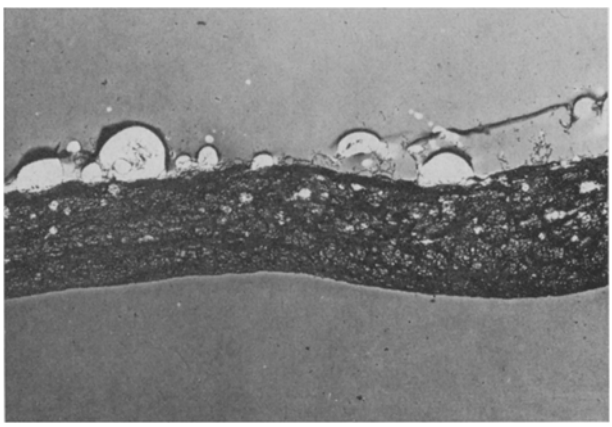
to the lumen of the pulmonary trunk. It shows numerous focal areas of high fibrinolytic activity randomly distributed in the thickened vessel wall. This pattern is characteristic for an area of tissue repair undergoing organization such as observed following experimentally induced tissue injury[5]. The same pattern was observed in samples from another pig heart.



B) Transverse section of the wall of the pulmonary trunk adjacent to the area in Figure A. ×8.5. Other details as in Figure A.

In the rabbit, cross sections of the DA showed well demarcated zones of lysis in the peripheral parts of the obliterated areas after 60 min of incubation. An abundancy of cells indicated that organization was still progressing. Lysis was absent in other vascular structures of the rabbit, including the adventitia of the aorta and pulmonary artery, even after 3 h of incubation. Similarly, in 2 guinea-pigs scattered focal lysis appeared in relation to the obliterated DA after 30 min of incubation, while lytic zones became visible in the aorta and pulmonary artery only after 60 to 120 min and were restricted to the adventitia[6].

Zusammenfassung. Im obliterierenden Ductus arteriosus vom Schwein, Kaninchen und Meerschweinchen erscheinen Zonen von intensiver fokaler fibrinolytischer Aktivität, die charakteristisch für neugebildetes vaskularisiertes Bindegewebe im Wundheilungsgebiet sind.

PIA GLAS-GREENWALT, CONSTANCE STRAND and T. ASTRUP

The James F. Mitchell Foundation, Institute of Medical Research, 5401 Western Avenue N.W., Washington (D.C., 20015, USA), 8 October 1971.

H. C. KWAAN and T. ASTRUP, J. path. Bact. *87*, 409 (1969).

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The Histochemically Demonstrable Monoamines of Human Fetal Carotid Body

Several biochemical and histochemical reports have revealed that the mammalian carotid body contains catecholamines and 5-hydroxytryptamine (for ref. see HAMBERGER et al.[1], CHIOCCIO et al.[2]). The localization of different amines in the cells of the carotid body has been discussed (MORITA et al.[3], ZAPATA et al.[4]) together with their functional importance for the generation of the chemosensory response. However, the cytochemical basis of the chemosensory function of the carotid body is still a matter for discussion. The presence of the monoamines has been demonstrated in all mature mammalian carotid bodies studied, and also in man. These compounds, or at least some of them, could be considered necessary for the normal chemosensory response of the organ.

In the embryological papers on the development of carotid body (BOYD[5], ROGERS[6]), conventional light microscopic methods alone have been used. No investigations dealing with the catecholamine histochemistry of fetal carotid bodies were available. The present paper is a preliminary report of studies concerning the fetal function and histochemical differentiation of the human carotid body.

Material and methods. The carotid bodies of 6 human fetuses (Cr 10.5–14.5 cm) were prepared immediately after the disconnection of the fetoplacental circulation. The specimens were frozen quickly in isopenthane cooled with liquid nitrogen. For the study of the distribution of histochemically demonstrable catecholamines and 5-HT, the formaldehyde induced fluorescence method was essentially the same as described by ERÄNKÖ[7]. An efficient chemical water trap in the form of large amounts of phosphorous pentoxide was used (OLSON and UNGERSTEDT[8]). The exposure to formaldehyde was performed at 60 °C for 30 min and then at 80 °C for 60 min. The freeze-dried specimens were embedded in a mixture of Epon and Araldite (ERÄNKÖ and ERÄNKÖ[9]). The blocks were cut at 2–5 μm using glass knife and LKB Pyramitome. For fluorescence microscopy, a Leitz Ortholux microscope was used with a HBO 200 mercury lamp (Osram) and with the following filters: A 3 mm thick BG 38 heat absorbing filter, one 3 mm thick BG filter, a TAL 408 interference filter (all filters by Schott & Gen., Mainz), an epi-illuminator by Ploem and Leitz ultraviolet absorbing filter K 470.

