by the configuration of maturing face cisternae and the lack of secretory vesicles. The shape of the cisternae at the forming face and the presence of vesicles in this area presumably prevent an involvement of these cisternae in dictyosome association. The occurrence of dictyosomes with a double polarity requires special intercisternal adhesive mechanisms. It is difficult to imagine that the association of the dictyosomes in this form is mediated by a particular affinity of similarily composed or functionally adequate membranes. It is more probable that intercisternal materials are involved in the adhesion of two dictyosomes. These intercisternal materials are often represented by fibrils. These materials are expected to occur also at the surface of the outermost cisterna of the maturing face.

After the cyanide treatment, approximately 1% of all dictyosomes within a root hair show a double polarity. The overwhelming portion of single dictyosomes is characterized by similar morphological alterations[9] of which some are specified above. For that reason it is questionable whether the assemblage of two dictyosomes is a direct consequence of cyanide action. It is more likely that cyanide (1 m*M*, 2 h) brings about the precondition(s) for the adhesion of the dictyosomes by modifying their maturing faces. The formation of 'twin-dictyosomes' is probably dependent on a sufficiently close approach of two altered dictyosomes with their paralleled maturing faces.

It is uncertain for how long this dictyosome configurations exist. One has to take into consideration a imited duration of these structures. These facts probably account for the rare occurrence of dictyosomes with a double polarity in cyanide treated root hairs of cress.

The 'twin-dictysosomes' described above are in no way related to dictyosome associations observed in diatoms ('Doppelplättchen'[10,11]) which consist of two single dictyosomes separated by elements of the endoplasmic reticulum[12].

Zusammenfassung. Nach der Behandlung von Wurzelhaaren der krausen Gartenkresse *Lepidium sativum* mit 10^{-3} *M* KCN treten Dictyosomen mit verdoppelter Polarität auf. Diese ungewöhnlichen Dictyosomenformen entstehen möglicherweise durch die Zusammenlagerung von zwei in ihrer sekretorischen Aktivität gestörten Dictyosomen. Die Zusammenlagerung erfolgt wahrscheinlich an den Sekretionsseiten der Dictyosomen.

K. ZAAR

Lehrstuhl für Zellenlehre der Universität Heidelberg, Berlinerstrasse 15, D-69 Heidelberg (Germany),
5 May 1971.

[9] K. ZAAR, Thesis. Fakultät für Biologie. Universität Heidelberg (1972).
[10] R. JAROSCH, Protoplasma *55*, 406 (1962).
[11] R. W. DRUM, J. Ultrastruct. Res. *15*, 100 (1966).
[12] The author is indepted to Prof. E. SCHNEPF, M. MAIWALD and D. DEICHGRÄBER for critically reading the manuscript.

Afferent Nerve Endings in the Avian Lung: Observations with the Light Microscope

Although a few observations have recently been made on possible afferent nerve endings in the vertebrate lung with the electron microscope[1–3], the evidence obtained with the light microscope for a sensory innervation appears to be very slight and in no class of vertebrate has the general structure and distribution of these afferent endings in the lungs been established. Unfortunately, in the few available accounts of possible afferent endings observed with the light microscope in the lungs of vertebrates most of the evidence for the endings is presented in the form of drawings rather than photographs; this evidence is therefore extremely difficult to interpret.

The recent experimental studies on the regulation of breathing in birds[4,5] indicate that information on the precise location of the sensory nerve endings in the avian lung is urgently required. The distribution of elastic tissue[6] and surfactant[7] in the lungs of birds suggests that the atria, the small chambers connecting the lumen of each tertiary bronchus with its surrounding area of gaseous exchange, are extremely mobile and may therefore be the sites of sensory nerve endings monitoring movement of the lungs; moreover possible afferent axonal endings have been observed here with the electron microscope[8]. The presence of afferent nerve endings in the walls of the tertiary bronchi and atria was therefore investigated with the light microscope.

