Book Reviews

Creating New Elements

Super-Heavy Elements. Theoretical Predictions and Experimental Generation. Proceedings of a symposium, Ronneby, Sweden, June 1974. SVEN GÖSTA NILSSON and NILS ROBERT NILSSON, Eds. Nobel Foundation, Stockholm, and Almqvist and Wiksell, Stockholm, 1974. iv, 188 pp., illus. Paper, 88 Sw.Kr. Nobel Symposium 27, Physics. Also published as *Physica Scripta*, vol. 10A, 1974.

The creation of new elements in the periodic table is a fascinating branch of nuclear science. In the last 35 years, 13 and possibly 15 new elements heavier than uranium (element 92) have been synthesized—mostly in the United States. In recent years the Soviet Union has become a major competitor, and elements 104 and 105 remain unnamed because of controversy about where they were first produced. The slow climb up the periodic table, however, is drawing to a close. Atomic nuclei exist because the nuclear force operating between nucleons, which holds the nucleus together, exceeds the coulomb force operating between protons, which tends to blow the nucleus apart. For each new element created an additional proton is added, and the stage has now been reached at which the coulomb force is dominant and nuclei fly apart by spontaneous fission before their properties can be studied.

In 1966, as a result of theoretical calculations, a new island of nuclear stability was predicted in the region of atomic number 114. This stability results from including certain shell effects that essentially increase the nuclear force so that it again dominates the disruptive coulomb force. These nuclear shell effects are analogous to the atomic shell structure that explains the periodic table of the elements. Element 114 with an atomic mass of 300 (some 40 mass units heavier than the heaviest element yet known) is predicted by some theorists to live a substantial length of time—perhaps 10^9 years. Its discovery in nature or its production in the laboratory would represent a dramatic and important step in the development of nuclear science.

The symposium of which this book is the proceedings was devoted to the theoretical predictions of, and the experimental searches for, these superheavy elements. Such proceedings by their very nature make few concessions to lay readers, and this one is no exception. Several of the invited papers can be read with profit by nonexperts, however. In particular, a good summary is provided in the introduction by S. G. Nilsson, a member of the organizing committee and an important contributor to the theory of superheavy elements. Subsequent articles by G. T. Seaborg (former chairman of the U.S. Atomic Energy Commission and codiscoverer of most of the known new elements) discussing the predicted chemical properties of several of the superheavy elements, by A. Bohr and B. R. Mottelson (who, along with J. Rainwater, were winners of the 1975 Nobel Prize in physics) discussing some current themes in nuclear research, and two articles, one by G. Herrmann and the other by M. Nurmia, discussing searches for superheavy elements in nature past, present, and future are all of substantial general interest.

To summarize briefly the results of the conference, superheavy elements have as yet neither been found in nature nor produced artificially in heavy-ion-induced nuclear reactions. The theoretical predictions, considerably refined over those of eight years ago, still call for an island of stability near atomic number 114 and atomic weight 298. No plausible mechanisms for the production of these elements during the cataclysmic astrophysical processes in which the present stable elements were synthesized have yet been advanced, however, so their existence in nature is unlikely. Their synthetic production will have to result from laboratory bombardment of heavy-element targets with relatively high-atomic-number ion beams from present or future accelerators. The best combination of ion beam species, energies, and targets to employ is not known. Much valuable tilling of the earth in this fertile heavy-ion field will occur before the few gold coins buried there are found—if indeed they ever are.

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Substrates of Human Behavior

Biogenetic Structuralism. CHARLES D. LAUGHLIN, JR., and EUGENE G. D'AQUILI. Columbia University Press, New York, 1974. xii, 212 pp., illus.

Biogenetic Structuralism has two main themes. First, it discusses the nature of structuralism as a philosophy, and advocates it as the best means of establishing the basic and universal rules that control human behavior. Second, it argues that such rules are embodied in "neurognostic models" that are to a considerable extent genetically determined and must therefore be studied as products of past biological evolution in exactly the same way as the human foot or hand. Both arguments seem to me to be of general and great importance, and the failure of the authors to substantiate their claims and so to convince a wide audience is disappointing.

As I understand it, structuralists attempt to deduce the underlying rules by which complex organization may be generated from simple premises. Such induction is, of course, part of all scientific investigation, but it is peculiarly characteristic of certain areas of science: embryology, for example, has always been concerned to establish the nature of the instructions that control the series of decisions that allow every fertilized egg of a species to generate a structure of extraordinary complexity and yet of precisely similar form. Structuralism as embodied in the writings of Lévi-Strauss has the special additional attraction that it gives a systematic and coherent description of very varied phenomena, such as social organization; it is not always clear, however, how far the hypothetical deep structure that allows such description is actually concerned in the generation of the phenomena. Laughlin and d'Aquili discuss this ambiguity in a section that deserves careful reading.

Clearly it would have been possible to concentrate on psychological and ethological evidence for behavioral universals in man and his near relatives, and thereby expose hypotheses more directly to verification or disproof. Instead, the authors chose to concentrate much of their effort on endeavoring to find the neutral substrates for the "deep structures" postulated by Chomsky and Lévi-Strauss (and even Jung). This may be a justifiable strategy in that the audience that is most inclined to view the infant mind as a tabula rasa is also most familiar with such work, and so most readily convinced by arguments based on it. However, its use is an enterprise of great difficulty, and Laughlin and d'Aquili seem to me not to have been able to carry the self-imposed burden.

