

Traditions of Czech and Slovak Developmental Physiology

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Summary

Since the beginning of the 19th century, the comparative and ontogenetic branches of developmental physiology were cultivated in our country. Evidence was given that development of the gastrointestinal tract in tadpoles is dependent on the quality of proteins in their food. A complete metamorphosis of *Amblystoma mexicanum*, was entirely accomplished by feeding with powderized thyroid gland. The definition and chronological delimitation of both the suckling and weaning period in experimental animals opened the investigation of the effect of disturbance of the natural environment caused by premature weaning on the ensuing development of an individual. A new term was coined "late effects of early adaptations". Analysis was provided by impressive research of the development of energetic metabolism and development of gastrointestinal tract functions, water and electrolyte exchange and endocrine functions including the role of the pineal gland in control of circadian rhythms (12 references).

Key words

Late effect of premature weaning – Perinatal development – Energetic metabolism – Gastrointestinal tract functions – Water and electrolyte metabolism – Endocrine functions

Our country became a cradle of genetics over 135 years ago. From the small Czech nation originated the discovery of the cell and centrosoma. Since the beginning of the 19th century, the comparative and ontogenetic branches of developmental physiology were cultivated in this country. From the very beginning, the relationship of the developing organism to its environment was a characteristic of this research. Before the First World War, Czech physiology brought remarkable discoveries. Evidence was provided that development of the gastrointestinal tract in tadpoles is dependent on the quality of proteins in their food (Babak 1903). Complete metamorphosis of *Amblystoma mexicanum*, an amphibian able to achieve only the larval stage in the course of its natural development, was entirely accomplished by feeding it with powderized thyroid gland (Laufberger 1913).

After the Second World War the effort of several teams of physiologists was concentrated on systematic research in developmental physiology, namely on a) traditional analysis of the process of development, b) description of the nervous system functions in different stages of ontogeny, c) investigations of the role of the thyroid in ontogenetic development (resumed in studies aimed at thiouracil as a possible competitor of uracil) (Hahn and Poupa 1951), and d) the impact of thyroid function on ontogeny of mammals (investigated in Slovakia by Sámel *et al.* (1963).

An essential step forward represented the definition and chronological delimitation of both the suckling and weaning period in experimental animals (Babický *et al.* 1970). A project was initiated to investigate the effects of a disturbance of the natural environment caused by premature weaning on the further development of an individual. This effect was manifested namely by a disorder of the maternal behaviour of early weaned females which was also present in the daughters of prematurely weaned females although their weaning period was not shortened (Nováková 1976). A number of other changes in physiological functions were proven in prematurely weaned animals in the course of their subsequent development. Accordingly, a new term was coined "late effects of early adaptations". Analysis for this research was provided by impressive research of the development of energetic metabolism and development of gastrointestinal tract functions (Hahn and Koldovský 1967, Koldovský 1969), of water and electrolyte exchange (Dlouhá 1982), and of endocrine functions (Kraus 1978).

The introduction of microsurgical techniques by our embryologists made it possible to conduct successful experimental investigations of inborn errors. Introduction of the developmental approach contributed to the discovery of essential data on the formation of the immune system (Šterzl 1988). Analysis of environmental factors related to the development

brought new data on circadian rhythms and the role of the pineal gland (Illnerová 1986).

Perhaps the most significant contribution of Czech developmental physiology to the practice

consisted in the enforcement of the priority of maternal milk in the nutrition of newborns and in "humanization" of infant feeding formulae.

References

- BABÁK E.: Über den Einfluss der Nahrung auf die Länge des Darmkanals. *Biol. Zbl.* 23: 477-484; 519-528, 1903.
- BABICKÝ A., OŠŤÁDALOVÁ I., PAŘÍZEK J., KOLÁŘ J., BÍBR B.: Use of radioisotope techniques for determining the weaning period in experimental animals. *Physiol. Bohemoslov.* 19: 457-467, 1970.
- DLOUHÁ H.: *Postnatal Development and Kidney Function*. Academia Publishing House, Prague, 1982.
- HAHN P., KOLDOVSKÝ O.: *Utilization of Nutrients during Postnatal Development*. Pergamon Press, Oxford, 1967.
- HAHN P., POUPA O.: Antihistamines and thyroxine metamorphosis in tadpoles. *Nature* 167: 84, 1951.
- ILLNEROVÁ H.: *Circadian Rhythms in the Mammalian Pineal Gland*. Academia Publishing House, Prague, 1986.
- KOLDOVSKÝ O.: *Development of the Small Intestinal Functions in Mammals and Man*. Karger, Basel, 1969.
- KRAUS M.: *Activity of Adrenal Cortex and Postnatal Development*. Academia Publishing House, Prague, 1978.
- LAUFBERGER V.: The induction of axolotl metamorphosis by thyroid hormone (in Czech). *Biol. Listy* 2: 228-235, 1913.
- NOVÁKOVÁ V.: *Time of Weaning and its Effect on the Brain*. Academia Publishing House, Prague, 1976.
- SÁMEL M., ČAPUTA A., ŠTRUHÁROVÁ L.: Extraterine recirculation of iodine from young to mother in rat. *Nature* 198: 489-490, 1963.
- ŠTERZL J.: *The Development and Induction of the Immune Response* (in Czech). Academia Publishing House, Prague, 1988.

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