

# RESEARCHSPACE@AUCKLAND

## http://researchspace.auckland.ac.nz

### ResearchSpace@Auckland

### **Copyright Statement**

The digital copy of this thesis is protected by the Copyright Act 1994 (New Zealand).

This thesis may be consulted by you, provided you comply with the provisions of the Act and the following conditions of use:

- Any use you make of these documents or images must be for research or private study purposes only, and you may not make them available to any other person.
- Authors control the copyright of their thesis. You will recognise the author's right to be identified as the author of this thesis, and due acknowledgement will be made to the author where appropriate.
- You will obtain the author's permission before publishing any material from their thesis.

To request permissions please use the Feedback form on our webpage. <a href="http://researchspace.auckland.ac.nz/feedback">http://researchspace.auckland.ac.nz/feedback</a>

# General copyright and disclaimer

In addition to the above conditions, authors give their consent for the digital copy of their work to be used subject to the conditions specified on the Library Thesis Consent Form.

# THE COMPARATIVE FORM, FUNCTION AND ECOLOGY OF SOME NEW ZEALAND BRITTLE-STARS (OPHIUROIDEA)

Thesis presented for the Degree of Doctor of Philosophy in Zoology, at the University of Auckland

New Zealand

by

Richard John Pentreath

in

August 1968

UNIVERSITY OF AUCKLAND
LIBRARY
15678-68
593.94
P41
Cop.1

Thesis 15678-68 593.94 P41 cop.1

## ACKNOWLEDGEMENTS.

I should like to thank my supervisor, Professor J. E. Morton, for his interest and encouragement throughout the entire course of this study and particularly for reading the manuscript.

Dr. M. C. Miller kindly supervised the work in Professor Morton's absence and has maintained a continued interest for which I am most grateful.

The electronmicroscopy was carried out through the kindness of Dr. S. Bullivant, who also gave invaluable advice on the techniques. Mr. J. J. Fields meticulously prepared the sections and also took the electronmicrographs. Other photographs were kindly prepared by Mr. G. W. Batt.

Many people within the department have been most helpful. In particular Mr. J. Kerr, histologist, has been of great assistance throughout the entire course of this work and I should like to record my thanks for his interest and advice. I should also like to thank the other members of the department, both staff and students, who have readily given assistance on many aspects of this study.

For the use of the facilities of the Leigh Marine Laboratory
I am indebted to Dr. W. J. Ballantine. I am also most grateful
for the kind hospitality received at the Kaikoura Marine Laboratory
through the courtesy of Dr. B. Wisely and at the Portobello Marine
Station as a guest of Dr. E. J. Batham.

The work was carried out on tenure of a Commonwealth Scholarship.

# CONTENTS.

SECTION	1	INTRODUCTION	Page
	1.1	General considerations	1
	1.2	The ophiuroids studied and their occurrence	3
SECTION	2	FEEDING METHODS, AND THE FUNCTIONAL MORPHOLOGY OF THE STRUCTURES INVOLVED	8
	2.1	Introduction	8
	2.2	Methods	10
	PART	1. OPHIUROIDS OF THE LEIGH REEF	
	2.3	Ophionereis fasciata	15
	2.4	Ophiactis resiliens	27
	2.5	Ophiopteris antipodum	33
	2.6	Electron microscopy	41
	2.7	Discussion	45
	PART	2. OTHER INTERTIDAL OPHIUROIDS	
	2.8	Monamphiura aster	56
	2.9	Ophiomyxa brevirima	62
	2.10	Pectinura maculata	66
	2.11	Axiognathus squamata	68
	2.12	Discussion	72
SECTION	3	THE RADIAL CANAL AND OPERATION OF THE PODIA	75
	3.1	Introduction	75
	3.2	The podial valve	76
	3.3	The radial canal and its musculature	77
	3.4	Extension and retraction of the podia	79

SECTION	4	MORPHOLOGY OF THE GUT AND A QUALITATIVE REVIEW OF DIGESTIVE ENZYMES	90
	4.1	Introduction	90
	4.2	Material and methods	91
	4.3	Morphology of the gut	93
	4.4	Peristomial organ	100
	4.5	Qualitative review of enzymes	102
	4.6	Discussion	104
SECTION	5	RESPIRATORY SURFACES AND RESPIRATION	109
	5.1	Introduction	109
	5.2	Possible respiratory surfaces	110
	5.3	Respiration: material and methods	115
	5.4	Respiration: experimental results	116
	5.5	Discussion	124
SECTION	6	GONADS AND REPRODUCTION	130
	6.1	Introduction	130
	6.2	Structure of the gonads, development of the gametes, and the breeding cycle	131
	6.3	Discussion	140
SECTION	7	SOME ECOLOGICAL FACTORS	145
	7.1	Introduction	145
	7.2	Distribution	145
	7.3	Abundance at Leigh	148
	7.4	Arm loss and regeneration	150
SECTION	8	SUMMARY	154