Biosynthesis of dTTP in *Escherichia coli*. dCTP Deaminase, a New Enzyme Operative in the Pathway

A strain of *Escherichia coli* HD1038, isolated as a pyrimidine over-producer, was found to contain a dCTP pool 10 times as large and a dTTP pool half as large as in the parent strain. Mutant and parent strains grow with the same generation time in minimal medium. Addition of any pyrimidine deoxyribonucleoside to the growth medium resulted in a marked increase in the dTTP pool in the mutant strain and a reduction of the dCTP pool to normal levels. The addition of ribonucleosides or purine deoxyribonucleosides to the medium did not alter the anomalous pool sizes significantly.

Although thymine-stressed mutants display characteristics quite similar to the mutant described here (i.e. high dCTP, low dTTP) they differ markedly in other respects. Unlike thymine-stressed strains, HD1038 has a low dUMP pool and its pool sizes return to normal on deoxyuridine addition.

A new pathway for the synthesis of dUMP was described recently for *Salmonella typhimurium* and a novel enzyme, dCTP deaminase, was isolated. In this paper we describe *E. coli* mutant deficient in this enzyme. The isolation of such a mutant allows dTTP biosynthesis to be examined more closely than was hitherto possible. The biosynthesis in the mutant and in the parent strain of *E. coli* is discussed.

Gerard A. O'Donovan

Texas A & M University
College Station, Texas 77843

Jan Neuhard

University Institute of Biological Chemistry
Copenhagen, Denmark

The Ages of Lunar Maria

The previously presented geomorphic index (*Geol. Soc. Amer. Bull.*, **81**, pp. 337–352) is a quantitative description of the geomorphology of lunar surfaces. In the case of the maria but not of the highlands, the geomorphic index is proportional to the age of the mare surfaces, thus permitting the determination of their relative ages. The geomorphic indices of the maria show that each mare surface is not the result of a single effusion, but of several that occurred over a span of time. From a stratigraphic point of view, there is a lateral interfingering of the effusions of different maria. Certain maria, such as Tranquillitatis, have older surfaces than other maria, meaning that effusions started earlier in some maria than in others, or that older effusions were buried by younger ones. Young effusions are lacking on the surface of certain maria, such as Humorum, indicating that the end of the effusive activity was not contemporaneous for all the maria.

A preliminary translation of the geomorphic index into age in years is attempted by using the Apollo 11 and 12 radiogenic ages. By using the range of values obtained by four models, the most recent effusion can have any age between zero and 2.6×10^9 years. Older effusions, however, can be dated with a smaller range. The oldest appear to have an age of more than 4×10^9 years. The principal conclusion of the study is that the mare effusions were not a relatively short-lived phenomenon but occurred throughout a considerable portion of the lunar geological history.

L. B. Ronca

Lunar Science Institute
Houston, Texas 77058

New Methodology to Reduce the Environment–Heredity Uncertainty About Dysgenics

Can science evaluate dysgenic contributions to growing white and Negro social problems? A proposed diagnosis of evidence that dysgenics is most severe for Negroes [W. Shockley, *Science* 21 Oct 66, *Proc. Nat. Acad. Sci. USA* Jun 67, May 69, Dec 69] would determine effects

of racial composition, estimated from "tracer genes," on IQ for half-siblings in environments controlled to the degree of being in the same illegitimate nonwhite slum family. A new proposal combines improved accuracy in determining racial composition of populations (T. E. Reed, *Science* 22 Aug 70 finds 22 ± 1% Caucasian genes in Oakland, California, negroes) with population IQ differences (R. Heber describes environmentally matched Milwaukee school populations averaging 30 IQ points difference depending on mother's IQ being above or below 80). The hypothesis that the difference arises from racial mixes of 33 and 11% for the two populations respectively results in the testable prediction of 84 versus 30 instances of Reed's Caucasian gene for the two groups of 300 children each. A Negro university offers a comparable research possibility for which environmental influences of Caucasian genes might be negative rather than positive. Racial compositions could be determined for test populations selected on the basis of higher and lower performance on both nationally standardized tests and alternatively on any locally accepted measures of intellectual achievement. Resulting facts would be relevant to important national social objectives. Estimates of the variance of racial composition support the feasibility of this proposal.

William Shockley

Stanford University
Stanford, California 94305

Role of Laboratory Studies in Space Science

During the past two decades space research has been greatly expanded and accelerated through the use of rockets, satellites, and ground-based telescopes. These have collectively provided the bulk of the primary data regarding the nature and composition of the earth's environment. The interpretation and understanding of these data depends on a knowledge of the collision properties of the various charged and neutral species present. These data have been provided primarily through laboratory investigations by means of a variety of experimental techniques. Of these some seek to accurately reproduce in the laboratory certain atmospheric phenomena while others isolate discrete atmospheric species, which are then studied as they react with each other. This paper will briefly but critically review the major laboratory techniques currently in use and identify major problem areas.

R. F. Stebbings

Rice University
Houston, Texas 77001

Observability of Single Atoms in Biological Molecules

To form an image of a single molecule in which the images of the individual atoms are resolved, the wavelength of the illuminating radiation must be similar to or smaller than the interatomic spacing ($\lambda \lesssim 1$ Å), and each atom imaged must scatter (or absorb) at least one quantum of radiation. Although the effects of elastically scattered quanta on molecular structure may be ignored, the inelastic collisions will lead (with a certain probability) to molecular dissociation or rearrangement, and the "image" formed will be a composite picture of the molecule over the history of its irradiation and may bear little relation to its original structure. On the basis of estimates of the molecular damage caused in the observation process we conclude that "molecular microscopy" of biological molecules in which the individual atoms are resolved is impossible with an electron or x-ray microscope. Similar conclusions are reached with respect to microscopes using all other possible illuminating radiations, with the possible exception of neutrons.

G. T. Trammell

Rice University
Houston, Texas 77001

J. R. Breedlove

Rice University; present address E.G.&G.
Los Alamos, New Mexico 87544