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SEASONAL CHANGES IN THE BRAIN WEIGHT OF THE COMMON SHREW (*SOREX ARANEUS ARANEUS* LINNAEUS, 1758)

SEZONOWA ZMIENNOŚĆ WAGI MÓZGU U *SOREX ARANEUS ARANEUS* LINNAEUS, 1758.

The seasonal changes discovered by Dehnel (1949) in the height of the skull of the common shrew (*Sorex* L.) have been confirmed in the following years by many authors (Kubik, 1951; Pucek, 1955; 1957; Caboń, 1956; Schubarth, 1958; Crowcroft & Ingles, 1959). Investigation has been made of the mechanism reducing the height of the skull in the winter period, the morphological expression of which are the resorption processes and rebuilding of the bone tissue of the cranial arch (Pucek, 1957). Schubarth (l.c.) and Crowcroft & Ingles (l.c.) basing their findings on examination of a large number of shrews, confirmed the occurrence of Dehnel's phenomenon in the area comprised by Germany and England. It would therefore appear that this phenomenon may take place at least in those species of shrew which inhabit the northern zone of their geographical range.

In 1956 Caboń revealed the existence of seasonal changes in weight and volume of the brain in *Sorex minutus* L., correlated to a great extent with corresponding changes in the height and capacity of the skull.

In order to determine whether this kind of variation occurs in *S. araneus* also, examination was made of 326 specimens of this species, caught in Białowieża in 1949,and also in certain winter months in 1948, 1950 and 1953—55. The shrews were preserved in alcohol. The volume of the brain was determined by the use of a pycnometer (Caboń, 1956). Three craniometric measurements were made of the skulls of these same specimens: condylobasal length, maximum breadth of brain-case and height of skull per bullae.

The variations in skull measurements of the series of shrews examined do not differ from data already published (Dehnel, 1949; Kubik, 1951; Pucek, 1955).

The curve of the seasonal variations in the weight of the brain of *S. araneus* is very similar to the variations in the capacity of the brain-case (Pucek, 1955) — see Fig. 1.

Table 1.

Seasonal variation in the brain-weight of the Common shrew.

Brain-weight in mg. / Months	140.0–	147.0–	154.0–	161.0–	168.0–	175.0–	182.0–	189.0–	196.0–	203.0–	210.0–	217.0–	224.0–	231.0–	238.0–	n	Av.
VI								2	2	6	3	6	4	3	2	28	217.20
VII								2	8	4	7	10	5	2		38	213.45
VIII						3	3	5	7	13	12	7	3			53	206.05
IX					1	3	4	3	2	2	4	1				20	195.60
X				1	1	1	2	1	2	3						11	190.54
XI			2	1	2	1	2	1	2							11	178.45
XII	1	3	2	3	2	1	1									13	162.29
I		2	4	3	4											13	162.29
II – III	2	4	4	1												11	153.00
IV – V					2	2										4	174.95
VI				1	1	1		1								4	176.70
VII			1	2	8	6	2	2	1							22	176.54
VIII			1	4	5	6	3	1								20	174.60
IX		2	4	5	3	1	1	1								17	166.09
X		3	1	4	1	2										11	163.17
XI	1	1	1													3	150.45

The maximum brain weight is found in young individuals from June, that is, directly after they have entered the stage of independent life (Table 1). During the course of the summer the average monthly decrease in the brain weight is slight, but nevertheless constant and significant. During the period from June to September inclusively, the brain weight falls by 16.66 mg., i.e. on an average over 3 mg. monthly. Over the succeeding months the decrease in average weight of brain is twice as great (over 7 mg.) per month. An acceleration is therefore observed of the regression process similar to that noted in the case of the capacity and height of the skull (Pucek, 1955), of the thymus (Bazan, 1952), and other organs (Table 2). The minimum brain weight of shrews in the series examined occurs in March. Beginning with April, the weight of the brain increases. The second maximum during the life of the shrews in the weight of this organ is noted in old adults from June and July. Towards the autumn the weight of the brain again decreases. How far this process progresses is unknown, since only in exceptional cases can old adults still be caught during the second winter of their lives.