Observations. The carotid bodies were easily recognizable between the base of internal and external carotid arteries (Figure 1). The organ was clearly separated from the adventitia of the vessels. A smaller artery, the ascending pharyngeal artery was seen between body and the external carotid artery.

The organ was composed of small tight groups of brightly yellow fluorescent cells, probably comparable to the chemoreceptor or glomus cells of adult carotid bodies. The carotid bodies were located in loose perivascular connective tissue and there was not any continuous capsule surrounding the fluorescent cells. The fluorescent cells or groups of them were organized around capillaries

[1] B. HAMBERGER, M. RITZEN and J. WERSÄLL, J. Pharm. exp. Ther. *152*, 197 (1966).
[2] S. R. CHIOCCHIO, M. P. KING and E. T. ANGELAKOS, Histochemie *25*, 52 (1971).
[3] E. MORITA, J. R. CHIOCCHIO and J. H. TRAMEZZANI, J. Ultrastruct. Res. *28*, 399 (1969).
[4] P. ZAPATA, A. HESS, E. L. BLISS and C. EYZAGUIRRE, Brain Res. *14*, 473 (1969).
[5] J. D. BOYD, *Embryology* (Carnegie Institute, Publication 26, Washington 1937), No. 152, p. 1.
[6] D. C. ROGERS, J. Anat. *99*, 89 (1965).
[7] O. ERÄNKÖ, J. R. microsc. Soc. *87*, 259 (1967).
[8] L. OLSON and U. UNGERSTEDT, Histochemie *22*, 8 (1970).
[9] O. ERÄNKÖ and L. ERÄNKÖ, Progr. Brain Res. *1970*, 34.

contacting the basement membrane of the vessels (Figures 2 and 3). The pericytes, surrounding the clusters of fluorescent cells in an adult were very thin. The monoamine storing cells seemed to be in efficient contact with the local sinusoidal capillary system. The capillary supply was rich, the cross sections of the vessels were usually round and wide (Figures 2 and 3).

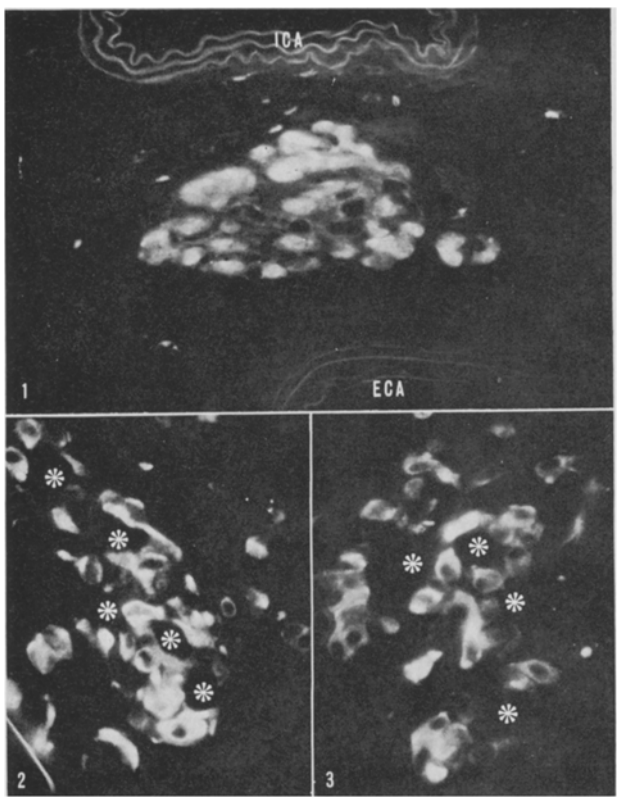

Fig. 1. A horisontal 7 μm section through the carotid body. The brightly yellowish fluorescent collection of glomus cells is located between the bases of internal and external carotid arteries (ICA and ECA). Round cross sections of capillaries are clearly visible. × 175.
Fig. 2. and 3. The glomus cells were in intimate contact with the sinusoidal capillaries (marked with stars). The cells are mostly small and round. Note the differences in the intensity of fluorescence between individual cells. × 200.

