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COLLOQUIUM ON Variation and Evolution in Plants and Microorganisms: Toward a New Synthesis: 50 Years after Stebbins -- NATIONAL ACADEMY OF SCIENCES Colloquium Series -- National Academy of Sciences Colloquia Bound Reprints Available -- Contents -- Introduction -- VARIATION AND EVOLUTION IN PLANTS AND MICROORGANISMS: TOWARD A NEW SYNTHESIS 50 YEARS AFTER STEBBINS -- Early Evolution and the Origin of Cells -- Viral and Bacterial Models -- Protocell Models -- Population Variation -- Trends and Patterns in Plant Evolution -- Colloquium -- G. Ledyard Stebbins (1906-2000): An appreciation -- Solution to Darwin's dilemma: Discovery of the missing Precambrian record of life -- PIONEERING PATHFINDERS -- EMERGENCE OF A NEW FIELD OF SCIENCE -- LESSONS FROM THE HUNT -- The chimeric eukaryote: Origin of the nucleus from the karyomastigont in amitochondriate protists -- TWO DOMAINS, NOT THREE -- THE CHIMERA: ARCHAEBACTERIUM/EUBACTERIUM MERGER -- THE "THIODENDRON" STAGE -- KARYOMASTIGONTS PRECEDED NUCLEI -- Dynamic evolution of plant mitochondrial genomes: Mobile genes and introns and highly variable mutation rates -- The evolution of RNA viruses: A population genetics view -- RNA VIRUSES: BIOLOGICAL AND POPULATION PROPERTIES -- RNA VIRUSES MEET THE POPULATION GENETICS THEORY OF EVOLUTION: THEORETICAL BACKGROUND -- EXPERIMENTAL VIRUS MODEL AND FITNESS ASSAYS -- THE DYNAMICS OF DELETERIOUS MUTATIONS IN FINITE POPULATIONS -- ADAPTATION: COMPETITION IN CONSTANT, CHANGING, AND SUBDIVIDED ENVIRONMENTS -- CLONAL INTERFERENCE IMPOSES A LIMIT ON THE RATE OF VIRUS ADAPTATION -- NUCLEOTIDE DIVERSITY AND FITNESS RECOVERY IN THE EVOLUTION OF A HIGHLY DEBILITATED VSV EXPERIMENTAL POPULATION: THE SAMPLING -- QUASISPECIES AND POPULATION GENETICS THEORIES OF THE EVOLUTION OF RNA VIRUSES. Effects of passage history and sampling bias on phylogenetic reconstruction of human influenza A evolution -- DESCRIPTION OF DATA SET AND DEFINITION OF TERMS -- HYPOTHESIS 1: HM MUTATIONS -- HYPOTHESIS 2: SAMPLING BIAS -- DISCUSSION -- Bacteria are different: Observations, interpretations, speculations, and opinions about the mechanisms of adaptive evolution -- OBSERVATIONS -- INTERPRETATIONS, SPECULATIONS, AND OPINIONS -- CONCLUSION -- Evolution of RNA editing in trypanosome mitochondria -- KINETOPLASTID PROTISTS CONSIST OF TWO MAJOR GROUPS: THE TRYPANOSOMATIDS AND THE BODONIDS -- KINETOPLASTIDS CONTAIN A SINGLE EXTENDED TUBULAR MITOCHONDRION WITH AN UNUSUAL MITOCHONDRIAL DNA -- U-INSERTION/DELETION RNA EDITING -- C TO U EDITING AND THE ORIGIN OF URIDINE-INSERTION EDITING IN TRYPANOSOMES -- CONCLUSIONS -- Population structure and recent evolution of *Plasmodium falciparum* -- THE MALARIA PLAGUE AND CONTROL EFFORTS -- EVOLUTIONARY ASSOCIATION OF *P. FALCIPARUM* WITH THE HOMINID LINEAGE -- MALARIA'S EVE: RECENT ORIGIN OF *P. FALCIPARUM* WORLD POPULATIONS -- THE RECENT ORIGIN OF *P. FALCIPARUM* POPULATIONS VIS-À-VIS ANTIGENIC POLYMORPHISMS -- THE CSP -- CRYPTIC REPEATS IN THE MSP-1 POLYMORPHISM -- MSP-2 POLYMORPHISM -- ANTIGENIC POLYMORPHISM, INTRAGENIC RECOMBINATION, AND POPULATION STRUCTURE -- Transposons and genome evolution in plants -- THE DISCOVERY OF TRANSPOSITION -- PLANT TRANSPOSONS IN THE AGE OF GENOMICS -- WHAT DO TRANSPOSONS DO? -- THE PARADOX -- SYNTENY AND DIVERGENCE -- PLANT GENOMES EXPAND -- TRANSPOSITION -- AMPLIFICATION AND REARRANGEMENT -- GENOME CONTRACTION -- CONTROLLING TRANSCRIPTION, RECOMBINATION, AND TRANSPOSITION --

HOMOLOGY-DEPENDENT GENE SILENCING -- THE ORIGIN OF TRANSPOSONS AND METHYLATION -- CONCLUSIONS -- Maize as a model for the evolution of plant nuclear genomes -- POLYPLOIDY AND CHROMOSOMAL DUPLICATION.

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#### Sommario/riassunto

In 1991, the National Academy of Sciences inaugurated a series of scientific colloquia, five or six of which are scheduled each year under the guidance of the NAS Council's Committee on Scientific Programs. Each colloquium addresses a scientific topic of broad and topical interest, cutting across two or more of the traditional disciplines. Typically two days long, colloquia are international in scope and bring together leading scientists in the field. Papers from colloquia are published in the *Proceedings of the National Academy of Sciences (PNAS)*. The colloquium "Variation and Evolution in Plants and Microorganisms: Toward a New Synthesis 50 Years After Stebbins" celebrates the 50th anniversary of the publication of Stebbins' classic book, *Variation and Evolution in Plants*. *Variation and Evolution in Plants*, published in 1950, the last of a quartet of classics that, in the second quarter of the 20th century, set forth what became known as the "synthetic theory of evolution" or "the modern synthesis." The other books are Theodosius Dobzhansky's *Genetics and the Origin of Species* (2), Ernst Mayr's *Systematics and the Origin of Species* (3), and George Gaylord Simpson's *Tempo and Mode in Evolution* (4). The pervading theory of these books is the molding of Darwin's evolution by natural selection within the framework of rapidly advancing genetic knowledge. *Variation and Evolution in Plants* distinctively extends the scope of the other books to the world of plants. Dobzhansky's perspective was that of the geneticist. Mayr's was that of the zoologist and systematist. Simpson's was that of the paleobiologist. All four books were outcomes of the famed Jesup Lectures at Columbia University. Plants, with their unique genetic, physiological, and evolutionary features, had been left out of the synthesis until then. In 1941, the eminent botanist Edgar Anderson was invited to write botany's analogue to Mayr's *Systematics and the Origin of the Species* and to publish it jointly with Mayr's book. Anderson did not fulfill the task, and Stebbins was thereafter invited to deliver the Jesup Lectures in 1947. *Variation and Evolution in Plants* is the outgrowth of those Lectures.