The brain of old adults never attains the dimensions which are observed in young specimens. The difference between averages is about 31 mg., i.e.

the brain weight of old adults is 18% lighter than that of young shrews. A similar situation exists in the dimensions of the brain-case (height and capacity). The rate and extent of the variations (increase in percentages) of the brain and skull are illustrated by Table 2. It will be seen from this, and also from Fig. 1, that there is a great degree of correlation in the course of the variations of the elements of Dehnel's phenomenon referred to. This correlation is an indication of their functional interdependence.

Table 2.

Comparison of the rate of changes in the dimensions of the skull and brain-weight.

Period and age group	Changes in monthly averages / in % /		
	Height of skull	Brain-case capacity	Brain-weight
VI juv. ⟶ X juv.	- 0.82	- 6.31	-12.27
X juv. ⟶ II + III juv.	-11.96	-21.57	-19.21
VI juv. ⟶ II + III juv.	-12.69	-26.52	-29.56
II + III juv. ⟶ VII ad.	+10.34	+15.73	+15.39
VI juv. ⟶ VII ad.	- 3.29	-14.97	-17.72
VII ad. ⟶ XI ad.	- 7.50	- 6.59	-14.78

Table 3.

Variations in brain-weight depending on sex of the Common Shrew.

Months	Age group	No.	Average weight of brain in mg.		
			♂♂	♀♀	Total
VI - IX	juv.	139	211.53	204.67	208.80
X - XI	juv.	22	192.03	174.95	184.50
XII-III	juv.	37	167.30	156.53	159.53
VI - IX	ad.	63	176.42	168.09	173.11
X - XI	ad.	14	167.95	154.82	160.44

Investigations made by Pucek (1955) and Schubarth (1958) show that there are essential differences in the course of the winter depression in the skull of the female from that in the case of males. These differences are clearly evident in old adults. This dimorphism is also visible in the weight of the brain (Table 3). The seasonal depression of this organ is more strongly marked in the case of females than in males, especially in the autumn and winter periods.

The variation in the volume of the brain runs parallel to the curve of variation in its weight.

Seasonal changes in the skulls of shrews are concentrated in the cerebral part (height per bulae, brain-case capacity). The remaining parts of the skull do not exhibit variation of this type (maximum breadth), or remain unchanged throughout the entire life of these animals (condylobasal length).

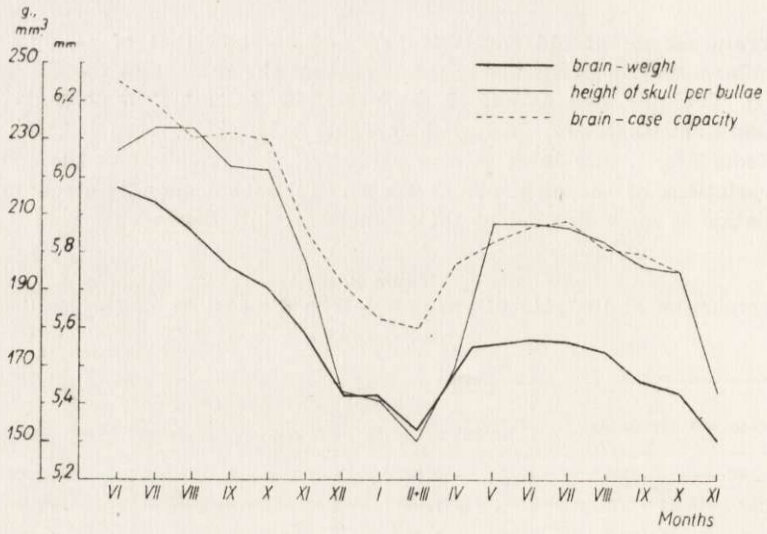

Fig. 1. Seasonal changes in the brain-weight, height of skull and brain-case capacity during the life cycle of Common shrew.

The results obtained would appear to confirm P u c e k's assumption (1955) that the variations in dimensions of the brain case involving resorption and rebuilding of the bone tissue are a secondary phenomenon dependent on variations in the brain, which is subject to the greatest seasonal fluctuations.

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