ASPECTS *of* SPONGE BIOLOGY

Edited by

FREDERICK W. HARRISON

and RONALD R. COWDEN

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To Jeffrey D. Rude
who died October 12, 1975 at McMurdo Sound, Antartica while conducting research on the biology of sponges.

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Preface

Aspects of Sponge Biology developed from a symposium held in Albany, New York, in May 1975, sponsored by the Society for Developmental Biology and the Department of Anatomy, Albany Medical College. This symposium brought together the majority of North American investigators of sponge biology. The book is unusual in that, in addition to presentations in current investigations, it contains the symposium participants' discussion of several of the problem areas of sponge biology. The introductory chapter is intended for established investigators in other fields who either wish to study the sponges *per se* or to utilize these animals as model systems to clarify basic biological problems. This book, then, attempts to present the sponges as a challenging, virtually untapped resource for future studies. It includes the most current research in the field yet, simultaneously, leads investigators into research opportunities seen for the near future. *Aspects of Sponge Biology* should prove valuable to invertebrate zoologist, cell and developmental biologists, aquatic biologists, ecologists, investigators of cell surface phenomena, comparative physiologists, and to anyone involved in problems of water quality. We feel that the study of sponge biology is entering into an extremely exciting and rapidly evolving period in which the utilization of techniques unavailable in the recent past will not only provide answers to many of the problems now existing in sponge biology but will also raise challenging new questions.

Fredrick W. Harrison
Ronald R. Cowden

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Introduction and General Discussion

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INTRODUCTION: PRINCIPLES AND PERSPECTIVES IN SPONGE BIOLOGY

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Within recent years, the utilization of sponges in research has increased to a tremendous extent. The application of newer technologies to problems of sponge biology has greatly clarified many of the problems that plagued earlier investigators. We feel, however, that the sponges present a virtually untapped tool for use in basic research with many areas of utilization and investigation unrecognized. This chapter is intended, then, to serve as a guide to either the young investigator beginning a career or the established scientist who wishes to utilize, for the first time, sponges as a research vehicle. We realize that it is not possible or reasonable to review all the different facets of sponge biology. However, we wish to introduce the novice to: methods for collecting, laboratory maintenance and examination; key references, including monographs and review papers; and selected areas of research on sponges which need to be undertaken or need to be reevaluated in light of new techniques and/or ideas.

Collecting Techniques

In collecting sponges, the methods employed will often be determined by the collectors' proposed use of the material. If one is collecting for taxonomic studies of marine sponges, for instance, it is best, if feasible, to collect entire specimens. In this case, color photographs, underwater if possible, of the specimens are quite helpful in species determinations. Conversely, with freshwater sponges, the collection of entire specimens is not essential but one should collect gemmule-bearing specimens if possible. This is because most taxonomic schemes in use today employ gemmule and

gemmosclere (gemmule spicule) morphology as diagnostic criteria. In either case, it is important to separate small, five cubic millimeter, pieces of sponge into a histological fixative. Fixatives of preference are Bouins or ethanol-acetic acid (3:1). Following fixation, specimens should be processed routinely through washes, etc., with storage in 70% ethanol. The remainder of the specimen may be placed directly into 70% ethanol or retained as a dried specimen.

Maintenance of Sponges in the Laboratory

The problems of maintenance of marine and freshwater sponges in the laboratory have been reviewed by Fell ('67). Although freshwater sponges are notoriously difficult to maintain in the laboratory, Imlay and Paige ('72) described a simple laboratory system with continuous water flow in which freshwater sponges not only survived for three months but, in most cases, exhibited considerable growth. The continuous flow multichamber system described by these authors used trout fry food (Glencoe starter granules) fed into the first prechamber at the rate of ½ gram of feed per day. Although the exact system described, i.e., direct introduction of raw habitat water, would be impractical for most laboratories, a recirculating system could be easily devised. The design for an inexpensive recirculating system, in this case a refrigerated seawater system for marine organisms, was described by Bakus ('65). This system could be easily adapted for maintenance of freshwater sponges according to the technique of Imlay and Paige ('72).

The various techniques used in laboratory examination of sponges, i.e. explants, dissociation and reaggregation, growth of sponges from larvae, production of sponges from gemmules, and cell culture, have been thoroughly reviewed by Fell ('67) in a particularly informative article.

Current Problems in Systematics

Until recently, the systematics of freshwater sponges was hopelessly confused. The revisionary work of Penney and Racek ('68) brought some degree of order into this chaotic area and, in particular, demonstrated global evolutionary patterns within the gemmule-forming spongillids. However, there are still major areas requiring clarification in freshwater sponge systematics. Traditionally, skeletal and/or gemmule morphology have been the basic criteria utilized in systematic analyses of both freshwater and marine sponges. Increased recognition of the problems caused by ecomorphic variation in skeletal and gemmule structure of spongillids (see Poirrier'69, '74, and this volume) necessitate a more