

# **The Principal Diseases of Lower Vertebrates**

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# THE PRINCIPAL DISEASES OF LOWER VERTEBRATES

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## Preface

The "Principal Diseases of Lower Vertebrates" presents the material published by Heinz H. Reichenbach-Klinke between 1957 and 1962 in three separate volumes as "Krankheiten der Aquarienfische" (Alfred Kernen, Stuttgart), "Krankheiten der Amphibien" and "Krankheiten der Reptilien" (Gustav Fischer, Stuttgart). The scope of the work has been enlarged with material contributed by E. Elkan who has also done the translation. We have tried to extend the pathology of fish beyond that of the species kept in aquaria. The scope of fish pathology is, however, widening so rapidly at the present time that no textbook can ever hope to be completely up-to-date even for a short period. Representatives of the main groups of parasites affecting fish have been presented as far as possible.

Experience has shown that those who keep, or are interested in, one kind of lower vertebrate will sooner or later also take an interest in one of the other groups. It was therefore thought expedient to include what is at present known of lower vertebrate pathology in one volume, even at the risk of some repetition where fishes, amphibians and reptiles suffer from similar diseases or are the victims of identical parasites.

Since with the exception, perhaps, of the fishes, the lower vertebrates are of little economic importance, little attention had been paid to their diseases until the day when their usefulness in the laboratory was recognized. Since then, a host of highly technical papers on the pathology and the parasitology of lower vertebrates has appeared in journals inaccessible to the general public. Even so, the textbooks on pathology, bacteriology, zoology and parasitology devote at best only very little space to the diseases of animals not classified as "domestic" or "agricultural".

In trying to fill this gap we have been aware of the fact that we are dealing with an almost unexplored area of science, and that our knowledge in this field is expanding rapidly. Even so it is hoped that the book may be of use to those interested in any specific problem and may help them to locate the original papers dealing with that particular item.

No attempt has been made to make this book in the widest sense of the word "popular". The disciplines of anatomy, physiology, pathology and zoology are too complicated in their demands of some basic knowledge of the relevant terminology to make that possible. Yet it is hoped

that the book—and particularly the illustrations—may be of use to those who keep lower vertebrates for scientific and non-scientific purposes.

If, in many of its parts, this book reads like a pure textbook of parasitology, this is simply due to the fact that, as we descend the evolutionary ladder, more and more diseases are due to parasites and the primary and secondary damage they cause. A basic knowledge of parasitology is therefore indispensable for anyone wanting to keep fish, amphibians or reptiles in good condition.

The production of this book would have been impossible without the kind permission of editors of various scientific journals to reproduce material and illustrations first published in their pages. This refers particularly to the Zoological Society of London, The British Herpetological Society, *Nature*, the *Journal of Protozoology*, *Cancer Research*, *Copeia* and others. To all of them and the many individual authors who gave us permission to use some of their material, we are sincerely grateful.

Acknowledgements are equally due to the German publishers Alfred Kern Verlag, Stuttgart, and Gustav Fischer Verlag, Stuttgart, who generously allowed us to reproduce material published by them under the titles quoted above and who were kind enough to agree to our plans for this English edition in one volume. Finally we wish to thank Academic Press, London, for their helpful collaboration in the production of this book.

Particular thanks are due to a number of authors who allowed us to use or to photograph some of their material; in particular Dr. E. Amlacher, Berlin, Mr. C. Arme, Leeds, Dr. W. Foersch, Munich, Dr. P. Ghittino, Turin, Dr. W. Meyburg, Bremen, Dr. T. Roskam, IJmuiden, and also the Bavarian Institute for Experimental Biology, Munich, as well as to two technical assistants in the Department of Chemistry of the same Institute, Miss H. Amtmann and Mr. W. Schlagbauer, who assisted in the execution of some of the drawings.

Since both authors hope to continue working in the field of lower vertebrate pathology they will be grateful to receive relevant material dead or alive. A great deal of collaboration between zoologists, parasitologists and pathologists will be needed before a complete text of lower vertebrate disease can be written.

H. REICHENBACH-KLINKE

E. ELKAN

January 1965

# Contents

	<i>page</i>
Preface. ....	v

## PART I. FISHES

1. Method of Investigation.....	3
A. Symptoms of Disease—Life Span of Fishes.....	3
B. Killing and Detailed Examination of Specimens.....	4
C. Rules to be Followed on Sending in Fish for Investigation	9
References .....	10
2. Infectious Diseases .....	12
A. Diseases due to Bacterial Infection.....	12
References.....	25
B. Diseases Caused by Flagellates.....	28
References.....	34
C. Diseases Caused by Rhizopoda .....	35
D. Diseases Caused by Sporozoa.....	35
References .....	53
E. Diseases Caused by Ciliates and Suctoria.....	55
References.....	65
F. Parasitic Coelenterates.....	66
Reference .....	67
G. Trematodes Parasitizing Fish.....	67
References.....	87
H. Tapeworms (Cestodes) Parasitizing Fish .....	88
References.....	94
I. Acanthocephala Parasitizing Fish.....	96
References .....	99
J. Nematoda and Nematomorpha Parasitizing Fish.....	99
References .....	106
K. Leeches (Hirudinea) Pathogenic for Fish.....	106
References .....	107
L. Crustaceans Pathogenic for Fish.....	107
References .....	120

	<i>page</i>
M. Tongue Worms (Linguatulida) . . . . .	121
Reference . . . . .	122
N. Mollusca . . . . .	122
References . . . . .	124
O. Fishes Damaged by Parasitic Algae . . . . .	124
References . . . . .	124
P. Fungi Pathogenic for Fish . . . . .	124
References . . . . .	145
Q. Virus Diseases . . . . .	147
References . . . . .	150
 3. Non-Infectious Diseases of Fish. Environmental Factors . . . . .	 151
A. Melanosis . . . . .	151
References . . . . .	152
B. Tumours Affecting Fish . . . . .	152
References . . . . .	164
C. Diseases due to Faulty Nutrition . . . . .	165
References . . . . .	170
D. Environmental Factors . . . . .	171
References . . . . .	174
E. Poisons Affecting Fish . . . . .	175
References . . . . .	178
 4. Healing of Wounds and Regeneration . . . . .	 179
References . . . . .	181
 5. Abnormalities . . . . .	 182
References . . . . .	185
 6. Lampreys (Cyclostomata) and their Diseases . . . . .	 187
References . . . . .	189
 7. Fish as Carriers of Human Diseases . . . . .	 190
References . . . . .	194
 8. Review of Main Symptoms and Localization of Fish Diseases . . . . .	 195
References . . . . .	200

	<i>page</i>
9. Treatment.....	201
A. Treatment by Means of Drugs and Chemical Substances..	201
B. Physical and Biological Means of Treatment .....	203
References.....	205

## PART II. AMPHIBIA

10. Technique of Investigation.....	209
A. When Should an Investigation be Carried Out?.....	209
B. Killing and Dissection of Specimens.....	210
C. Further Investigation.....	214
D. Despatch of Amphibians to the Laboratory.....	218
E. Fixation.....	218
References.....	219
11. Infectious Diseases.....	220
A. Diseases due to Bacterial Infection.....	220
References.....	237
B. Diseases Caused by Protozoa.....	239
References.....	263
C. Diseases Caused by Worms.....	266
References.....	280, 286, 291, 303, 304
D. Leeches (Hirudinea) Parasitic in Amphibia.....	305
References.....	307
E. Parasitic Crustaceans.....	307
References.....	308
F. Arachnoidea and Insects.....	308
References.....	309, 311, 313
G. Molluscan Larvae Encysting in Tadpoles.....	314
References.....	314
H. Diseases due to Fungi and Parasitic Algae.....	315
References.....	319
12. Tumours, Benign and Malignant.....	321
References.....	351
13. Damage through Various Environmental Factors.....	354
References.....	357



	<i>page</i>
<b>14. Syndromes from Various Causes</b> .....	358
A. Ovarian Cysts.....	358
B. "Molchpest".....	359
C. Diseases of the Digestive Organs.....	361
D. Bone Damage.....	362
E. Paralysis.....	363
F. Blindness.....	363
G. Hydrops.....	363
H. Hypertrophy of the Lime Sacs.....	365
I. Vesical Calculus.....	366
References.....	366
<b>15. Surgical Conditions, Wound Healing and Regeneration</b> .....	368
A. Surgical Conditions.....	368
B. Healing of Wounds and Regeneration.....	369
References.....	369
<b>16. Abnormalities</b> .....	370
A. Duplication.....	370
B. Disturbances during Metamorphosis.....	370
C. Sex Reversal.....	373
D. Albinism and Melanism.....	373
References.....	375
<b>17. Table of Main Symptoms and Causes of Diseases</b> .....	377
<b>18. Therapy</b> .....	379
A. Table of Chemical Means of Treatment.....	379
B. Treatment by Physical Means.....	380

### PART III. REPTILIA

<b>19. Technique of Investigation</b> .....	385
A. Symptoms of Disease. Ages of Reptiles.....	385
B. Anaesthesia, Killing of Specimens, Dissection.....	386
C. Detailed Examination of Organic Systems.....	388
References.....	393

# CONTENTS

xi

	<i>page</i>
<b>20. Infectious Diseases.</b> .....	<b>394</b>
A. Bacterial Infections.....	394
References.....	398
B. Protozoal Diseases .....	399
References.....	419
C. Turbellaria .....	421
References.....	422
D. Trematoda .....	422
References.....	434
E. Tapeworms (Cestoidea) .....	435
References.....	441
F. Acanthocephala .....	442
References.....	444
G. Nematoda.....	444
References.....	471
H. Leeches. ....	473
References.....	474
I. Mites (Acarina).....	474
References.....	493
J. Tongue Worms (Linguatulida).....	495
References.....	502
K. Insects .....	504
References.....	505
L. Diseases Caused by Fungi.....	505
References.....	509
<b>21. Non-Parasitic and Environmental Diseases</b> .....	<b>510</b>
A. Tumours .....	510
References.....	515
B. Diseases due to Faulty Environment.....	516
References.....	524
C. Injuries through Physical Factors.....	525
References.....	526
D. Poisoning .....	526
References.....	527
<b>22. Wound Healing and Regeneration</b> .....	<b>528</b>
References.....	530
<b>23. Developmental Abnormalities</b> .....	<b>531</b>
References.....	535

	<i>page</i>
24. The Organic Systems of Reptiles and their Importance in Reptilian Pathology. ....	537
References. ....	540
25. Table of Localization, Symptoms and Possible Causes of Diseases in Reptiles. ....	541
26. Treatment. ....	543
A. Drugs. ....	543
B. Biological and Physical Methods of Treatment. ....	544
27. Reptilia and Human Hygiene. ....	545
References. ....	546
Glossary I. Zoological Names, Trivial Names and Main Habitat of Species Mentioned in the Text. ....	547
Glossary II. Trivial and Zoological Names. ....	560
SUBJECT INDEX. ....	569

**Part I**  
**Fishes**



## CHAPTER 1

# Method of Investigation

### A. SYMPTOMS OF DISEASE—LIFE SPAN OF FISHES

No diagnosis of the disease that has befallen an animal can be made without proper investigation and, if possible, extended observation of the "patient". Just as our knowledge of the number of possible diseases of animals increases year by year so must our methods of investigation multiply and become more and more complicated. Equally, it must be remembered that many symptoms may not be typical of one disease only but may be present in many quite unrelated conditions.

The fish, an actively motile aquatic creature, necessarily shows its own characteristic range of symptoms. One of the first symptoms to be observed is usually a change in the normal mode of swimming. Locomotion, obviously out of control, becomes aimless: the fish swims jerkily and in small circles, is unable to keep on an even keel, or to raise itself when it sinks to the bottom. In extreme cases the loss of equilibrium can go so far as to make the fish swim upside-down, the abdomen turned towards the surface. If symptoms like these appear among fish under observation one specimen should be sacrificed for investigation. Less serious, perhaps, are attempts on the part of the fish to scrape along stones or to butt against the wall of the container in an attempt to rid itself from irritating parasites attached to its skin.

The recognition of feeding anomalies is extremely difficult. Complete refusal to feed is not necessarily a sign of illness. Many fish fast while their ovaries mature simply because, besides the enormously swollen ovaries, there is no space left for the other intestines. Also, like many other animals, a fish may take only one special kind of food and starve to death if this is not available.

Loss of colour and general pallor is a typical and alarming sign usually caused by metabolic or circulatory disturbances. Bacteria and microsporidia, affecting the skin or the muscles, may cause the same symptoms. On the other hand a fish may lose colour for lack either of light or of oxygen, if not of both, without being organically diseased. If the discoloration is confined to circumscribed areas of the skin, parasites should be suspected.

The appearance of an abnormally dark discoloration may equally be a sign of disease, particularly if the patches are black or brown. They may often be caused by the presence of subcutaneous parasites. Dark spots accompanied by local swelling may be due to tumours.

General degeneration of the skin occurs in the course of metabolic disturbances. It usually starts at the fins, which look torn and shredded, and continues with patchy losses of epidermis, haemorrhage and the development of ulceration. To this group belongs a kind of inflammation of the skin characterized by rough scales. In severe cases the scales may stand out at right angles.

Even a slight dullness of colours that should be brilliant may be of importance, particularly if the cornea of the eye is involved. It need hardly be mentioned that any swelling or protrusion of an eye must be regarded as a grave symptom.

Parallel with diseases of the skin, skeletal degenerations develop, affecting the jaws, the gill covers, and finally the spine and the tail, which may become shortened and distorted.

Apart from the localized symptoms the general behaviour of the fish should be watched, particularly if an otherwise active specimen hides in dark corners and seems unable to move its fins normally.

A seriously diseased fish, when caught in the net, fails to make the typical jerky movements in an attempt to escape. The absence of this escape reflex must be regarded as a grave symptom, particularly if it is accompanied by an absence of eye movement. The normal fish moves its eyes in relation to the source of light striking the tank. Absence of these eye and escape reflexes deserve particular attention where other symptoms of disease may be lacking.

The observer who knows his fish and their normal behaviour well will easily notice one of the many symptoms mentioned and this will allow him to isolate the affected individual before the disease has spread to others.

Symptoms due to disease should be distinguished from signs of old age. To assess these we should have some information on the expectation of life in the fishes. This varies from about 3 years for small species to about a hundred in large ones. Some of the observations available are set out on p. 5.

## B. KILLING AND DETAILED EXAMINATION OF SPECIMENS

Laboratories equipped to carry out such examinations prefer to obtain their material fresh and as soon after death as possible. The ideal method would therefore be to chill the dead fish and send it to

Species	Average expectation of life (years)
<i>Nannostomus aripirangensis</i> Meinken	3
<i>Amia calva</i> L.	7
<i>Pristella riddlei</i> Meek	8
<i>Danio malabaricus</i> Jerdon	9.5
<i>Lepidosiren paradoxus</i> Fitz	10
<i>Anguilla anguilla</i> L.	10-11*
<i>Pterophyllum scalare</i> C. & V.	11
<i>Hemichromis bimaculatus</i> Gill	14
<i>Corydoras paleatus</i> Jenyns	16
<i>Melanotaenia nigrans</i> Rich.	17
<i>Puntius lateristriga</i> C. & V.	18
<i>Olupea harengus</i> L.	18
<i>Puntius semifasciolatus</i> Gthr.	19
<i>Puntius binotatus</i> C. & V.	20
<i>Eleotris marmorata</i> Blkr.	20
<i>Gadus callarias</i> L.	25
<i>Carassius carassius auratus</i> Bloch	30
"Flatfish"	60-70
<i>Acipenser ruthenus</i> L.	72
<i>Huso huso</i> L.	up to 75
<i>Silurus glanis</i> L.	up to 100
<i>Cyprinus carpio</i> L.	up to 100
* If migration and ovulation is suppressed 55 and more	

the laboratory in a Thermos flask. It should be remembered that haematological, bacteriological and virological examinations cannot be carried out on fixed material. The dissection of many of the intestines, too, is much more difficult in material that has been passed through formaldehyde or alcohol. On the other hand it must be considered that post-mortem fish material deteriorates within 1-2 h, particularly in the hot season. If, therefore, conditions should be particularly favourable, diseased fish should be sent in alive, in large cans holding water with oxygen sufficient for the journey and waterweeds to counteract excessive shaking. It is now possible to send small live fish with about a litre of water in a well closed polythene bag suitably packed in a cardboard box by rail. If available, some oxygen can be blown into the bag before closing it. Water plants will not produce oxygen in the dark but they will protect the fish from trauma.



In the case of external parasites answers may be expected soon. Any microscopical investigation, particularly those involving bacterial culturing or cutting of sections, may take one to several weeks. If more than one diseased specimen is available, the laboratory will be glad to have several, which will allow the use of a variety of methods to find the cause of the disease.

Fish can be killed by the time-honoured method of a blow on the head or by decapitation. Chemical methods, however, which do not damage any part of the fish's body, are much to be preferred. Ether and chloroform are miscible with water in sufficient quantity to effect anaesthesia or death. Urethane (2-5%) can be used for the same purpose. Among the latest arrivals MS 222 Sandoz (Basle) has become popular. Kodak recommend Quinaldine in low concentration.

The following parts deserve our particular attention: skin, including eyes; nasal aperture and lateral line system; gills and oral cavity; blood and intestinal contents; brain and spinal cord; muscles; peritoneal cavity and the remaining intestines and reproductive organs.

The skin is first inspected with a hand lens which will reveal any of the larger ectoparasites. Smears are made next and examined under the microscope. Later the fish may be scaled and skinned so that the skin can be examined for dermal or subcutaneous cysts. Among the ectoparasites we may expect to find bacteria, flagellates, ciliates, sporozoa, gyroductylids, metacercariae, parasitic copepods and fungi.

The gills are dissected out after removal of the gill cover. They may be the seat of bacteria, flagellates, ciliates, sporozoa, trematodes and fungi.

As in many human diseases the blood picture often gives a hint of the nature of the disease, but the usefulness of blood counts and of the determination of the relation of white to red corpuscles is limited if we are in ignorance of the normal figures for the species. These figures change in the presence of parasites and in more than one species an unparasitized specimen would be difficult to find. Nor can we be sure that laboratory-bred animals will give figures comparable with those normal to the species in its natural environment. Gross leucocytosis, in particular eosinophilia, is however significant. The white blood corpuscles found in fish are lymphocytes, monocytes, neutrophile granulocytes and eosinophile granulocytes. Fish have no bone marrow and the leucocytes develop in lymphoid tissue in the kidney where it lies dispersed between the uriniferous tubules. In selachians (cartilaginous fish) such tissue is also found between the mucosa and the muscular coat of the oesophagus. The acidophile granules in the leucocytes of rays are much larger than those of higher vertebrates