The effect of pretreatment with adrenergic β-receptor blocking agent on the increased susceptibility to fibrillation in moderate hypoxia is demonstrated in Figure 2. As can be seen, hypoxia reversibly reduced auricular and ventricular fibrillation thresholds: 1 mg/kg DCI evoked a clearly demonstrable rise of both and practically prevented subsequent hypoxia in reducing the thresholds below the initial value. Adrenergic β-receptor blocking agents are effective also when given during the hypoxic period. Figure 3 shows that 2 mg/kg DCI, 2 mg/kg i06, 1 mg/kg Alderline and 2 mg/kg i013 are equally effective in counteracting the fibrillation threshold reducing influence of moderate hypoxia. This latter is reproducible at will after elimination of the drugs, as can be seen from the graph.

Accordingly β-receptor blocking sympatholytics proved to be useful in preventing hypothermic and hypoxic increase of susceptibility to arrhythmias. Whether this effect is mainly due to an inhibitory influence on the cardiac sympathetic, or to some 'unspecific' quinidine-like antiarrhythmic action of these compounds (MORALES-AGUILERÁ and VAUGHAN WILLIAMS[8], SEKIYA and VAUGHAN WILLIAMS[9]), still remains to be cleared up.

The significance of our findings can be summarized as follows: On the one hand they draw attention to a new possibility of therapeutic application of the adrenergic β-receptor blocking agents, and on the other hand they point to the important role of the cardiac sympathetic control in the mechanism of increased liability to arrhythmias in moderate arterial hypoxia and hypothermia.

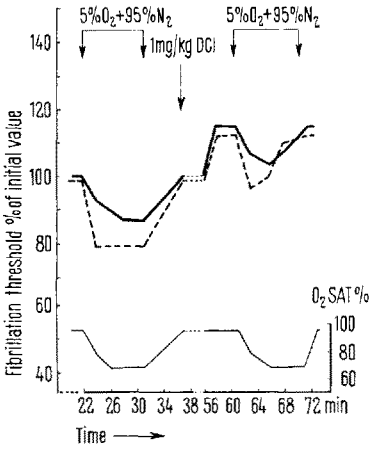


Fig. 2. Effect of DCI pretreatment (1 mg/kg i.v.) on auricular and ventricular fibrillation thresholds in arterial hypoxia.

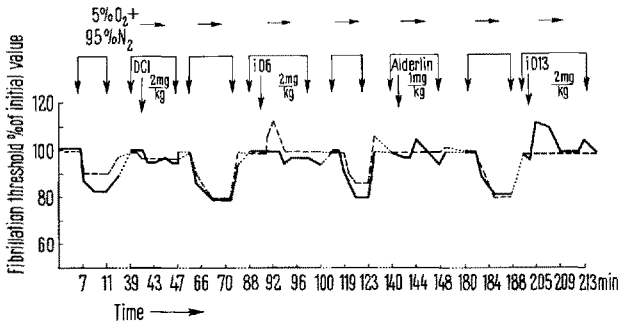


Fig. 3. Influence of different adrenergic β-receptor blocking agents on hypoxic decrease of the fibrillation thresholds, when administered i.v. during inhalation of a gas mixture containing 5% O_2 in N_2.

Zusammenfassung. Erhöhte Arrhythmiebereitschaft des hypothermischen und hypoxischen Herzens (in situ) konnte durch β-Rezeptoren blockierende Sympatholytica, wie Inderal, Alderlin und Dichloroisoproterenol, sowie zwei seiner Homologe (i06 und i013) stark bis völlig gehemmt werden.

L. SZEKERES, J. PAPP, and W. FÖRSTER

Department of Pharmacology of the University Medical Schools of Pécs (Hungary) and Magdeburg (DDR), June 25, 1965.

Degenerative Changes in Dendrites Following Axonal Transection

Two basic phenomena are utilized for tracing the course and termination and for localizing the cells of origin of nerve fibre bundles. These are the Wallerian degeneration and the retrograde cell reaction, respectively. Some neuroanatomical problems cannot be solved experimentally by Wallerian degeneration or by retrograde cell reaction. For example, in certain loci it is not possible to make lesions so selective that the ensuing degeneration will represent axons and axonal arborizations belonging to one fibre system only. For this reason it may be impossible to demonstrate experimentally whether degenerating arborizations passing to a nervous structure are collaterals from a neighbouring fibre system or whether they are true terminal branches belonging to a separate system.

Utilizing the fact that nerve cells of new-born animals are more apt to react by disintegration following axonal transection than nerve cells of adult animals[1], the author has performed a series of experiments.

In one group of kittens, unilateral transections of the hypoglossal nerve were carried out. The animals were operated on at various ages and kept alive for various

[1] A. BRODAL, Arch. Neurol. Psychiat. *43*, 46 (1940).

periods. In transverse sections stained by the NAUTA[2] technique, degenerating nerve fibres were seen on the proximal side of the transection in the medulla at the side of the nerve transection, at the site where hypoglossal nerve fibres are situated. Details of this study will be published separately.

In two other groups of kittens, unilateral transections were made of the sciatic nerve and of lower lumbar ventral roots, respectively. Degenerating nerve fibres were seen in Nauta preparations at the side of the transection in the ventral horn, and at the sites in the white substance where the nerve fibre bundles which give rise to the ventral spinal roots are situated.

In a fourth group of kittens cerebellar lesions were performed. Degenerating nerve fibres were seen in Nauta preparations from the medulla at the sites where efferent fibres from, for example, the inferior olive and the lateral reticular nucleus to the cerebellum are situated.

The results from these last three groups will be published in greater detail later.

The common finding in all groups is the occurrence of degenerating fibres proximal to the site of the transection.

In addition to this, an unexpected discovery was made. In some preparations, apparently degenerating dendrites in continuity with nerve cells were found to be impregnated. This was found in the hypoglossal nucleus and in the ventral horn at the side of the transection. One of the cells was seen to give rise to as many as six degenerating dendrites.

The Figure illustrates a cell of this type in the right hypoglossal nucleus from an 11-day-old kitten, which was submitted to a transection of the hypoglossal nerve in the carotid triangle on the right side and killed 7 days later. From the bottom and from the left side of the impregnated cell two rather coarse processes with secondary ramifications can be seen, in what is apparently a state of disintegration. The left one can be traced for about 6 cell lengths. The fragments of the processes with their ramifications are of varying sizes and have irregular contours. The sites of branching are clearly visible. The two processes with their ramifications have been interpreted as degenerating primary and secondary dendrites. In addition, a short fine fragmented fibre can be seen in continuity with the top of the cell. This is presumably a third dendrite. On the right side of the cell a conical narrowing is visible. This has been interpreted as the axon hillock.

The discovery of degenerating fibres on the proximal side of transected axons is absolutely contradictory to the Wallerian law, according to which degeneration may occur in the distal but not in the proximal part of a transected axon, with the exception of a short segment close to the transection.

The observation of degeneration proximal to the site of the transaction has been reported previously, however. At the end of the last and at the beginning of the present century several authors were aware of the occurrence of what was termed retrograde fibre degeneration or indirect Wallerian degeneration[3]. This was observed in fibre systems from various mammals, including man. Some authors even used retrograde fibre degeneration as a method for tracing the intramedullary course of the motor components of some of the cranial nerves.

During the last decades this type of degeneration has attracted very little attention. It is obvious, however, that some authors have been aware of its existence[4–6].

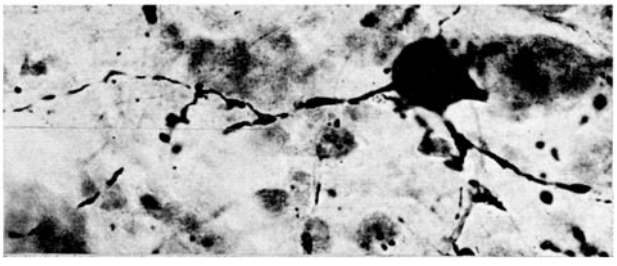
Of special interest in connection with the present findings are the papers by GUILLERY[4] and POWELL and COWAN[6], who used the Nauta technique. They have suggested that part of the granulation observed by them may have comprised degeneration products from dendrites. It seems clear, however, that degenerating dendrites as demonstrated in the present paper have not previously been observed in histological sections.

The fact that degenerating dendrites can be demonstrated in histological sections is of very great interest. It has long been possible to 'mark' the cells of origin of various nerve fibre bundles by utilizing the retrograde cell reaction. The results presented in this paper demonstrate that dendrites belonging to a fibre system may also be 'marked'. It will therefore be possible to obtain directly a map of the receiving area of a specific neurone with greater detail than has previously been possible. Moreover, by applying methods for the staining of normal or degenerating boutons on material with the afferent systems intact or experimentally destroyed it will be possible to acquire more precise information concerning synaptic relations.

Zusammenfassung. Im Zusammenhang mit Untersuchungen an jungen Katzen über den Effekt der Durchschneidung von Axonen sind in Nauta-Präparaten zum ersten Mal am zentralen Teil der Neurone degenerierende Dendriten gefunden worden. Die Bedeutung dieses Befundes wird kurz diskutiert.

G. GRANT

Department of Human Anatomy, University of Uppsala (Sweden), July 27, 1965.



Cell with degenerating dendrites. Nauta preparation. × 540. The picture is composed of three photomicrographs taken at different foci (see the left part of the picture). Compare with text.

[2] W. J. H. NAUTA, in *New Research Techniques of Neuroanatomy* (Ed. W. F. WINDLE; C. C. Thomas, Springfield, Ill., 1957).

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[5] H. F. M. BUSCH, *An Anatomical Analysis of the White Matter in the Brain Stem of the Cat*, Thesis (Van Gorcum & Co. N.V., Leiden 1961). – W. M. COWAN, L. ADAMSON, and T. P. S. POWELL, J. Anat., Lond. *95*, 545 (1961). – B. G. CRAGG, Exp. Neurol. *5*, 406 (1962).

[6] T. P. S. POWELL and W. M. COWAN, J. Anat., Lond. *98*, 579 (1964).