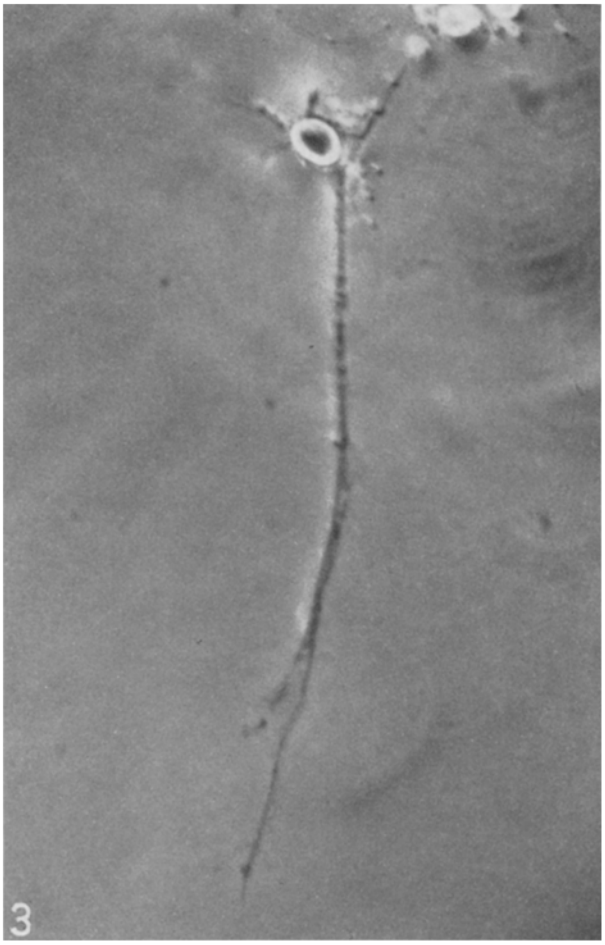

Fig. 3. Long axon-like process originates from a cell cluster. Phase contrast microscopy. Photographed through the culture dish. ×500.

tumour, like more mature cell types or still undifferentiated cells, which would behave like neural crest cells and be sensitive to NGF. On the other hand, no axon formation was observed in cultures without NGF, although the cells were taken from the same neuroblastoma. Several agents are known to induce the differentiation of neuroblastoma cells such as prostaglandins and cyclic AMP[8,9]. The promotion of neurite growth with NGF would be mediated through cyclic AMP, as has also been suggested, by ROISEN et al.[10].

Further studies on the nature and maturation stages of the processes produced by cultured neuroblastoma cells with NGF are needed, i.e. by fluorescence and electron microscopy. However, our observations show that purified NGF causes differentiation in vitro of the tumour cells and suggest that the spontaneous transformation of human neuroblastomas to ganglioneuromas may be due to the action of a NGF-like substance.

Zusammenfassung. Durch Züchtung in vitro wird gezeigt, dass Zellen eines menschlichen Neuroblastoms unter dem Einfluss eines Nervenwachstumsfaktors die Fähigkeit haben, sich in Nervenzellen zu differenzieren und somit die Zellen dieses bösartigen Tumors histogenetische Potenzen besitzen, welche nicht aktiviert werden.

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Development of the New Pacinian Corpuscles. Studies on the Foreign Innervation of Mesentery

Development of the receptors is one of the most important but unfortunately unsolved problems of sensory physiology. It is well known that the growth of afferent nerve fibres produces sensory receptors specific to the given tissue. However, it is yet to be seen what determines the development of such receptors: the properties of nerve fibres[1,2] or just the specification of tissue elements[3–5].

When studying the process of receptor development, using not only morphological but also physiological methods, it is very important to have a possibility of continuous observation of a single sensory element at various stages of development. So, the Pacinian corpuscles of cat mesentery, visible even to the naked eye, are well suited for a study of this kind. Preliminary report was published elsewhere[6].