An attempt to ascribe the universals of language or society to "neurognostic models" present in all infants because they are to a substantial extent under genetic control must begin by considering in detail how far such universals may be imposed by the anatomy and physiology of the human body and the nature of the physical environment. It is possible that some features of behavior are universal because they depend, for example, on the fact that all women have two breasts, or that objects fall toward the earth's surface. I am sure that it is unfair to Chomsky to present as a major insight into the genetic basis of language that "The boy broke the window" and "The window was broken by the boy" are sentences having a common deep structure. As long as bricks are hard and glass is brittle any description of such an event is bound to convey the same small number of pieces of information.

A major opportunity was missed by the failure to compare in as great detail as possible the data now available for specific aphasias with modern theories of linguistic deep structure. Perhaps the loss of particular categories of verb following certain lesions can be viewed as a test of such linguistic theory, perhaps not: the arguments involved must rest on a great deal of detailed comparison which is not undertaken here.

Lévi-Strauss's position is also presented fairly cursorily, although here conciseness is more reasonable. The authors concentrate on the hypothesis that the "primitive mind orders things in terms of opposites." They suggest that such a tendency could be profitably explored by studying neural structures that are involved in the analysis of spatial relations, and advance the parieto-occipital region as a candidate. The organization of abstract and contrasting concepts into a spatial display by mechanisms evolved to deal with real spatial relations is clearly a fascinating subject for study. A real weakness, at least in presentation, is that some readers will require evidence as to how far the binary oppositions proposed by Lévi-Strauss as basic to the organization of complex social structures exist in minds other than his own.

The authors add three other examples of their own of "genetically determined structures underlying cognition." These are: (i) social bonding, which is rather oddly described as "alignment of (experience of) self with conspecifics to form a group," (ii) mastery and euphoria versus helplessness and depression, and (iii) phobias and "positive alignments." Again there is little attempt to review the published evidence, although this could have been very valuable. In the case of phobias, for example, a good deal is now known in animals of the basis for species-specific responses to predators.

Finally, the biological content of the book has serious faults. In general, the position is taken that increased complexity of neural connections was produced by allometric growth of the human brain as a consequence of increased body size, and that the new abilities that resulted were only then subject to direct selection pressure. The consequences of increased brain size following an increase in body size remain a fruitful field of argument. I believe that their importance may be exaggerated: within animals of very similar body plan allometry is usually not marked. In any case, in the human line it is quite clear that much of the absolute increase in brain size is due not to allometry but to a change or changes in the relation of brain size to body size, which in turn presumably reflect new selection pressures on behavior. Any balanced treatment should also include the evidence that special abilities characteristic of man, such as the ability to mimic complex sounds or to convey accurate information about the position and distance of absent food sources, can evolve (as, for example, in parrots and in bees) independently of each other.

It is also disturbing to a biologist to be told that social structure ("culture") is selectively neutral, that selection in man was for increasing neural complexity (rather than for the ability to do something), and that depression evolved as a means of eliminating failures from a social group.

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Far Eastern Prehistory

The Traditional Culture and Society of Korea. Prehistory. Papers from a conference, Honolulu, June 1971. RICHARD J. PEARSON, Ed. University of Hawaii Center for Korean Studies, Honolulu, 1975. viii, 210 pp., illus. Paper, $4.50. Occasional Papers of the Center for Korean Studies, No. 3.

Prehistoric research in Korea was virtually monopolized by Japanese before 1945. When the Japanese left, there were few trained Korean personnel to conduct the inquiry into the prehistoric past of their own land. Papers in this volume summarize the accomplishments, in spite of the often unfavorable sociopolitical circumstances, of the last two and a half decades. The three Korean contributors are from South Korea, but the papers attempt to cover the cultural remains of both North and South Korea, from the Paleolithic beginnings to the early Metal Age in the first millennium B.C.

The volume editor, Pearson, describes Korean prehistory as an "infant discipline" and states that "the major temporal and cultural divisions are still being blocked out" (p. 1). It is hoped that the completion of this process will see definition of temporal units that are meaningful in the Korean situation. This reviewer fears that the North Korean scholars' argument for the existence of a real "Bronze Age" in Korea, summarized by Jung-bae Kim, may result in the creation of an artificial cultural unit. Certain Japanese scholars in the past called those assemblages which include various forms of bronze, iron, and stone artifacts, among them stone implements duplicating bronze forms, "Aeneolithic." This term, with a possible connotation of derivativeness, apparently offends Korean scholars. Whether these first-millennium-B.C. assemblages should be called "Aeneolithic" or "Bronze Culture" seems a curiously futile argument. From this distance, it appears that the cause of national pride would be better served by a chronological framework that is most applicable to the task of understanding Korean culture history in its own terms.

Similarly, it is misleading to label the assemblages from the lower strata of the Sŏkchang-ni as "Lower" and "Middle" Paleolithic, on the basis of general resemblances of specimens to artifacts recovered at Ting-ts'un in North China, and even at La Quina, France. Geological and chronometric information is urgently needed. Even when this is available, one wonders whether the tripartite division of the Paleolithic into "Lower," "Middle," and "Upper" is a really meaningful framework for dealing with East Asian assemblages. I have found that it is not, as far as Japanese assemblages are concerned.

Ethnic identities of prehistoric populations constitute one of the major concerns of the authors, and cultural changes are seen as the results of migrations and influences. Wŏn-yong Kim, following the long-established practice of dividing Korean "Neolithic" pottery into Plain and Comb-pattern, suggests that both the early Plain pottery group and the early Comb-pattern group were Paleo-Asiatics who arrived from Siberia around 4000 B.C. and 3000 B.C., respectively. This was followed, beginning about 2000 B.C., by "sporadic migrations of Manchu-Tungus," who are credited with the introduction of agricultural technology into Korea. The Comb-pattern Paleo-Asiatics "were gradually chased away or assimilated by the incoming Tungusic bands" (p. 85). The end of the "Neolithic," and the beginning of