

through" applies. This may be unfair; somehow I also read into the book the implicit statement that "if you think things are bad here, you should see the United States." If true, this assessment derives more from the contributions of the two Americans who participated in the symposium than from any British proclamation of superiority. I am not convinced that Britain is significantly closer than we to that hypothetical steady state which theoretical ecologists like to dream about.

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## Chemistry of Natural Products

Only infrequently does one who reviews a volume the size of this one find that the task is not onerous but actually thrilling and immensely stimulating. R. H. F. Manske, who edited the volume, **The Indole Alkaloids** (Academic Press, New York, 1965. 877 pp., \$32), is to be congratulated for having assembled an all-star cast of collaborators for the production of this latest volume of his definitive series, "The Alkaloids: Chemistry and Physiology."

In the entire field of the chemistry of natural products, the explosive advances made during recent years in the chemistry of the indole alkaloids probably have no parallel. In volume 7 of the series (1960), treatment of the subject comprised some 200 pages; the present volume runs to something like four times that number of pages, with most of the content being new. Material reported in previous volumes is summarized to the extent that the present volume is self-consistent but not repetitive.

The book contains 22 chapters written by such authorities in the alkaloid field as A. R. Battersby, E. Coxworth, B. Gilbert, J. E. Saxton, E. Schlittler, G. F. Smith, A. Stoll, W. I. Taylor, and Manske himself, with the assistance of coauthors in some instances. The impact of the development of new physical methods such as nuclear magnetic resonance (NMR), mass spectrometry, and x-ray analysis on the solution of the problem of structure assignment and stereo conformation is apparent throughout the volume. This is strikingly emphasized by the fact

that in volume 7, which covers the literature through 1957, five pages were devoted to alkaloids of the *Aspidosperma* and the structure of no member of the group was known. In volume 8, 178 pages are devoted to this group. The extensive compilations of fragmentation patterns and NMR data will be of invaluable help to those who, in the future, engage in structural studies of natural products.

Classification of the alkaloids is becoming increasingly difficult, and for the most part a system based on botanical origin has been used in this volume. This necessarily involves some overlap, but repetition is avoided by judicious cross-referencing. The book's appeal to the taxonomist will be great.

The literature is covered through 1964, a feat not frequently encountered. In some chapters references to *Chemical Abstracts* are included in citing work published in obscure journals, a practice that merits commendation.

The typography is excellent. The relatively high cost of the book seems quite justified in view of the plethora of projection structures and tables. I noted only one minor error.

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## Geobotany

The science of geobotany, or the use of plants as indicators of variations in the chemistry or water availability of the substrate, has not been adequately developed in the United States. Government agencies have made a few studies of the use of indicator plants in prospecting, and several bulletins describing phreatophytes that indicate groundwater have been published. University research in this field has not been significant, and that of private companies, of course, is not being published. The governmental organization and integration of environmental projects in Russia have advanced the science markedly in that country. A geobotanist is automatically included on all geological expeditions. Maps of plant distribution are first made from the air and later ground checked as additional environmental data are acquired. Fine maps of plant distribution are available for all of Russia, and detailed studies are being made con-

tinuously by a large staff of well-trained scientists.

This volume, **Plant Indicators of Soils, Rocks, and Subsurface Waters** (Consultants Bureau, New York, 1965. 222 pp., \$27.50), edited by A. G. Chikishev, is a collection of papers given at a joint conference of the Geographical Section of the Moscow Society of Naturalists, the All-Union Research Institute of Hydrogeology and Engineering Geology, and the All-Union Aerogeological Trust by workers who have been studying the effectiveness of geobotanical indicators in solving a wide range of scientific and practical problems. According to the preface, plant indicators are being used "in the agricultural evaluation of territories, in engineering and geological surveys, for clarifying hydrogeological conditions in irrigated districts, for studies of swamps intended for industrial and agricultural uses, in prospecting for certain species of useful fossils, etc." The book includes fairly generalized review papers by the well-known geobotanists, Viktorov, Voronkova, Vostokova, Vyshivkin, Shvyryaeva, and Nesvetailova, and detailed accounts of specific projects by 44 new workers.

A half-dozen papers deal with the use of plants in determining the chemical composition of, and depth to, groundwater. This knowledge has aided greatly in the search for freshwater in southern deserts, and in areas of salt water north of the Caspian Sea. Other papers describe the use of plants in determining the structure of peat deposits, and the degree of decomposition, the humidity, ash content, and groundwater level in bogs.

Plant distribution is used in engineering geology to determine the extent of particular soil units, the mechanical composition of the subsoil, and general hydrogeological conditions. Indicator plants are also used to assess soil fertility, delineate alluvial plains, evaluate salinization, dryness, and so forth.

Indicator plants are being used as aids in mapping Quaternary deposits of various kinds, including fluvio-glacial and morainic deposits, and in prospecting for salt domes and kimberlite dikes.

Shvyryaeva gives a fine discussion of the compilation of geobotanical maps. If data are collected on the soils, the age, genesis, and lithology of the underlying rocks, the salinity of the rocks, the depth and mineralization at the groundwater table, and the geomorphology at the time of plant map-

ping, then a series of indicator maps can be created from the original map. Thus, individual maps are compiled of soils, lithology, salts, geomorphology, and water conditions. Lastly, these can be variously combined to show potential for agricultural use and the dynamics of salinization of soil-forming rocks.