The first series of experiments were performed to find out the regeneration ability of mechanoreceptors of the mesocolon. In 16 adult cats the Pacinian corpuscles were extirpated or simply the nerve fibres were severed. The data show that even 8 months after operation the regeneration of receptors from the remained nerve fibres could not be seen anywhere. These results confirm well with other data[7–11].

After finishing the first part of experiments, we investigated the effect of additional innervation of mesentery tissue by the somatic sensitive nerve (n. saphenus) foreign to this tissue, which ramifies in the hairy skin of an animal where Pacinian corpuscles are absent. To accomplish this task, the nerve was dissected on the level of the knee joint and then its central end was guided in to the abdominal cavity and led between the two layers of mesentery. Originally, there were no Pacinian corpuscles at all in the mesocolon of some cats. In other cats all Pacinian corpuscles were extirpated from

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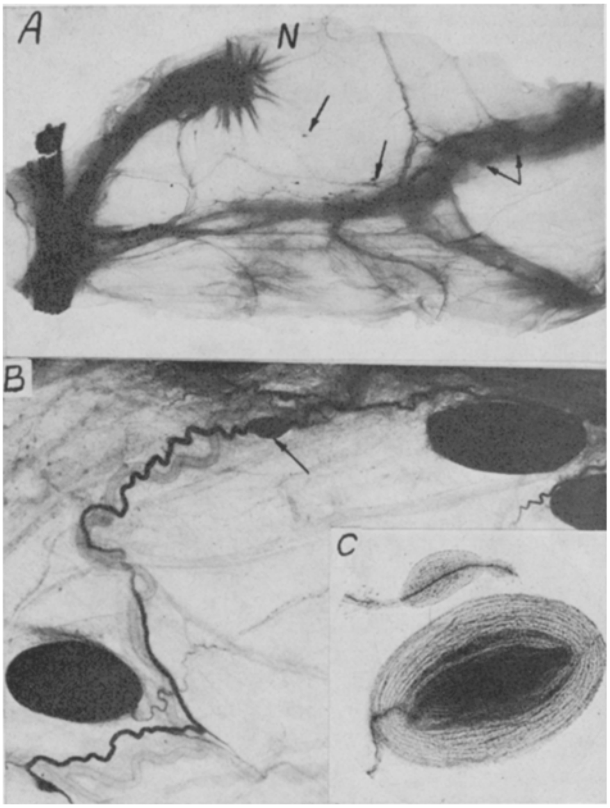

Fig. 1. Newly formed receptors in the cat's mesocolon. (A, B) silver method of Bilshovsky; C) OsO_4 impregnation). A) cat No. 25 in 7 months after operation (the graft of N. saphenus was made on 22nd december 1971). N, the starlike neuroma; arrows indicate some small (to the left and both fully formed (to the right) receptors. B) cat No. 6 in 5 months after operation (the graft of N. saphenus was made on 15th october 1971); the arrow indicates one small Pacinian corpuscle. × 20. C) comparison of receptors at various stages of development (the same cat as in B); the smaller receptor has a bead-like form. ×160.

