

Parasitology

Symposia of the British Society for Parasitology Volume 20

The Reproductive Biology of Parasites

Edited by P. J. Whitfield



PARASITOLOGY

Symposia of the British Society for Parasitology Volume 20

THE REPRODUCTIVE BIOLOGY OF PARASITES

Edited by

P. J. WHITFIELD

CAMBRIDGE UNIVERSITY PRESS

CAMBRIDGE

LONDON NEW YORK NEW ROCHELLE

MELBOURNE SYDNEY

**Published by the Press Syndicate of the University of Cambridge
The Pitt Building, Trumpington Street, Cambridge CB2 1RP
32 East 57th Street, New York, N.Y. 10022**

© Cambridge University Press, 1983

**Printed in Great Britain at the
University Press, Cambridge**

CONTENTS

<i>Preface</i>	1
<i>List of contributions</i>	2
<i>Chairman's opening remarks</i>	3
The cell biology of sexual development in plasmodium	7
Summary	7
Introduction	7
The sexual cycle	8
(1) Gametocytogenesis	8
(a) Induction	8
(b) Gametocyte maturation	10
(2) Gametogenesis	17
(a) Induction	17
(b) Gamete development	17
Macrogametogenesis	19
Microgametogenesis	19
(3) Zygote formation	22
References	24
Sexual processes in the kinetoplastida	29
Summary	29
Introduction	29
Methods and analysis of data	30
(1) Morphology and cytology	30
(2) Isoenzyme studies	31
(3) Selective markers	38
Evidence for sexual processes	40
(1) African trypanosomes	40
(2) <i>Trypanosoma cruzi</i>	45
(3) <i>Leishmania</i> spp.	48
(4) <i>Crithidia fasciculata</i>	50
(5) Other species	50
Conclusions and prospects	51
References	53
Recent advances in our understanding of pentastomid reproductive biology	59
Summary	59
Introduction	59
Sexual dimorphism	61
Sexual differentiation and development of the reproductive system	62
The reproductive system	66
General structure	66
Copulation and the transfer of sperm	67
The functional anatomy of the reproductive tract	71
Females	71
Males	74
Egg production and the life-cycle	77
Conclusions	78
References	79

The production and functional morphology of helminth egg-shells	85
Summary	85
Introduction	85
The structure and formation of the helminth egg-shell	85
Systematic review of helminth egg-shell structure	86
(1) Digeneans	86
(2) Cestodes	86
(3) Nematodes	86
(4) Acanthocephala	89
Tanning systems	90
Operculae	91
Surface specialization	91
The function of the egg-shell	92
(1) Permeability	92
(2) Mechanical and chemical resistance	92
Desiccation survival	93
Egg-shell spores	93
Conclusions	94
References	95
Patterns of sexual reproduction among parasitic platyhelminths	99
Summary	99
Introduction	99
The development and movement of reproductive cells in male and female systems	100
(1) The male system	100
(2) The female system	101
Inseminative behaviour of parasitic platyhelminths	104
(1) Digenean inseminative behaviour	104
Cross-insemination	105
Self-insemination	106
Mating behaviour of schistosomes	107
(2) Monogenean inseminative behaviour	108
(3) Cestode inseminative behaviour	109
(4) The importance of cross-fertilization to the viability of the species	110
The strength of reproductive barriers between well-defined morphological species	114
References	116
Parthenogenesis and asexual multiplication among parasitic platyhelminths	121
Summary	121
Introduction	121
The use of asexual multiplication and parthenogenesis among parasitic and commensal platyhelminths	122
Parthenogenesis and asexual multiplication among adult digeneans and cestodes	123
Parthenogenesis	123
Amictic multiplication by adult <i>Metacestoides corti</i>	127
Proglottid formation in polyzoic tapeworms	127
Multiplication in digenean germinal sacs	129
The nature of germinal sac multiplication	129

The organization and control of germinal sac multiplication	135
Productivity of germinal sac multiplication	137
Asexual multiplication of cestodes within intermediate hosts	141
The systematic distribution of asexual multiplication among metacestodes	144
Types of proliferative metacestode	144
Cellular aspects of metacestode proliferation	146
Population increases generated by metacestode proliferation	150
The significance of parthenogenesis and asexual multiplication in the life-histories of parasitic platyhelminths	151
Conclusions	153
References	154
Ovoviviparity in platyhelminth life-cycles	161
Summary	161
Introduction	161
Egg formation	161
Embryo development	163
Requirements for ovoviviparity	165
Space	165
The rate and continuity of egg formation	166
Control of release of infective stages	168
Embryo nutrition	170
Effect of ovoviviparity on reproductive processes	172
The potential restriction of egg formation	172
Hazards of loss	173
Concentration of infective stages	174
Increased probability of sib-mating	174
Increased pathogenicity	175
Adaptations of ovoviviparity	175
Physico-chemical constraints on parasite embryonic development	175
Temporal constraints on host–parasite contact	176
Spatial constraints on host–parasite contact	178
Adaptations of ovoviviparity for increasing reproductive capacity	180
Comparison of oviparity and ovoviviparity	182
Evolution	186
Conclusions	189
References	193
Pattern and paradox in parasite reproduction	197
Summary	197
Introduction	197
Why reproductive output is not always maximized in free-living species	197
Solution to parasite paradox	200
Effect of extrinsic adult mortality on reproductive investment	201
Trade-off between the size and number of reproductive propagules	202
Discussion	206
References	206