

structure^{11,12}. It emerged from the present study that the β granules in the pig displayed a similar picture of multiple irregular granules to that previously described in the dog^{4,6}. More careful quantitative analyses revealed, however, that the granules in the dog were more elongated than those in the pig. This indicates that the morphological appearance of the β granules is influenced also by other factors than the primary structure of the insulin. Whether an identical composition and order of the amino acids in the insulin molecule may also be compatible with the more striking species differences which have been encountered in the β granules remains to be settled. In the further exploration of this matter it would, for example, be of interest to extend the quantitative electron-microscopic analyses also to other species (sperm and fin whale) with identical primary structures of insulin¹³.

Zusammenfassung. Die Primärstruktur des Insulins ist bei Hund und Schwein identisch. Elektronenmikroskopisch

wurde festgestellt, dass die sekretorischen Granulae der pankreatischen β -Zellen bei beiden Arten eine unregelmässige Form haben. Eine quantitative Analyse ergab jedoch, dass die β -Granulae des Hundes länger sind als die des Schweines.

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Riboflavin in the Blood Serum, the Skin and the Venom of some Snakes of Burma

Some Brazilian snakes (*Bothrops jararaca*, *Eudryas bifossatus*) have been reported to contain significant amounts of riboflavin in the blood plasma^{1,2}. However, other species like the rattlesnake (*Crotalus terrificus terrificus*) and the non-venomous *Xenodon merrimii*, lack flavin in their blood and possess only a blue fluorescent pigment related to pteridines³. It is interesting to note that the venom of the *Bothrops* is also rich in riboflavin whereas that of the *Crotalus* is devoid of it⁴. The flavins detected in the plasma are free or combined with proteins and microbiologically active⁵.

It seemed therefore worthwhile to study whether some of the common snakes of Burma, India and South-East Asia, of different species not found in South America, contain flavin in their blood serum. The venomous species which we worked with were the cobra, the viper and the krait; the non-venomous were the python and two other smaller species (*Oligodon cyclurus* and *Cerberus rynchops*). Riboflavin was found in measurable amount in only two venomous snakes (krait and viper) in the blood serum as well as in the skin; the python showed the largest riboflavin content. This flavin was not found in

the venom of the cobra or the viper and only in low concentration (38 $\mu\text{g/g}$ dry weight) in the venom of the krait (*Bungarus fasciatus*). The skin is generally richer in all the species studied, except the cobra and *Oligodon cyclurus* which do not contain a measurable amount. It is interesting to note that the skin of the krait contains flavin only in the yellow band. It has been reported by BLAIR and GRAHAM that the skin of some African green snakes (*Philothammus semi-variegatus* and *Dispholidus typus*) also contain riboflavin⁶. The Table summarizes our results.

The blood was collected in large test tubes immediately after decapitation of the animal and the serum separated by centrifugation. In a few cases (python) the determinations were performed with cold blood plasma 1 h after the decapitation of the snake. The technique of VILLELA and PRADO was followed for the extraction and the flavin was estimated visually by comparing the intensity of the green fluorescence of the clear extracts with riboflavin standard solutions¹. An UV-lamp, adapted to a special device in which the light path hits the solution through a filter at an angle of 45°, was used as comparator⁶. The hydrosulphite test was performed according to NAJJAR⁶.

Zusammenfassung. Es wurden sowohl giftige als auch ungiftige Schlangen aus Burma auf den Gehalt an Flavinen in Blut und Haut untersucht.

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Riboflavin in the blood serum and skin of some Burmese snakes

Snakes	Flavin as riboflavin in $\mu\text{g}/100$ ml serum ^a	Flavin in $\mu\text{g/g}$ dry weight skin
<i>Naja naja</i> (cobra)	—	—
<i>Bungarus coeruleus</i> (viper)	18 (12, 15, 17, 22, 27)	17
<i>Bungarus fasciatus</i> (banded krait)	50 (22, 37, 82, 86, 120)	210
<i>Python molurus</i>	257 (250, 285)	315
<i>Oligodon cyclurus</i>	—	—
<i>Cerberus rynchops</i>	25.5 (21, 24, 27, 28, 28)	42

^a Average of pooling sera and of some individual determinations.

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