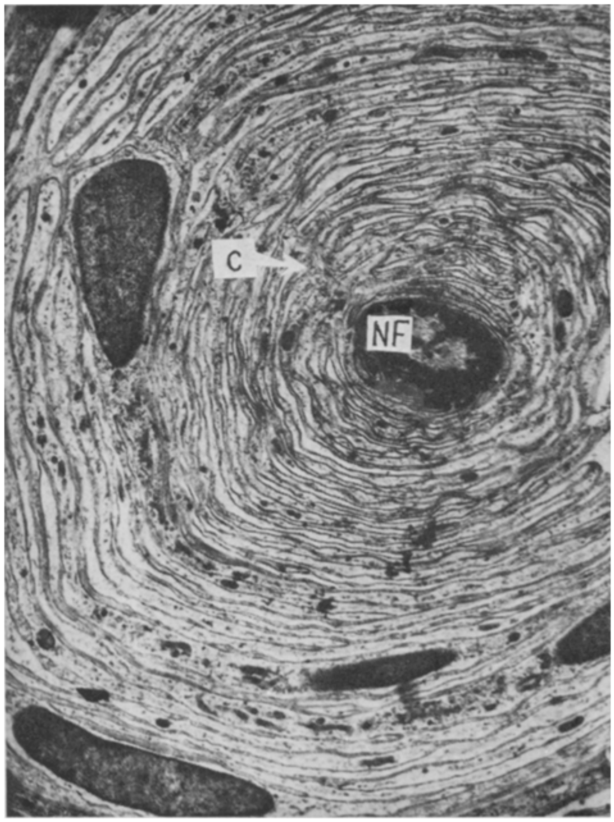

Fig. 2. The section of newly formed receptor. Kitten No. 15 in 5 months after operation (the graft of N. saphenus was made on 22nd May 1972). NF, nerve fibre; C, cleft in the inner core. × 2000.

the mesocolon before transplantation. In both cases in 3–8 months after the operation, the new Pacinian corpuscles were clearly observed in the mesocolon. The grafted nerve developed the neuroma on its end. From this neuroma and along the nerve-trunk, the growth of collaterals was observed. Some collaterals gave new Pacinian corpuscles at various stages of development (Figure 1). Sometimes, the nerve fibre was growing through the new-born capsules, giving several new beadlike Pacinian corpuscles (Figure 1B, C). Thus, in this series of experiments, 11 animals out of 13 developed from 2 to 6 new fully formed receptors each.

According to the present data, the speed of forming new Pacinian corpuscles in adult animals is not fast enough (more than 3 months were needed to give differentiated forms of receptors). For this reason the next series of experiments were performed on young animals which have, as is well known, a higher speed of regeneration. The new forming of receptors was quite successful in all of 8 cases; it was already completed in 2 months after the transplantation of the nerve and the quantity of newly formed Pacinian corpuscles was greater than in the case of adult animals. Two 2-months-old kittens, when operated, had no Pacinian corpuscles at all in the mesocolon, but 5 months later one had 18 and the other 19 well formed large receptors.

According to the histological and physiological investigation, newly- and normally formed in the same cat's mesentery Pacinian corpuscles showed no differences in their morphological and functional properties. In the investigation of the ultrastructural organisation of newly formed receptors, the axis cylinder, cells nucleous of the inner core and various cytolpasmatic processes were as usual. In the direction of the long transversal axis of the nerve ending, a cleft was clearly visible. (Figure 2). The extracorpuscular part of the nerve fibres of newly formed receptors was of about 5 to 10 μm in diameter. The electrical answers to the mechanical stimulation of newly formed receptors and of the receptors from other parts of the mesentery in one animal were identical (Figure 3). Sometimes the spontaneous action potentials were registered.

Thus the nerve, which usually does not form Pacinian corpuscles, develops this type of sensory endings characteristic of the mesentery tissue, when making contact with it. Therefore, the tissue factor may be considered determinative in the process of the development of receptor endings.

Recently, some authors[12] showed the possibility that the foreign nerve (n. hypogasticus) may grow into the old capsules. Their conclusions on the determinative role of the tissue factor in the development of sensory receptors agree with the conclusions of the present work. Our data also show that not all of the growing in the mesocolon

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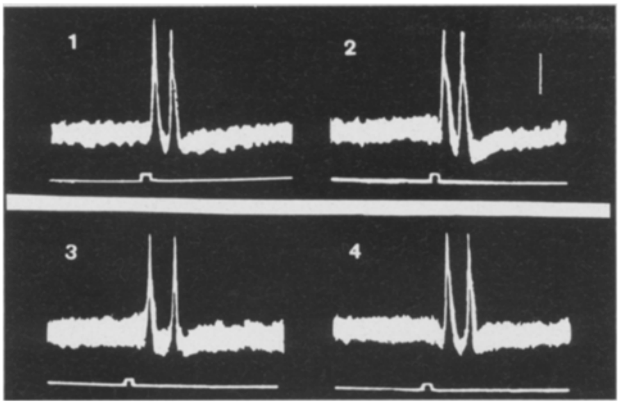

Fig. 3. The spikes of Pacinian corpuscles. 1 and 2. Kitten No. 11 in 6 months after operation; 3 and 4. cat No. 27 in 8 months after operation. 2 and 4, newly formed receptors; 1 and 3, normally formed receptors. The duration of mechanical stimulation (the mark beneath photoes) is 1 msec; calibration is 25 μV.

nerve fibres developed Pacinian corpuscles. Therefore, it is necessary to produce the determinative nerve-tissue situation to make it possible to develope these receptors.

