

The utility of these systems for such studies is well brought out in this interesting volume, and almost every paper reports astonishing phenomena. The volume will among other things be a useful source of good stories for undergraduate teaching. For example, Bierne splits male and female nemertine worms longitudinally and successfully grafts heterologous halves together to create sexual chimeras. He describes maintenance of both gonadal types in the intersexes (the male half eventually predominates at least until the chimera is very old) as well as the effects of these manipulations on differentiation of accessory sex organs and surrounding somatic sexual specializations such as gland cell and pigment distribution.

Pfannenstiel describes a protandric polychaete *Ophryotrocha*, where a single individual is always male as a juvenile and then becomes permanently female. However, when a pair of females meet one of the two sheds its oocytes and its jaw apparatus and within seven days becomes a male with the proper male jaw. After spawning, the sex roles reverse, and alternation of sex and jaws between the two individuals will occur as long as the pair are kept together (the "Paarkultureffekt"). This is presumably the result of an unknown pheromone.

Using the insect *Icerya purchasi*, M. Royer describes a functional hermaphroditism derived from two separate germ lines in each individual, one haploid and one diploid. These two lines arise from the same polyspermic egg, the haploid line arising from accessory sperm pronuclei.

R. W. Harrington describes sex determination in hermaphroditic self-fertilizing clones of the fish *Rivulus marmoratus*, where true females are rare or nonexistent and where the production of males is temperature-controlled. Further, there can be two types of males: primary, which bear no female ducts, and secondary, which are hermaphrodites in which the female genital apparatus has been temporarily suppressed. Self-fertilizing clones of *Rivulus* have been maintained in the laboratory for over 14 years (27 uniparental generations). Reinboth and his colleagues report on experiments using the well-known Siamese fighting fish (*Betta splendens*), where removal of the sex organs of the nearly mature female results in regeneration of male gonads and sexual apparatus. The male aggressive behavior and secondary sexual characteristics also appear.

The broad range of organisms used in the research reported here is surprising. Evidently intersexuality, either permanent or transitional, is well distributed and common throughout the animal kingdom. Also evident is ignorance concerning the exis-

tence of genetic mechanisms of sex determination for most of the organisms manifesting it. It would seem useful to direct some of the considerable energies devoted here to the search for male or female sex-determining neurosecretory cells to careful karyotype analysis. Though matings can provide clues to possible chromosomal mechanisms of sex determination (as in the contribution of T. Ginsburger-Vogel), they can also produce results that would be easier to interpret if the chromosomal constitution were better known.

A concise review article by U. Mittwoch on the chromosomal mechanisms of sex determination concludes the volume. It is almost wholly confined to the vertebrates. The mechanisms of sex regulation and differentiation in invertebrates appear at this point too variable and are still too inadequately described to permit a coherent viewpoint to emerge.

Despite the diversity of sexual variations recounted in the volume one is constantly reminded of the primacy of femaleness. With few exceptions, female differentiation occurs unless it is suppressed by male-inducing substances or occurs as soon as male-inducing factors disappear. It tends to be the underlying state, as exemplified by the presence of rudimentary ovaries in permanently asexual strains of *Planaria* (Lender and Briançon). Even where the organism in question ends up a male, it often turns out to be distinctly in the minority in the population and may be a sex-reversed female trying to increase the frequency of her genes within the population by behaviorally or hormonally suppressing the reproduction of other males or females (*Science* 190, 633 [1975]).

A curious problem arises from the specific set of differentiation restrictions placed on the primary germ cells. As nearly every paper in the volume demonstrates, oogenesis and spermiogenesis can take place simultaneously within the same gonad, often without a visible boundary between the two cell types. Some of these cases almost certainly represent transitions of sex, where the gonad bears remnants of the germ cell complement of the old sex at the same time the gonia of the new sex are maturing. However, many appear to be cases of functional hermaphroditism. A number of authors have demonstrated that germ cell differentiation is independent of sex chromosomal constitution. Rather, it appears to rely on the hormonal milieu. The simultaneous differentiation of the two germ cells in the same gonad argues against single hormonal factors, however. To account for the phenomenon one can imagine two populations of sex-determined gonia arising independently of somatic sex, an autosomal sex differentiation

mechanism (responding to the external environment), a nonantagonistic hormone system like that suggested for *Lymnea* (Joosse), or a single branch point in the germ-cell differentiation program. The last possibility is particularly intriguing.

