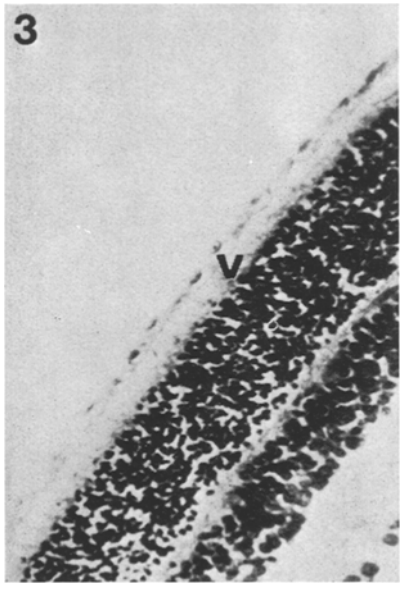

Fig. 3. Light micrograph of a 14-day-old neonatal rat retina after far red light treatment. Note decrease in thickness of the visual layer (V). ×450.

Our data indicate that light affects the development of the mammalian retinas as well, but perhaps in many different ways. Two closely related light waves (red and far red) exert totally different effects in the developing visual system. Red light appears to be stimulatory and far red light appears to be inhibitory. Since our experimental R_3 subgroup II (only treated with red light for once every 3 days) and R_1 and R_2 subgroups III (only treated with red light for 10 min each time) did not show any stimulatory effects after the red light treatment; therefore it seems that both timing and duration of treatment are critical factors. There is probably an existing minimum dosage for the treatment to be effective.

The mechanism of how 2 forms of light affect the retina, in particular the outer segments, remains obscure at this stage. A possible first target is perhaps the myoid region of the inner segments, in which groups of RNA are located. Since there is the myoid RNA that is responsible for the regeneration of the outer segments[5], it is reasonable to predict that an increase or decrease in thickness of the outer segments will result if one monitors the amount of RNA in this region. It could be that the light treatment affects directly the myoid region of the inner segments and causes an effect on the outer segments.

[5] R. W. Young, J. Cell Biol. *33*, 61 (1967).

Morphological Evidence for Axonal Transport of Glycogen in Neurons Innervating Cutaneous Receptors in *Lacerta sicula* (Squamata: Reptilia)

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Summary. Three types of glycogen-containing cutaneous nerve terminals – two of them hitherto unknown – are described. It is shown that the glycogen is synthesized in the perikaryon and transferred to the terminals by means of slow axoplasmic transport.

There are several types of nerve terminals in the skin of *Lacerta sicula* containing glycogen (Figures 4, 5 and 6). Since the terminals show no organelles for glycogen-synthesis, the question arizes as to how glycogen gets to them. As shown below, it appears very probable that it is brought to the terminals by axonal transport.

Wanson and Drochmans[1] showed that, in the skeletal muscle fibre of the rabbit, glycogen β-particles are being synthesized on sarcoplasmic vesicles (derivates of the sarcoplasmic reticulum). As far as we know, this fact has not been confirmed for nerve cells. Berthold[2] found that, in spinal ganglia cells of the frog, aggregations of glycogen particles often lie close to smooth surfaced membrane systems. This may be interpreted as implying that in neurons also glycogen is synthesized on membranes of the smooth endoplasmic reticulum. Observations made by Ibrahim[3], using enzyme-histochemical methods, also support the hypothesis of glycogen-synthesis in the perikaryon.

Glycogen synthesized in the perikaryon is transferred to the terminals by axoplasmic transport. Morphological proof for this hypothesis is given by the following observations: 1. In the lower regions of the corium, myelinated axons densely packed with glycogen are found (Figure 1). These axons contain mitochondria, vesicles and – depending on the type of fixation and anesthetic used – neurofilaments and neurotubules. The glycogen-containing sections of the axon are somewhat wider in diameter. 2. In the superficial corium, the axons after having lost their myelin lamellae show bead-like protrusions (Figure 2) which contain – in addition to large amounts of glycogen – mitochondria, neurofilaments, neurotubules and vesicles. These 'beads' are always covered by a continuous Schwann-cell sheath. 3. 'Beads' similar to those mentioned above can be found in the intercellular space of the epidermis (Figure 3). Since the Schwann-cell sheath ends at the basal lamina, neither the beads nor the axons are surrounded by it.

The presence of 'beads' in an axon is due to the discontinuous transport of glycogen. Since discontinuous transport is found only in slow axoplasmic transport[4], it can be concluded that glycogen is transferred to the terminals be means of slow axoplasmic transport.

Among the glycogen-containing terminals, the following types can be distinguished: 1. A terminal portion (with its finger-like protrusions) of the receptor axon in the non-encapsulated lamellated corpuscles in the corium

[1] J.-C. Wanson and P. Drochmans, J. Cell Biol. *54*, 206 (1972).
[2] C. H. Berthold, J. Ultrastruct. Res. *14*, 254 (1966).
[3] M. Z. M. Ibrahim, Adv. Anat. Embryol. Cell Biol. *52*, 1 (1975).
[4] S. Ochs, in *The Peripheral Nervous System* (Ed. J. I. Hubbard; Plenum Press, New York 1974), p. 47.

(Figure 4). This portion contains – in addition to glycogen – mitochondria, neurofilaments and sporadic non-granulated vesicles measuring about 60 nm. 2. A discoid terminal measuring several µm in diameter (Figure 5)[5,6]. It contains – in addition to glycogen – the above-mentioned organelles. It represents the only type of epidermal terminal. 3. A spheroid terminal (Figure 6). It contains – in addition to glycogen – the above-mentioned organelles. Being a corial terminal, it is surrounded by a thin Schwann-cell sheath which often shows interruptions over large areas of its surface. The terminal, however, is separated from the surrounding corium by a continuous basal lamina.

The morphological similarity between discoid and spheroid terminal suggests that both belong to the same type of receptor which occurs in the epidermis as well as in the corium. The flattening shown by the epidermal discoid terminals is probably caused by the flattening of the keratinocytes surrounding the terminal in the layers just beneath the stratum corneum.

The glycogen transferred to the terminals most probably serves as an energy supply for receptor processes. Enzyme-histochemical studies to back this hypothesis are at present being carried out.

[5] M. VON DÜRING, Z. Anat. EntwGesch. *141*, 339 (1973); Z. Anat. EntwGesch. *145*, 299 (1974); Abhdlg. Rhein. Westf. Akad. Wiss. *53*, 123 (1974).

[6] L. LANDMANN and W. VILLIGER, Acta anat. *93*, 319 (1975). – Experientia *31*, 967 (1975).

[7] Micrograph taken by W. VILLIGER, Anatomisches Institut der Universität Basel.

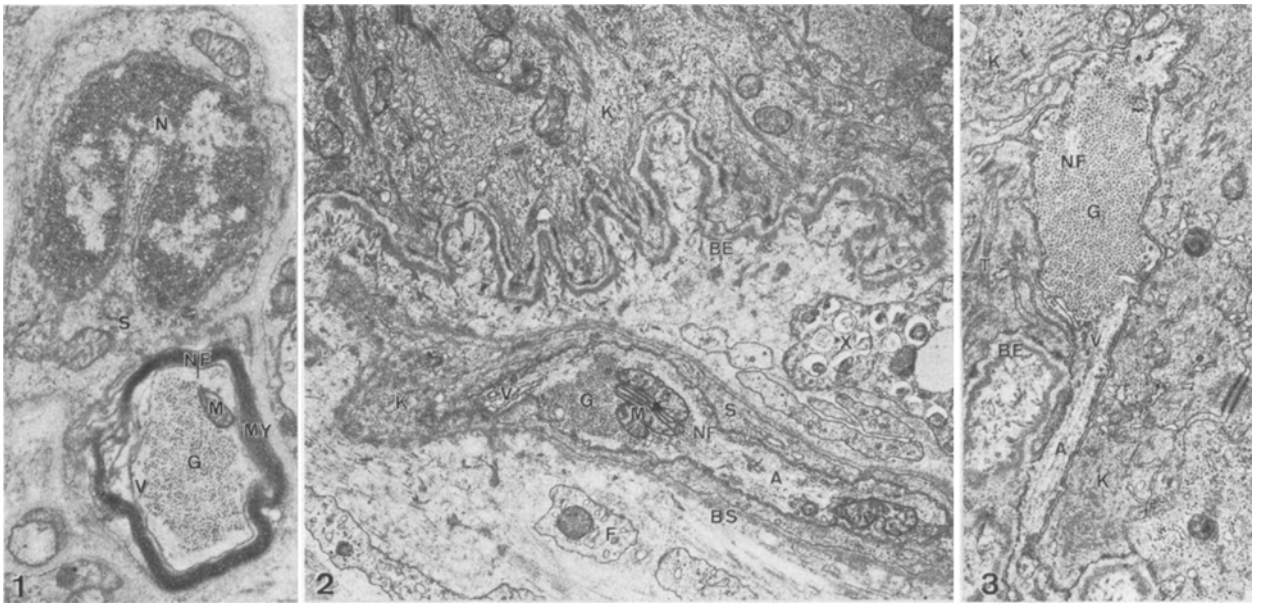

Fig. 1. Myelinated axon containing glycogen. G, glycogen; M, mitochondrion; MY, myelin sheath; N, nucleus of Schwann-cell; NF, neurofilaments; S, Schwann-cell; V, vesicles. × 11,500.

Fig. 2. Axon just beneath the epidermis after losing its myelin sheath with 'bead' containing glycogen[7]. A, axon; BE, basal lamina of the epidermis; BS, basal lamina of the Schwann-cell; F, fibrocyte; G, glycogen; K, keratinocyte; M, mitochondria; NF, neurofilaments; S, Schwann-cell; V, vesicles; X, xanthophore. × 11,500.

Fig. 3. Axon with 'bead' containing glycogen in the intercellular space of the epidermis[7]. A, intraepithelial axon; BE, basal lamina of the epidermis; G, glycogen; K, keratinocytes; NF, neurofilaments; T, tonofilaments; V, vesicles. × 15,500.

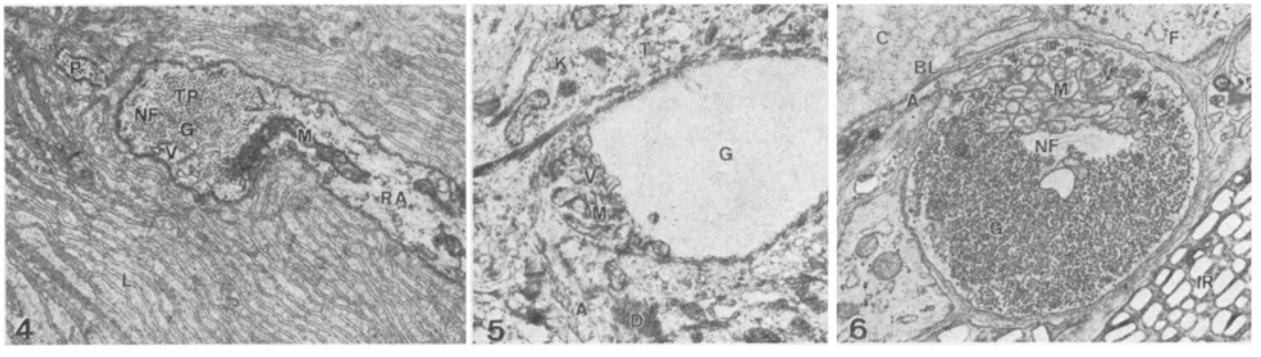

Fig. 4. Terminal portion of receptor axon in a non-encapsulated lamellated corpuscle with fingerlike protrusion[7]. G, glycogen; L, lamellae; M, mitochondria; NF, neurofilaments; P, fingerlike protrusion; RA, receptor axon; TP, terminal portion of receptor axon; V, vesicles. × 14,000.

Fig. 5. In superficial keratinocyte invaginated discoid terminal of the epidermis[7]. A, axon; D, desmosome; G, glycogen; K, keratinocyte; M, mitochondria; T, tonofilaments; V, vesicles. × 10,000.

Fig. 6. Spheroid terminal in the superficial layers of the corium. A, axon; BL, basal lamina; C, collagen; F, fibrocyte; G, glycogen; IR, iridophore; M, mitochondria; NF, neurofilaments; V, vesicles. × 13,000.