Zusammenfassung. Nach Implantation des proximalen Stumpfes eines afferenten, somatosensiblen Nerven in das Mesenterium einer Katze bilden sich um die auswachsenden Nervenfasern nach 3–5 Monaten neue, aber dem Ort entsprechende Rezeptoren aus, im Fall des Katzenmesenteriums also Pacinische Körperchen, Rezeptoren, die normalerweise nicht im Gebiet des implantierten Nerven vorkommen.

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Asymmetrical Growth of Superior Temporal Gyri in Man

Records of sensory experience seem to be stored in the superior temporal gyri: stimulation of this region in conscious patients has sometimes caused them to report the re-experiencing of auditory and visual experiences from their past lives[1,2]. Specialization of one hemisphere, usually the left, for verbal function may be reflected in anatomical asymmetries[3,4]. The present study was designed to detect possible macroscopic differences between the right and left superior temporal gyri in human infants and adults.

Materials and methods. Brains used in this study had been declared normal at autopsy. They appeared free from distortion after fixation, and were intact except for our removal of the meninges. Handedness data were not available.

Measurements were made directly on the brains of 27 young infants who died before the age of 4 months. Widths were measured at 5 mm intervals along the horizontal parts of the superior temporal gyri. To eliminate any bias, another series of 54 brains was measured using photographs, 50% of which were reversed in a random sequence. In each of 42 adult brains, 10–14 pairs of widths were measured. Fewer measurements were obtained from the photographs of 12 smaller brains of 2–18-month-old infants.

Results. In the 27 infant brains measured directly, right gyri were not significantly wider: t (unpaired) = 0.956, $P < 0.34$. The Mann-Whitney test gave a Z-value of 1.192, $P < 0.22$. For the 12 infant brains in the second series $t = 1.4577$, $P < 0.10$. In the 42 adult brains measured with the blind technique the right gyrus appears wider (Table): t (paired) = 2.911, $P < 0.005$.

Means and standard deviations of gyral widths

	Widths (mm)	Right	Left
12 infants	125 pairs	11.895 ± 4.287	11.310 ± 3.373
42 adults	502 pairs	13.148 ± 3.977	12.538 ± 4.098

In 8 adults, the two-tailed Wilcoxon signed ranks test showed the right gyrus as being wider. In one adult the left gyrus was wider, at the same level of significance ($P < 0.05$). In 42 brains, random variation of gyral widths should account for a wider right gyrus in 1.05 brains, and a wider left gyrus in another 1.05 ($P < 0.05$). Comparing the observed number of 8 having larger right gyri, 33 symmetrical, and 1 having a larger left gyrus with the expected values of 1.05, 39.90, and 1.05, the χ squared goodness of fit test gave a value of 47.1, for which $P < 0.001$ with 2 degrees of freedom. No such difference appeared in either group of infants.

Discussion. PENFIELD and PEROT[2] reported points in the superior temporal gyri from which 'experiential' responses were obtained. Excluding points in the right gyri corresponding with those in the speech arrest area of the left, 60 were found on the right and 30 on the left. Confidence limits (5%) for the percentage of points found on the right are 60–79. Few cerebral functions are delineated by anatomical landmarks. Greater widths of the right superior temporal gyri in adults may, however, reflect the bias toward the right temporal lobe seen in the phenomenon of 'experiential' response. This anatomical bias toward the right, seen in 42 adults, did not appear in 35 infants.

Zusammenfassung. Nachweis, dass in Erwachsenen der Gyrus superior temporalis auf der rechten Hirnseite breiter ist als auf der linken, während in Kleinkindern beide Gyri gleich breit sind.

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