The lungs of 20 young and adult birds (*Gallus domesticus*) were examined with the light microscope using the methylene blue technique and modified Bielschowsky-Gros silver[9] and Champy osmium tetroxide[10] methods. The interpretation of the nervous tissue was based on the discussions of CAUNA[11], MILLER and KASAHARA[12], MUNGER[13], and POLÁČEK[14] which indicate the existence of 3 types of afferent endings: free endings, encapsulated endings and neurite-receptor cell complexes.

[1] R. D. COOK and A. S. KING, Experientia *25*, 1162 (1969).
[2] M. FILLENZ and R. I. WOODS, in *Breathing* (Ed. R. PORTER, Ciba Foundation Hering-Breuer Centenary Symposium; Churchill, London 1970).
[3] J. M. LAUWERYNS, J. C. PEUSKENS and M. COKELAERE, Life Sci. *9*, 1417 (1970).
[4] A. S. KING, V. MOLONY, J. MCLELLAND, D. R. BOWSHER and M. F. MORTIMER, Experientia *24*, 1017 (1968).
[5] M. R. FEDDE and D. F. PETERSON, J. Physiol., Lond. *209*,609 (1970).
[6] A. S. KING, R. N. W. ELLIS and S. M. S. WATTS, J. Anat. *101*, 607 (1967).
[7] A. S. KING and V. MOLONY, in *Physiology and Biochemistry of the Domestic Fowl* (Eds. D. J. BELL and B. M. FREEMAN; Academic Press, London 1971).
[8] R. D. COOK, Ultrastructural Observations on the Bronchial Smooth Muscle, its Innervation, and the General Innervation of the Lung in *Gallus domesticus*. Ph. D. thesis, University of Liverpool (1971).
[9] J. R. RINTOUL, The Comparative Morphology of the Enteric Nerve Plexuses. M. D. thesis, University of St. Andrews (1960).
[10] S. D. SUTHERLAND, J. Anat. *97*, 624 (1963).
[11] N. CAUNA, J. comp. Neurol *113*, 169 (1959).
[12] M. R. MILLER and M. KASAHARA, Am. J. Anat. *115*, 217 (1964).
[13] B. L. MUNGER, in *Touch, Heat and Pain* (Eds. A. V. S. DE REUCK and J. KNIGHT, Ciba Foundation Symposium; Churchill, London 1966).
[14] P. POLÁČEK, Acta Fac. med. Univ. brun *23*, (1966).

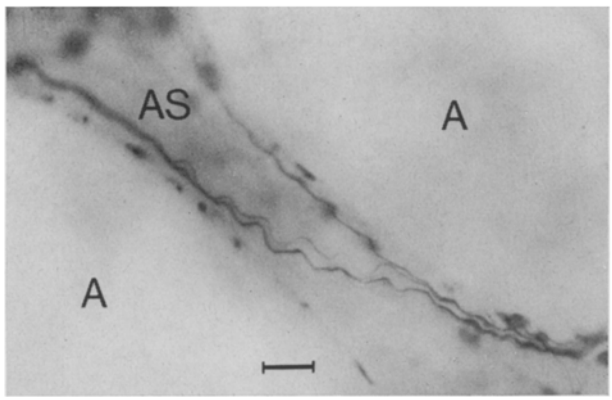

Fig. 1. Photomicrograph of the innervation of the atria (A) of the lungs of *G. domesticus*. Plexus of fine nerve fibres in an interatrial septum (AS) (a wall shared by 2 atria). Scale = 10 μm. Modified Bielschowsky-Gros silver technique.

