nutrient-dependent/pheromone-controlled adaptive evolution: a model
[23] Role of olfaction in Octopus vulgaris reproduction
[24] Cytogenetic approaches for determining ecological stress in aquatic and terrestrial biosystems
[25] Mitochondrial functions modulate neuroendocrine, metabolic, inflammatory, and transcriptional responses to acute psychological stress
[26] Distinct E-cadherin-based complexes regulate cell behaviour through miRNA processing or Src and p120 catenin activity
[27]Oppositional COMT Val158Met effects on resting state functional connectivity in adolescents and adults