SPECIAL ARTICLES.

EPITHELIAL DEGENERATION, REGENERATION AND SECRETION IN THE MID-INTESTINE OF COLLEMBOLA.

IN *Collembola*, a degeneration of the inner half of the epithelial wall of the mid-intestine occurs in connection with each ecdysis. The cells of the mid-intestine become confluent and important changes of alveolation ensue; nearly half the nuclei migrate toward the intima, while the rest of the nuclei remain near the basement membrane; a wall now forms between the two sets of nuclei, dividing the epithelium into two concentric layers. The inner of these two layers degenerates; the cytoplasmic reticulum disintegrates; the nuclear membranes disappear and the chromatin granules become scattered, but remain intact; much of the fluid substance is resorbed into the remaining layer of cells. The disorganized epithelium, surrounded by a peritrophic membrane, is expelled through the rectum shortly after the external moult.

The process is an excretory one. By this means, the rapidly accumulating concretions of sodic urate are removed from the cells of the mid-intestine, as are also, but incidentally, certain unicellular parasites (Gregarinidæ).

The nuclei lost by degeneration are replaced by the mitotic division of the remaining nuclei —this occurring before the inner portion of the epithelium is cast off.

The peritrophic membrane, which always envelopes a food-mass, is formed by the splitting of the intima, and is, therefore, a secretion from the epithelium of the mid-intestine. The wall that divides the originally single layer of cells into two layers, splits into two membranes, one of which surrounds the degenerating epithelium as a peritrophic membrane, while the other forms the new intima of the mid-intestine.

The formation of new cells takes place throughout the epithelium by mitosis; this regeneration does not occur from local centers, or 'crypts,' as it does in other insects; furthermore, no amitotic divisions are found at any time.

Secretion is performed (1) by the general epithelium of the mid-intestine; (2) by special clear cells in the middle region of the mid-intestine; (3) by specialized cells in the posterior region; these last give off proliferations into the lumen, which become constricted off, as free, rounded, cytoplasmic vesicles, which break down in the alimentary canal and mingle their contents with the food (much as in other insects).

The novel rôle of the mid-intestine as an organ of excretion is correlated with the absence of Malpighian tubes in *Collembola*.

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EARTHQUAKES RECORDED AT CHELTENHAM MAGNETIC OBSERVATORY JANUARY 24-31, 1906.[1]

1. January 24:

	North-South Component.	East-West Component.
Beginning	2 h. 04 m. 10 s.	2 h. 04 m. 28 s.
Beginning principal portion	2 04 10	2 04 28
End principal portion	2 08 18	2 08 28
End	2 33 56	2 29 48
Maximum amplitude	2.0 mm. at 2 h. 06 m. 32 s.	1.8 mm. at 2 h. 06 m. 08 s.
Average period of waves:		
Maximum	11.0 s.	10.8 s.
End	7.2	8.6

2. January 24:

Beginning	2 h. 42 m. 12 s.	2 h. 42 m. 38 s.
Beginning principal portion	2 43 20	2 43 03
End principal portion	2 46 12	2 45 34
End	2 52 50	2 51 39
Maximum amplitude	1.5 mm. at 2 h. 44 m. 14 s.	2.2 mm. at 2 h. 44 m. 48 s.
Average period of waves:		
Maximum	10.5 s.	12.3 s.
End	7.2	8.6

3. January 24:

Beginning	16 h. 58 m. 50 s.	16 h. 58 m. 20 s.
Beginning principal portion	16 59 20	16 59 20
End principal portion	17 02 50	17 03 30
End	17 10 50	17 08 30
Maximum amplitude	1.0 mm. at 17 h. 01 m. 34 s.	0.6 mm. at 17 h. 00 m. 25 s.
Average period of waves:		
Maximum	11.6 s.	9.2 s.
Beg. prin. portion	9.1	—
End prin. portion	8.8	7.1

[1] Communicated by the superintendent of the Coast and Geodetic Survey, Mr. O. H. Tittmann. The observatory is situated at Cheltenham, Md., in latitude 38° 44'.0 N. and longitude 76° 50'.5 west of Greenwich. The times recorded are

