

The structural and ultrastructural comparative studies of skin differentiation in two lepidosaurian species – sand lizard (*Lacerta agilis* L.)^{*} and Egyptian cobra (*Naja haje* L.)^{**}

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All lepidosaurian species are terrestrial animals that have become completely independent of the aquatic environment and therefore the skin of lizards and snakes are dry and has low permeability to water. This kind of integument protects the organism from mechanical damage and dehydration. Epidermis of adult lizards and snakes consists of six layers, built from different types of cells. It changes throughout life and periodically regenerates and is shed. The process occurs either continuously along with its exfoliation (lizards) or the epidermis is periodically renewed over the whole body in the process known as skin shedding or moulting (snakes). The functions of the epidermis and its appendages in reptilian species similarly as in other vertebrates are established during embryogenesis and they are the results of a complex and precisely coordinated stratification program. The knowledge of the process of skin differentiation in squamate species in comparison of the process of skin morphogenesis in other vertebrates is poor. The purpose of this study was to compare developmental process of skin differentiation in sand lizard *Lacerta agilis* L and Egyptian cobra (*Naja haje*). The eggs of the *Lacerta* and *Naja* were incubated in the constant temperature at 30°C and the embryos were isolated, starting at eggs lying and finishing at hatching of the first individuals. The

age of *Lacerta* embryos was calculated using the developmental table of Peter (1904) and the age of *Naja* was calculated using the table of species development (Khannoon and Evans, 2014). Based on structural and ultrastructural investigation, the embryonic development of the sand lizard and Egyptian cobra integument was divided into four phases. Our studies show that: during early developmental stages, cells was made of layers in embryonic epithelium of both studied species were basically similar. The differences between structure and ultrastructure of differentiated skin in *Lacerta* and *Naja* appeared just at the end of embryos development. The shedding complex in both compared reptilian species is different that is a reflection of adaptation to different environmental conditions. Moreover, the most outer layer of developing epidermis – periderm in *Lacerta* consists only of one cellular layer but in Egyptian cobra is made of two layers.

REFERENCES

- KHANNON ER, EVANS SE (2014) The embryonic development of the Egyptian cobra *Naja h. haje* (Squamata: Serpentes: Elapidae). *Acta Zool* 95: 472–483.
- PETER K. 1904. Normentafeln zur entwicklungsgeschichte der zauneidechse (*Lacerta agilis*). In: Fischer G [ed.], vol. 4, 1–65. Keibel's Normentafeln, Jena.

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^{**}All specimens used in the experiment were captured according to the Egyptian regulations concerning the protection of wild species (Convention on Biological Diversity ratified in 1992 and 1994). The Egyptian cobra is not included in the Washington Convention of 1973.