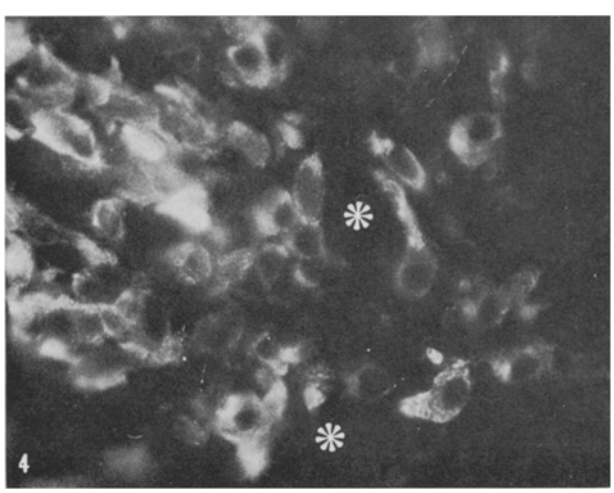

Fig. 4. A collection of glomus cells, 2 μm section. Note the internal granularity of the fluorescent cytoplasm. Capillaries marked with stars. × 378.

Fluorescent nerve fibres were not found to enter the bodies. However, on the walls of the capillaries, greenish fluorescent fibres could occasionally be found.

The fluorescent cells were small, measuring only 5–6 μm in diameter. Their shape was mostly round or polygonal; only a few elongated forms were found. Some mast cells were occasionally seen between the lobules.

Discussion. In previous studies of the catecholamine fluorescence of adult carotid bodies (NIEMI et al.[10], PALKAMA[11], HAMBERGER et al.[1] and CHIOCCIO et al.[2]) essentially similar localization of catecholamine specific fluorescence was reported. Instead of the differences in the colour of exhibited fluorescence (CHIOCCIO[2]) different types of cells were not visible with the filter combination used: all cells exhibited yellowish fluorescence, however, the intensity could vary markedly from cell to cell.

The fluorescence of the glomus cells faded faster than the fluorescence of control adrenal medullary cells. HAMBERGER et al.[1] noted similar rapid fading of fluorescence and stated that this kind of fading is characteristic specially of 5-HT. On the basis of the same criteria, it is postulated that the human fetal carotid body also contains 5-HT among other amines. The colour of the remaining fluorescence was essentially the same as before the most rapid fading.

The monoamine storing cells of the adult carotid body are surrounded by a special enclosing cell type sustentabular cells (BISCOE et al.[12], AL-LAMI and MURRAY[13], MORITA et al.[3], ZAPATA et al.[4], KNOCHE et al.[14]). In the adult bodies, a direct contact of monoamine-containing cell to the capillary basement membrane has not been demonstrated. In our specimens, the pericapillary space was often so minimal, that it led to suggest occasional direct contacts, too. The complete enclosure of monoamine storing cells might occur later during the ontogenesis.

The chemosensory reactions of adult carotid bodies are not completely cleared up, in particular the role of monoamines remains obscure (CHIOCCIO et al.[2]). The human fetal midterm carotid bodies showed many identical features with the adult ones, which might indicate that the organ is already actively functioning during the fetal period. The most important natural stimulus for a fetal carotid body is evidently asphyxia. Typical changes in the PO_2, PCO_2 or pH of the blood activate the chemosensory mechanisms of a mature carotid body. The identity of the histochemistry of human fetal carotid bodies with that of the adult led to the suggestion that the organ might already be of importance during the second third trimester of pregnancy. The fetal function of the carotid body might be the detecting of beginning asphyxia, possibly also inducing compensatory changes in the cardiovascular dynamics.

Zusammenfassung. Die Katecholaminfluoreszenz des menschlichen fötalen Glomus caroticum wurde untersucht und es wurde eine Ähnlichkeit mit derjenigen beim Erwachsenen gefunden.

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Department of Anatomy, University of Helsinki, Siltavuorenpenger, Helsinki (Finland), 7 October 1971.

[10] M. NIEMI and K. OJALA, Nature, Lond. *203*, 539 (1964).
[11] A. PALKAMA, Annls Med. exp. Biol. Fenn. *43*, 260 (1965).
[12] T. J. BISCOE and W. E. STEPHENS, J. Cell Biol. *30*, 563 (1966).
[13] F. AL-LAMI and R. G. MURRAY, Anat. Rec. *160*, 697 (1968).
[14] H. KNOCHE, E. W. KIENECKER and G. SCHMITT, Z. Zellforsch. *112*, 494 (1971).