It is important that these progress reports on geobotanical research in Russia be translated into English so that American geochemists can study them. This volume is, therefore, very valuable to anyone who uses plants as indicators. Unfortunately the translator was not acquainted with botanical jargon, and the translation is, therefore, a literal one. It is difficult to understand the meaning of "coedificator," the bedding groundwater, and similar expressions. The book is not for light reading, but for close study by experts in the fields discussed. It is invaluable in an English-speaking world devoid of comparable plant research.

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## Koyré's Newtonian Studies

Alexandre Koyré died on 28 April 1964. Beginning his career in the Paris of Meyerson and Brunschvig, he first studied the religious thinkers of the 16th and 17th centuries; but he later moved more and more into the history of scientific thought, where he made himself probably the most profound, and the most widely respected, scholar of his generation. The first major fruit of this interest was the book *Études Galiléennes* (1939), which gave a new depth and perspective to our understanding of Galileo's true contributions, while making us realize fully for the first time how strong were his intellectual ties to his predecessors—and even to antiquity.

Unlike George Sarton, who took all history, sciences, and civilizations as his province, Koyré placed voluntary limitations on himself. His chosen area was that of cosmology, astronomy, and mechanics from Copernicus to Newton; and in recent years, dividing his time between the *École Pratique des Hautes Études* (Paris) and the Institute for Advanced Study (Princeton), he published a series of notable papers on the ideas of Isaac Newton. Many of these papers arose

from his unfinished collaboration with I. B. Cohen of Harvard on a definitive scholarly edition of the *Principia*, and they have already taught us how far, until our own times, Newton had been deified rather than understood.

The present posthumous collection, *Newtonian Studies* (Harvard University Press, Cambridge, Mass., 1965. 269 pp., \$7.95), by Koyré, comprises six shorter papers from the years 1948 to 1961, all of which have already appeared in the journals, together with one major and extensive essay—not hitherto available, and running (with its appendices) to some 150 pages—on the intellectual affiliations between Descartes and Newton. This study, based on a Horblit Lecture first given at Harvard in 1961, demonstrates convincingly the dominant role of Descartes' work in determining, not merely the "Cartesian" system of physics which Newton's *Principia* was designed to sweep aside (and so its literary layout) but the very form of the questions and concepts with which Newton himself operated in building up his own theories.

In expounding his profound interpretations of past scientific thought, Koyré used all the resources of a perceptive and generous spirit; and he succeeded, more than any other of his contemporaries, in balancing the claims of science, philosophy, and religion against those of "history," more narrowly understood. Those of us who disagreed with him in print on points of detail would be greeted at the next meeting with an affectionate "*Ah, mon cher adversaire*"; we have learned from him some of the secrets of humane scholarship, and we are the losers—personally as well as professionally—by his death.

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## Dilemma of Research Strategy

In a prisoner's dilemma each of two players independently selects one of two actions, C (for cooperative) or D (for defecting), and their combined choice determines an outcome for each. Their dilemma is this: no matter which action the other player takes, each prefers his outcome from choosing D to that from choosing C; yet, should both choose D, the outcome is less preferred by each to the

outcome that would have been received if both had chosen C. Such dilemmas are not just pathologies of game theory; they abstract into stark relief the dilemma between individual and social rationality often encountered in unbridled competition. To my knowledge, real dilemmas of this character are only resolved in favor of social rationality by altering the "game" through legal sanctions, subsidies, and the like; and when a suitable external social framework is absent or weak—for example, in an arms race between two sovereign nations—man's inability to find an acceptable resolution is only too grimly apparent. Such social analogies make clear why an investigator might be interested in how people behave in such games and how that behavior can be manipulated.

In *Prisoner's Dilemma* (University of Michigan Press, Ann Arbor, 1965. 270 pp., \$7.50), Anatol Rapoport and Albert M. Chammah report a number of studies with money payoffs; a total of 370 pairs of college students were run, each pair making hundreds of choices in one or more games. Although a good deal of analysis of the protocols is given, the main results seem to be three. First, subjects tended to be initially cooperative, quickly shifted to predominately D choices, and then the pairs gradually fixated on either DD or CC choices, with the latter rather more frequent. The final correlation in behavior within pairs did not stem from strong initial correlations but was rather a result of the interaction. Second, the final split between DD and CC choices varied with the exact payoffs and with the explicitness of the situation (when the payoff matrix was given, the percentage of CC choices was larger than when the matrix had to be inferred from trial-by-trial outcomes). Third, pairs of males ended with CC choices more often than did pairs of females. The authors show that this is not due to any initial differences in their disposition to choose C, but rather reflects the fact that the males were more likely to respond cooperatively to the other's C choices than to retaliate to the other's D choices, whereas the females were somewhat more likely to retaliate to D's than to cooperate to C's. Both tendencies were attenuated when males were paired with females.

These experiments appear to be at least as systematic and convincing as most experiments in social psychol-