development in an interpretation of phylogenetic relationships. Drawing on his own experience and the extensive literature he presents a new basis for phylogenetic analysis of annelids and arthropods, emphasizing the similarities and dissimilarities of the formation and fate of presumptive areas of the blastulas or blastoderms.

In eight chapters Anderson reviews the development of presumptive areas and presents fate maps for representatives of the polychaetes, the oligochaetes and leeches, the onychophorans, the myriapods, the apterygote and the pterygote insects, the crustaceans, and the chelicerates. These chapters are clearly and simply illustrated to present a basis for comparison and interpretation.

The final chapter is an attempt at an interpretation and synthesis of the evidence, in which Anderson presents his conclusions. The patterns of development in the Onychophora include all the developmental diversity and specialization exhibited within the Myriapoda and the Hexapoda. Anderson suggests that the onychophoran-myriapod-hexapod assemblage is a unitary phylogenetic group, the Uniramia. On the basis of embryological evidence none of these is regarded as ancestral to the others but each as having diverged independently from a common lobopod ancestor. The Crustacea form a second unitary group of arthropods, with the evidence suggesting a more distinct unity in their embryonic development than in that of the Uniramia. Comparison and analysis of developmental patterns of the Crustacea, Annelida, and Uniramia bring Anderson to the conclusion that these three groups are unrelated except insofar as all are members of a larger assemblage of invertebrates with a basic pattern of spiral cleavage.

The Chelicerata emerge for Anderson as a third unitary group of arthropods with a distinctive developmental pattern. Their total cleavage and the details of the arrangement of presumptive areas make difficult a linkage with the other groups. Anderson concludes that analysis of such features rules out any association with the Uniramia. A relationship of the Chelicerata to the Annelida or the Crustacea can be neither confirmed nor denied on the basis of his analyses. The absence of any evidence of spiral cleavage in the Chelicerata may suggest a phylogenetic origin independent of the other arthropod groups and the annelids.

Anderson concludes on the basis of studies in comparative embryology reviewed here that the arthropods constitute a polyphyletic assemblage, as previously suggested by Manton. He recommends that at least three phyla (Uniramia, Crustacea, and Chelicerata) should replace the currently accepted phylum Arthropoda. We may be sure that the last word is not yet in on this controversy of long standing.

This volume is a welcome addition to the literature. It is of importance as an effort to bring order and understanding to the chaotic literature of descriptive embryology of these segmented invertebrates. The emphasis which Anderson has given to the development and presentation of clear diagrammatic maps of the presumptive areas and to their use as a basis for interpretation and speculation is to be commended.

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Life under Pressure

Barobiology and the Experimental Biology of the Deep Sea. Proceedings of a symposium. RALPH W. BRAUER, Ed. North Carolina Sea Grant Program, University of North Carolina, Chapel Hill, 1972. xiv, 428 pp., illus. Paper, $10.

No marine biologist can resist comparing the volume of the oceans with that of the terrestrial biosphere. Leaving aside the actual biomass and its importance to man, the comparison shows that more than 99 percent of the globe's animated envelope is oceanic. Most of this impressive figure stands for an environment that is subjected to biologically effective hydrostatic pressure. With the *Challenger* expedition, it became known that life exists at all depths in the oceans, and this may be considered the start of pressure biology. Originally limited to morphological and ecological observations, "barobiology" gained new momentum as physiological effects of pressure became of interest during World War II. These studies were last summarized in the mid-1950's (F. H. Johnson, H. Eyring, and M. J. Polissar, *The Kinetic Basis of Molecular Biology*, Wiley, 1954).

Almost two decades' lack of comprehensive literature on pressure effects on organisms and life processes has been ended in the last few years by an outburst of three books. A collection of review articles, *High Pressure Effects on Cellular Processes* (A. M. Zimmerman, Ed., Academic Press, 1970), was followed by two symposium proceedings, *The Effects of Pressure on Organisms* (M. A. Sleigh and A. G. Macdonald, Eds., Academic Press, 1972), resulting from a September 1971 symposium, and the book under review here, resulting from a symposium held some months earlier. These three treatises cover almost identical ground, and there is an obvious overlap of authors (ten) and topics, which results in a certain amount of overkill.

Of the two proceedings volumes, *The Effects of Pressure* holds a definite advantage in representing the more recent meeting. Because of its predominantly British authorship it has less duplication of coverage. It includes useful complementary information, especially in chemistry, enzymology, microbiology, and animal behavior.

Although Brauer's book is less professional in format, it makes one wish to have been a participant in the workshop. The papers are too numerous for individual discussion. They are grouped under five general headings: Biological and Oceanographic Problems Requiring High Pressure Aquaria; Observations on Deep Ocean Fauna, *In Situ* Experiments, Methods of Retrieving Deep Ocean Fauna and Choice of Potential Biological Materials for Study in High Pressure Aquaria; Chemical Aspects—Sensors, Properties of Solutions and of Macromolecules; High Pressure Aquaria, General Design Characteristics; and Design and Performance Characteristics of Currently Existing High Pressure Aquarium Systems. This strong emphasis on high pressure aquaria is, fortunately, largely limited to the headings. The symposium is actually much broader in scope and comprises studies, or summaries of studies, on the physicochemical, biochemical, cellular, and ecological levels.