4. January 25:

Beginning	15 h.	47 m.	00 s.	15 h.	46 m.	45 s.
Beginning principal portion	15	47	15	15	49	14
End principal portion	15	48	15	15	50	45
End	15	54	00	15	53	24
Maximum amplitude	1.0 mm. at 15 h. 47 m. 38 s.			1.5 mm. at 15 h. 49 m. 44 s.		
Average period of waves:						
Beginning	3.2 s.			3.3 s.		
Beg. prin. portion	3.4			8.9		
Maximum	3.2			8.9		

5. January 27:

Beginning	5 h.	19 m.	00 s.	5 h.	19 m.	17 s.
Beginning principal portion	5	21	58	5	21	52
End principal portion	5	27	08	5	29	02
End	5	43	00	5	51	27
Maximum amplitude	1.4 mm. at 5 h. 26 m. 58 s.			2.2 mm. at 5 h. 27 m. 02 s.		
Average period of waves:						
Beginning	25.1 s.			26.0 s.		
Principal portion	19.0			16.2		
Maximum	16.8			17.9		
End	13.6			16.0		

6. January 31:

Beginning	10 h.	43 m.	44 s.	10 h.	43 m.	33 s.
Beginning principal portion	10	50	23	10	49	43
End principal portion	11	16	23	11	17	06
End	14	08	00	14	18	00
Maximum amplitude [2]	77 mm. at 11 h. 02 m. 43 s.			66 mm. at 11 h. 07 m. 46 s.		
Average period of waves:						
Beginning	3.6 s.			2.8 s.		
Principal portion	25.2			18.0		
End	18.5			18.0		

Multiplying ratio of both pointers, 10.

Period of north-south component pendulum about 25 seconds, of east-west component pendulum about 20 seconds.

W. F. Wallis,
Observer in charge.

seventy-fifth meridian mean civil time, counting the hours continuously from midnight to midnight.

[2] The maximum amplitudes of this earthquake were too large to be recorded. The pendulums struck the brushes on both sides. The amplitudes given were measured on the trace and are probably much too small.

Analysis of Mississippi River Silt.

On October 13, 1905, there appeared in Science a complete analysis of the water of the Mississippi River, and toward the close of it the author made the statement that the silt from the water sample had been saved and would be subjected to a plant-food analysis at a later date. Such an analysis has now been completed and the results are submitted in this article. The methods followed were the ones officially adopted by the Association of Agricultural Chemists, and the results are expressed in percentages of the moisture-free sample. It is to be regretted that the carbonic acid could not be determined, but the lack of material made it impossible:

Insoluble matter	67.71
Sol. Si. O_2	.22
K_2O	1.26
Na_2O	0.13
CaO	1.83
MgO	1.64
MnO	0.18
$Fe_2O_3Al_2O_3$ (mostly Al)	17.90
P_2O_5	0.25
SO_3	0.28
Water and organic matter	7.00
Total nitrogen	0.15

Some facts in connection with this analysis are of peculiar interest. In the first place the per cent. of soluble matter is large and the greater part of it is Al. This gives some insight into the origin of the silt. Another noteworthy feature is the large amount of potash and its ratio to the soda. While in eastern soils it is usual for the potash to be in excess of the soda, the proportion seems larger than customary. In western soils the soda is generally in excess of the potash, and this would indicate that the silt analyzed originally came from a semi-arid or humid region. However, considering the analysis as a whole, there would be no question about pronouncing this silt to be an excellent soil. All this plant food is being removed from the land and carried either to the sea or to the mouth of the river. For the sake of argument let us assume that the above analysis represents the average composition of the silt carried by the Mississippi during the entire year. This is doubtless not quite true, but will serve as a basis for some calculations. One estimate of the total amount of silt carried by the Mississippi during a year places the figures at 443,750,000 tons. Assuming this to be true, the following table gives in tons the amount of various substances removed in this silt during the year: