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The History of the Eye of Amblyopsis.

C. H. Eigenmann.

[Abstract.]

A. DEVELOPMENT.

The eye of Amblyopsis appears at the same stage of growth that it appears in fishes developing normal eyes.

The eye grows but little after its appearance.

All the developmental processes are retarded and some of them give out prematurely. The most important of the latter is the cell division and the accompanying growth that provides the material for the eye.

The lens appears at the normal time and in the normal way, but its cells never divide and never lose their embryonic character.

The lens is the first part of the eye to show degenerative steps and it disappears entirely before the fish has reached a length of 1 mm.

The optic nerve appears shortly before the fish reaches 5 mm. in length. It does not increase in size with the growth of the fish and possibly never develops normal nerve fibers.

The nerve does not increase in size with growth of the fish.

The optic nerve gradually loses its compact form, becomes flocculent, dwindles and can not be followed by the time the fish has reached 50 mm. in length. In the eye it retains its compact form for a much longer time, but disappears here also in old age.

The scleral cartilages appear when the fish is 10 mm. long; they grow very slowly—possibly till old age. They do not degenerate at the same rate as other parts of the eye if they degenerate at all.

B. HISTORY.

The history of the eye may be divided into four periods:

(a) The first period extends from the appearance of the eye till the embryo reaches 4.5 mm. in length. This period is characterized by a normal palingenic development except that cell division is retarded and there is very little growth.

(b) The second period extends from the first till the fish is 10 mm. long. It is characterized by the direct development of the eye from the normal embryonic stage reached in the first period to the highest stage reached by the Amblyopsis eye.

(c) The third period extends from the second period to the beginning of senescent degeneration, from a length of 10 mm. to about 80 or 100 mm. It is characterized by a number of changes, which, while not improving the eye as an organ of vision, are positive as contrasted with degenerative. There are also distinct degenerative processes taking place during this period.

(d) The fourth period begins with the beginning of senescent degeneration and ends with death. It is characterized by degenerative processes only, which tend to gradually disintegrate and eliminate the eye entirely.

C. SUMMARIAL TABLE OF THE ORIGIN, DEVELOPMENT AND DEGENERATION OF THE EYE AND ITS PARTS.

	Earliest Appearance or Differentiation.	End of Cell Division.	End of Morphogenesis.	End of Histogenesis.	Beginning of Degeneration.	Disappearance.
Eye	1.5 mm.	5-7 mm.	10 mm.	Before 25 mm.	25 mm.	Beyond 130 mm.
Choroid fissure	2.5 mm.	—	—	—	—	10-130 mm.
Pigmented layer	2 mm.	?	2.5 mm.	10 mm.	100 mm. or before.	Beyond 130 mm.
Cones	Rarely and then after 10.	—	?	?	?	?
Outer nuclear	4.4-5 mm.	5-7 mm.	—	10 mm.	Before 25 mm.	Beyond 130 mm.
Outer reticular	Never.	—	—	—	—	—
Horizontal cells	Never.	—	—	—	—	—
Inner nuclear	4.4-5 mm.	—	—	10 mm.	Before 25 mm.	130 mm. and beyond.
Ganglionic	4.4-5 mm.	—	—	10 mm.	Before 25 mm.	130 mm. and beyond.
Optic fiber layer or nerve	4.4-5 mm.	—	—	5 mm.	25 mm.	100 mm.
Scleral cartilages	9-10 mm.	?	?	75 mm.	—	—
Lens	2.5 mm.	5 mm.	5 mm.	—	3 mm.	6-10 mm.
Corneal epithelium	5 mm.	?	—	—	7 mm.	10 mm.

? I do not know.
— Does not take place.

D. CONCLUSIONS OF GENERAL BIOLOGICAL INTEREST.

Some late stages of development are omitted by the giving out of developmental processes. Some of the processes giving out are cell division, resulting in the minuteness of the eye and the histogenic changes which differentiate the cones and the outer reticular layer.

There being no causes operative or inhibitive either within the fish or in the environment that are not also operative or inhibitive in Chologaster agassizii, which lives in caves and develops well-formed eyes, it is evident that the causes controlling the development are hereditarily established in the egg by an accumulation of such degenerative changes as are still notable in the later history of the eye of the adult.

The foundations of the eye are normally laid, but the superstructure, instead of continuing the plan with additional material, completes it out of the material provided for the foundations. The development of the foundation of the eye is phylogenic, the stages beyond the foundations are direct.

E. TABLE OF MEASUREMENTS OF EYES OF EMBRYOS OF DIFFERENT SIZES.

Condition of Embryo Living or Direction of Sections.	Length of Embryos.	No. of Embryos Measur'd.	Longitudinal Diameter.	Vertical Diameter.	Axial Diameter of Eye from Cornea to Optic Nerve.
	1.6 mm	1	80 μ.	.....	36 μ.
	1.76	.....	100	.....	48
	2	3	135	.....	.....
	2.5	2	190	.....	100
	2.8	1	170	.....	.....
Alive	4	1	200	150	100
Alive	5	7	144	134	.....
Sagittal	6	1	136	88	.....
Cross	6	1	.....	70	100
Horizontal	6	1	136	.....	80 and 108
Mounted entire	6.5–7	1	160	160	.....
Cross	5.5–7	3	.....	126	99
Horizontal	6.5–7	3	152	.....	115
Sagittal	9–9.5	1	108	.....	88
Cross	9–9.5	1	.....	106	90
Horizontal	9–9.5	1	114	.....	98
Sagittal	10	1	120	112	.....
Cross	10	2	.....	108	109
Entire	10	1	135	130	.....
Horizontal	25	1	120	.....	128
Cross	25	1	.....	160	160
Horizontal	35	1	192	.....	144

The Eye of Rhineura Floridana.

C. H. Eigenmann.

[Abstract.]

Rhineura floridana is a legless, burrowing, amphisbaenian lizard, found in Florida. My attention was called to it by Mr. W. S. Blatchley, and I secured specimens through dealers and through Dr. W. B. Fletcher, of Indianapolis, who kindly forwarded a number of living specimens to me.

A study of the eye of this lizard has led to the following conclusions:

1. The eye of Rhineura has reached its present stage as the result of a process of degeneration that probably began in the early miocene.

2. The dermis and epidermis pass over the eye without any modification. The conjunctival pocket has vanished.

3. Harder's gland is many times as large as the eye and pours its secretion into the tear duct and thus into the nasal cavity.

4. The eye muscles have disappeared.

5. A cornea is not differentiated.

6. The lens is absent in half the eyes examined and varies greatly in those in which it was found.

7. The vitreous body has practically disappeared.

8. The pigment epithelium is variously pigmented. It is of greater extent than is sufficient to cover the retina and has been variously invaginated or puckered over the proximal and posterior faces of the eye.

9. An uveal part of the iris is not found.

10. The eye of Rhineura does not represent a phylogenetically primitive stage; it is an end product of evolution as truly as the most highly developed eye.

11. The adult eye shows few indications that there has been a cessation of development at any definite ontogenic stage. It does not resemble as a whole any ontogenic stage.

12. An arrest in the ontogenic development has taken place in so far as the number of cell multiplications concerned in forming the anlage of the various parts of the eye have decreased in number, and in the lack of union of the lips of the choroid fissure.

13. It is possible that the absence of cones or rods is due to an arrest in the histogenesis of the retina, but since these structures are normally formed in the young of Typhlotriton and disappear with age, it is possible

that their absence in the adult eye of Rhineura is also due to ontogenic degeneration.

14. The irregularity in the structure and existence of the lens and the great reduction of the vitreous body offer evidence in favor of the idea of the ontogenically and phylogenically earlier disappearance of the ontogenically and phylogenically newer structures.

15. Horizontal nuclei found between the pigment epithelium and the outer limiting membrane are probably derived from the proximal layer of the optic cup.

16. The different layers of the retina have reached a degree of differentiation out of proportion to the great reduction of the dioptric apparatus and general structure of the eye.

Zoölogical Miscellany.

C. H. Eigenmann.

1. Portions of a mastodon were found on a sand-bar in the Ohio River, near Rockport, Ind. They have been presented to Indiana University by Karl Cramer.

2. The bones of Megalonyx jeffersoni, from the Owen collection, have been mounted in their relative positions and are now on exhibition in Owen Hall.

3. The Museum of the Indiana University finds itself in possession of a collection of birds, made by President Roosevelt at St. Regis Bay and at Oyster Bay, between 1872 and 1877. Most of the specimens bear the original labels written by Mr. Roosevelt, which are examples of explicitness and fulness in labeling. The earliest specimen was collected February 12, 1872, and bears the serial number 4 of his collection. Mr. Roosevelt published a small paper upon the birds of the Adirondacks and another on those of Long Island, based in part on these specimens. The trustees of the University have ordered a dust-proof case to be made, in which they are to be preserved for the future.

There are forty-six birds in all, forty-two species, fifteen less than the number sent here by the National Museum.

The labels read as follows: