The K^+-activated hyperpolarization of both ganglion cells and splanchnic nerves was reversibly eliminated by the action of ouabain. As seen in Figure A-5 and B-4, the K^+-activated hyperpolarization was completely prevented by ouabain in a concentration as low as 2×10^{-3} mM; a depolarization now occurred when the K^+-free fluid was switched to the Ringer's solution.

The fact that K^+-activated hyperpolarization of both sympathetic ganglion cell bodies and axons was very sensitive to ouabain well supports the concept it was generated by an activation of the electrogenic Na^+-pump[3]. Although the mechanism by which the K^+-activated hyperpolarization of ganglion cells was accelerated by 5-HT could not be clarified, the acceleration did not seem to be due simply to an increase of the membrane resistance; the membrane resistance of ganglion cells measured by intracellular microelectrodes was not increased by 5-HT[5]. Therefore, the present results suggest that 5-HT directly accelerates the electrogenic Na^+-pump in ganglion cells[1]. 5-HT accelerated the K^+-activated hyperpolarization of ganglion cells but not that of nerve fibres. Presumably, the receptors which mediate the effect of 5-HT are located on the membrane of the cell bodies of sympathetic neurons but are absent in their axons.

Zusammenfassung. Die Hyperpolarisation von paravertebralen Ganglien des Ochsenfrosches (*Rana catesbeiana*) in vitro, die durch K^+ nach vorheriger Inkubation in K^+-freier Ringerlösung ausgelöst wird, war in Gegenwart von Serotonin (5-Hydroxytryptamin) deutlich verstärkt. Auf die K^+-bedingte Hyperpolarisation von Axonen des N. splanchnicus blieb Serotonin ohne Einfluss. Es wird angenommen, dass Serotonin die elektrogene Na^+-Pumpe über Rezeptorenstimulation aktiviert, die an der Membran der Zellkörper, nicht jedoch an Axonen sympathischer Neuronen vorhanden ist.

K. Koketsu and Y. Shirasawa

Department of Physiology,
Kurume University School of Medicine,
67 Asahi-machi, Kurume 830 (Japan),
22 February 1974.

[5] K. Koketsu and Y. Shirasawa, unpublished observation (1973).

Electroreceptive Properties of *Silurus glanis* (L.)

After it was well established that sharks and rays[1,2], as well as *Ictalurus nebulosus*[3], possessed a so-called 'passive' (non-electrogenic) electroreceptive system which makes them capable of using electrical cues from their environment, the question arose whether similar receptive properties could be found in other teleosts. In view of the order of magnitude of natural electric fields in freshwater[4], it seems that only a few of the known current density threshold values[5–10], e.g. those of *Clarias*[8], *Lepidosiren*[9] and *Anguilla rostrata*[10,11], are within the physiological range.

In a first attempt to examine further teleost species for the possession of biologically significant passive electroreceptive systems, specimens of the European silurid *Silurus glanis* (L.) were selected (length approx. 30 cm). According to the method described by Peters and Buwalda[3], spikes were recorded from the superficial branch of the lateral-line nerve, which innervates skin receptors of the flanks[12]. According to Herrick[13], this nerve corresponds to the ventral branch of the ramus lateralis X used by Peters and Buwalda[3] in the silurid *Ictalurus nebulosus*.

The results resemble fairly closely those obtained by Peters and Buwalda[3] and consequently show that this superficial branch of the r.lat. X is involved in the reception of weak electrical stimuli. As the adaptation to a DC stimulus current is slow (time constant of several sec), the receptors can be considered tonic. With a homogeneous, vertically applied sinusoidal stimulus current of 3 Hz, the threshold current density was approx. 10^{-10} A/mm^2. The upper limit of the frequency response differed somewhat from that of *Ictalurus*: instead of decreasing rapidly above 10 Hz, the response was quite pronounced up to 25 Hz, at which frequency a certain degree of spike synchronization was observed. With further increasing frequency, the response diminished rapidly.

The above-mentioned results show that *Silurus* possesses an electroreceptive system which may well function in preydetection and/or orientation, as found in *Ictalurus*[14,15].

Zusammenfassung. *Silurus glanis* (L.) hat elektrische Sinnesorgane, deren Eigenschaften mit denen des *Ictalurus nebulosus* übereinstimmen: die Rezeptoren sind tonisch, die obere Frequenzgrenze liegt bei etwa 25 Hz, und der Schwellenwert beträgt ungefähr 10^{-10} A/mm^2. Sie könnten also, wie bei *Ictalurus*, sowohl dem Beutefang als der Orientierung dienen.

F. Bretschneider

Laboratorium voor Vergelijkende Fysiologie,
Jan van Galenstraat 40,
Utrecht (The Netherlands), 11 March 1974.

[1] S. Dijkgraaf and A. J. Kalmijn, Z. vergl. Physiol. *47*, 438 (1963).
[2] S. Dijkgraaf and A. J. Kalmijn, Z. vergl. Physiol. *53*, 187 (1966).
[3] R. C. Peters and R. J. A. Buwalda, J. comp. Physiol. *79*, 29 (1972).
[4] R. C. Peters and F. Bretschneider, J. comp. Physiol. *81*, 345 (1972).
[5] Fe. and Fr. Scheminzky and F. Bukatsch, *Elektro-Biologie* (W. Junk, Den Haag 1941).
[6] P. F. Meyer-Waarden and I. and E. Halsband, *Einführung in die Elektrofischerei* (Westliche Berliner Verlagsgesellschaft Berlin 1965).
[7] H. C. Regnart, J. mar. biol. Ass. U.K. *17*, 415 (1931).
[8] H. W. Lissmann and K. E. Machin, Nature, Lond. *199*, 88 (1963).
[9] A. Roth, Naturwissenschaften *60*, 106 (1973).
[10] S. A. Rommel and J. D. McCleave, Science *176*, 1233 (1972).
[11] Similar investigations with *Anguilla anguilla* are in progress.
[12] M. Juge, Rev. suisse Zool. *6*, 1 (1899).
[13] C. J. Herrick, J. comp. Neurol. *21*, 177 (1901).
[14] R. C. Peters and J. Meek, Experientia *29*, 229 (1973).
[15] R. C. Peters and F. van Wijland, in press.