The symposium has brought together a group of workers who have published largely in European journals in French or German. The editor has seen to it that all the papers from the symposium are published in English, providing in the process a reference source for work that would have surely been largely overlooked by the English-speaking scientific community. One can object to awkward translation in some cases, and to mechanical errors in others (whole sentences repeated, for example), and even to the layout itself, which does not commend the printed page to the eye, but the overall value of the volume to so many endeavors and the thought-provoking information it contains far outweigh such matters.

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Celestial Mechanics. Vol. 4, Periodic and

(Continued on page 878)

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AN INTRODUCTION TO BIO-INORGANIC CHEMISTRY edited by David R. Williams, *The Univ. of St. Andrews, St. Andrews, Scotland. (23 Contributors)* Designed to provide an introduction to the field of metal ions in biological systems, this book demonstrates that bio-inorganic chemistry is a living, expanding subject that is both interesting and challenging. Sections describe the three natural divisions of the field: general principles of bio-inorganic chemistry, experimental methods used to produce the facts that gave rise to these principles, and application of these principles to medicine. '76, 416 pp. (6 3/4 x 9 3/4), 341 il., 62 tables, \$24.50

HUMAN ECOLOGY AND SUSCEPTIBILITY TO THE CHEMICAL ENVIRONMENT (5th Ptg.) by Theron G. Randolph, *The Swedish Covenant Hospital, Chicago.* How safe is our present chemical environment? To what extent does it contribute to chronic illness? How much do we know about the long-term effects of the by-products of progress? This synthesis offers a set of answers to these questions. Major chemical incitants are described along with their most common sources. The author explains the diagnostic routine of comprehensive environmental control, shows how finding and avoiding the inciting causes of illness is superior to treating the effects of the illness, and suggests treatment based on avoiding the incitants and increasing the individual's resistance to the chemical environment. '76, 160 pp., 1 il., \$8.50

CANCER GENETICS edited by Henry T. Lynch, *The Creighton Univ. School of Medicine, Omaha, Nebraska. (29 Contributors)* In this broad approach to cancer genetics, Doctor Lynch covers a wide range of problems associated with familial cancer. These include immunology; HL-A histocompatibility system; oncogenic viruses; cytogenetics; migrant groups; nongenetic factors such as cigarette smoking, and their interaction with host factors in lung cancer etiology; xeroderma pigmentosum and other disorders associated with hereditary predisposition to cancer. '76, 656 pp. (6 3/4 x 9 3/4), 222 il., 106 tables, \$49.50

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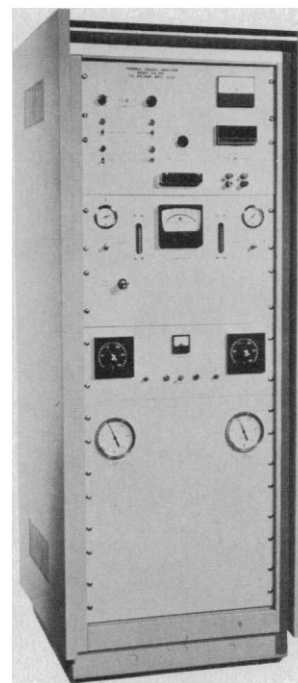
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Biological air sampler monitors airborne contamination

The NBS slit-to-agar microbiological air sampler is widely used for determining contamination levels in all environments. It is used for monitoring microbial levels in aseptic manufacturing facilities, surgical environments, isolation areas, laboratories and other special purpose facilities. Airborne particles 0.5 microns and larger are drawn onto a rotating agar plate. The plate is then incubated, colonies counted and a record of airborne organisms by number and type can be obtained as a function of specific time intervals.

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