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Adaptation of organisms by resonance of RNA transcription with the cellular redox cycle

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Sequence variation in organisms differs across the genome and the majority of mutations are caused by oxidation, yet its origin is not fully understood. It has also been shown that the reduction-oxidation reaction cycle is the fundamental biochemical cycle that coordinates the timing of all biochemical processes in the cell, including energy production, DNA replication, and RNA transcription. It is shown that the temporal resonance of transcriptome biosynthesis with the oscillating binary state of the reduction-oxidation reaction cycle serves as a basis for non-random sequence variation at specific genome-wide coordinates that change faster than by accumulation of chance mutations. This work demonstrates evidence for a universal, persistent and iterative feedback mechanism between the environment and heredity, whereby acquired variation between cell divisions can outweigh inherited variation.

Biography

Dr. Viktor Stolc is the director of the NASA Ames Genome Research Facility (Mountain View, CA), where he has pioneered the development of large-scale functional genomics projects, including high resolution tiling arrays for the entire human genome and various model organisms. Prior to joining NASA in 2000, Dr. Stolc worked as a Damon Runyon Cancer Research post-doctoral fellow at Stanford University Genome Technology Center (Palo Alto, CA), where he co-invented a method for direct multiplex characterization of genomic DNA. Dr. Stolc received his doctoral degree from Yale University School of Medicine, Department of Cell Biology (New Haven, CT), where he identified and characterized nuclear RNase P protein components from humans and yeast.