The highlights in the transcribed discussions have to be found by patient reading, but they are there. One of them has to do with the observation of an intriguing similarity between the narcotic effect of metabolically inactive gases at normal pressure and that of highly inert gases at elevated pressures. Corresponding similarities are not necessarily found on the molecular level, and it is interesting to note that more information is available from experiments on the physiological effects of hydrostatic pressure on higher forms

of life than on prokaryotic organisms. The meaning of such terms as "barophilic" appears to shift from the organismic to the biochemical level. Some authors stress the point that, independently of deep-sea-related problems, hydrostatic pressure can be employed as an experimental tool like any other physical parameter.

As a state-of-the-art document this book is an extremely useful complement to the two others, especially if one takes the pains to read the "small print." It reveals the obvious divergence of viewpoints and the urgent need for common strategy which are still characteristic of "barobiology" and make another get-together in the near future likely.

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De Broglie's Discovery

Function of Naturally Occurring Polyamines. URIEL BACHRACH. Academic Press, New York, 1973. xii, 212 pp., illus. $12.50.

Bachrach's book presents a concise, thorough, and well-organized summary of polyamine distribution and function. It appears relatively soon after a very similar book by Cohen (*Introduction to the Polyamines*, Prentice-Hall, 1971) as well as several very recent symposia and review articles (which Bachrach cites) covering the major developments in the field in the last 4 or 5 years. The reworking of somewhat familiar data and already well-documented historical landmarks does not detract from the usefulness of this book. Bachrach has succeeded in bringing together the older information and the significant new developments.

This small volume is very complete in the citations of polyamine studies (1099 references). It contains new information on polyamine-containing alkaloids (the inandenines) and a very thorough treatment of the induction and turnover of the now well-characterized enzymes of polyamine biosynthesis. The recent data on the elevation of urinary polyamines in cancer patients and the possible use of polyamine analysis of blood and urine as a diagnostic test to establish malignancy and to facilitate the evaluation of cancer therapy are only briefly considered.

The book should serve as a valuable source of literature citations of clinically oriented investigations of the polyamines. Studies on the concentrations of polyamines and polyamine-synthesizing enzymes in animal tissues and fluids in a variety of disease processes are well covered, and possible regulatory functions of polyamines in the synthesis of nucleic acids and the extensive literature on the hormonal elevation of polyamines and polyamine-synthesizing enzymes are extremely well reviewed. The book should be a valuable record of past, present, and future directions of polyamine investigations.

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Polyamines

Wave Mechanics. The First Fifty Years. WILLIAM C. PRICE, SEYMOUR S. CHISSICK, and TOM RAVENSDALE, Eds. Halsted (Wiley), New York, 1973. xiv, 436 pp., illus. $37.50.

The preface of this interesting volume begins with the sentence, "It is only rarely that the 50th anniversary of a great and fundamental scientific discovery occurs during the lifetime of its discoverer." Furthermore, in this case the honoree contributed the first chapter, entitled "The beginnings of wave mechanics." Louis de Broglie's discovery certainly merits this recognition.

Many of the chapters have a clear chemical emphasis which the editors evidently adopted. Others present important historical accounts by individuals who participated personally. But much of the text is directed to reviewing recent progress in the quantum mechanics of molecules.

De Broglie points out the importance of relativity in his thinking at the time of his historic proposal. He also reminds us that, although the application of the Schrödinger equation to nonrelativistic problems is now unambiguous, there remain debatable aspects in the ultimate interpretation. J. C. Slater and J. H. Van Vleck present interesting historical essays. Coulson's account of the contributions of wave mechanics to organic chemistry is lucid and balanced and should appeal to a wide circle of readers.

In recent years the use of *d* orbitals in hybrid orbital formation has come under attack by Jorgensen, among others, because the radial function for *d* orbitals in most atoms differs so much from that for *s* and *p* orbitals. Pauling and Keaveny in their chapter offer refutation of this argument by showing that a *d* shell may be subdivided into contracted and expanded orbitals. For typical transition element complexes the expanded *d* orbitals have radii comparable to the valence shell *s* and *p* orbitals.

Bagus *et al.* present a high-level discussion of the use of configuration interaction methods to investigate the correlation problem in atoms and molecules. The procedure adopted involves the use of large basis sets and extensive configuration interaction to yield predictions of an accuracy comparable to experiment for systems such as the CH radical where experimental investigations would be difficult or not currently feasible. Particular emphasis is placed on the form of the expansion and the use of methods such as the multiconfiguration self-consistent-field method and the iterative natural orbital method to attain nearly optimum convergence of this expansion.

Kaufman presents some very interesting but detailed and complex results that show how spin and symmetry restrictions yield anomalous behavior for $O^+ + N_2$ collisions at low energy. This chapter shows how reliable predictions can now be made in problems of this type.

The chapters by Dewar and Johnson concentrate almost exclusively on the approximate methods these authors advocate and use. Presumably Johnson's chapter was written before the recent paper of Clementi (*J. Chem. Phys.* **58**, 4699 [1973]), which disputes many of the statements about relative speeds of computation.

The senior editor, W. C. Price, contributes an exceptionally good review of photoelectron spectroscopy and its interpretation in the electronic structure of matter. This chapter will interest experimentalists as well as theorists and provides a generally informed reader an excellent introduction to this relatively new technique.

This volume with 22 chapters contains much valuable material and should be in any quantum mechanics library. Because of the great variation in level of presentation, however, only a few chapters will be of interest to a particular reader at one time. But after further study in general texts, a given reader will find other chapters valuable.

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