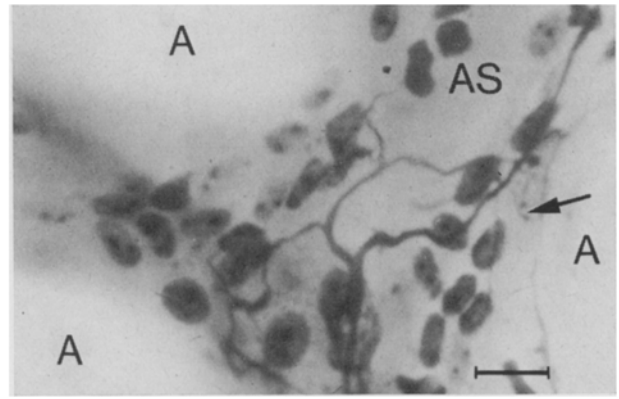

Fig. 2. Photomicrograph of a nerve fibre in the interatrial septa of the lungs of *G. domesticus* which is distributed in a way suggestive of a free sensory nerve ending; some of the finest branches of the ending appear to terminate in knob-like swellings (arrow). Scale = 10 μm. Modified Bielschowsky-Gros silver technique.

The airway walls of the tertiary bronchus and the atria opening into it were innervated by the same nerve plexus consisting mainly of fine fibres less than 1.5 μm in width (Figure 1). Occasionally, however, thicker nerve fibres which were considered to be afferent, left the plexus and were distributed separately. The structure and distribution of the terminal branches of these fibres strongly suggested that they were free sensory nerve endings. The most convincing evidence for these supposedly afferent endings was obtained with the silver stain (Figure 2). Each thick fibre divided rapidly several times into successively finer fibres which usually extended in opposite directions to each other and sometimes appeared to end in knob-like swellings. Although these endings innervated relatively large areas of the airway walls, their branches were distributed in several planes and it was only possible in a single photograph to demonstrate a small part of an ending. Encapsulated endings and neurite-receptor cell complexes were not seen.

This seems to be the first observation with the light microscope of possible afferent nerve endings in the walls of the tertiary bronchi and atria of the avian lung. Possibly they are the source of some of the unit activity in the cervical vagus in phase with resting breathing[4]. They may also be the intrapulmonary receptors that are sensitive to the concentration of CO_2 in the airways[5]. Further work, is in progress to establish precisely the structure and function of these afferent endings[15].

Résumé. Des examens au microscope optique on montré l'existence de terminaisons nerveuses, dont on supposait la présence, dans les structures des bronchioles tertiaires et des atrium des poumons de la poule domestique (*G. domesticus*). Les caractères morphologiques en sont décrits. On pense qul'il s'agit de la première preuve de l'existence de terminaisons afférentes dans les «conduits» d'air, réalisée à l'aide du microscope optique.

J. McLelland

Department of Veterinary Anatomy,
University of Liverpool,
P.O. Box 147, Liverpool L69 3BX (England),
26 July 1971.

[15] This work was supported by a grant from the British Egg Marketing Board.

The Effect of Plasma and Transferrin on the Hemin Inhibition of Iron Uptake by Reticulocytes

Hemin added to reticulocytes incubated in vitro inhibits heme synthesis[1]. Moreover, our experiments demonstrated that $10^{-4}M$ hemin concentration decreases reticulocyte uptake of iron[2]. In our incubation mixture[2], plasma was used as a donor of transferrin. Some studies[3,4] proved that various plasma proteins bind heme and may, in this way, release the effect of hemin on certain biochemical reactions[5]. The present study compares the effect of hemin on the reticulocyte uptake of iron which is bound either to the purified transferrin or to transferrin in plasma.

Methods. Reticulocyte-rich erythrocytes (referred to as reticulocytes) were obtained from three-times bled rabbits, washed and incubated for 60 min in a medium[2] containing ^{59}Fe bound either to purified transferrin or to transferrin of rabbit plasma. 0.3 ml of reticulocytes were incubated in the final incubation mixture containing 0.5 ml of rabbit plasma or 1.25 mg of rabbit transferrin. Before use, both

[1] D. Karibian and I. M. London, Biochem. biophys. Res. Commun. *18*, 243 (1965).
[2] P. Poňka and J. Neuwirt, Blood *33*, 690 (1969).
[3] N. H. Fairley, Q. J. Med. *10*, 115 (1941).
[4] D. A. Sears, J. Lab. clin. Med. *71*, 484 (1968).
[5] P. L. Scholnick, L. E. Hammaker and H. S. Marver, Proc. natn. Acad. Sci. USA *63*, 65 (1969).