

has shown a similar relationship. The presence of these cells and their relationship to nervous tissue and underlying muscle might reflect a different or additional function from the remainder of upper urinary tract muscle. In this context a number of authors have suggested the possibility of a renal caliceal or pelvic 'pacemaker'³⁻⁵. More detailed light- and electron-microscopic observations on these atypical muscle cells in normal and hydro-nephrotic human tissue are to appear elsewhere.

Zusammenfassung. Es werden atypische Muskelzellen beschrieben, welche sich um die Nierenbeckenkelche und die Nierenbecken befinden. Dabei handelt es sich um glatte Muskelfasern, die wahrscheinlich im Nierenbecken-

Uretergebiet endigen und deren Einfluss auf die Aktivität des Ureters diskutiert wird.

J. A. GOSLING⁶

Department of Anatomy, University of Manchester, Manchester, M13 9PL (England), 5 January 1970.

³ P. A. NARATH, *Renal Pelvis and Ureter* (Grune and Stratton, New York 1951).

⁴ F. KILL, *The Function of the Ureter and Renal Pelvis* (Saunders, Philadelphia 1957).

⁵ S. BOYARSKY and P. LABAY, *Ann. Rev. Med.* 20, 383 (1969).

⁶ I wish to thank Prof. G. A. G. MITCHELL for his interest and Mr. A. N. WAAS for valuable technical assistance.

Electron Microscopic Demonstration of a Particulate Component in the Glycocalyx

Isolated glomerular basement membranes from the porcine kidney still carry parts of the glycocalyx of neighbouring cells. These remnants could be demonstrated clearly by ultrahistochemical methods¹. The findings prompted us to study the glycocalyx on the surface of the basement membrane by more direct methods.

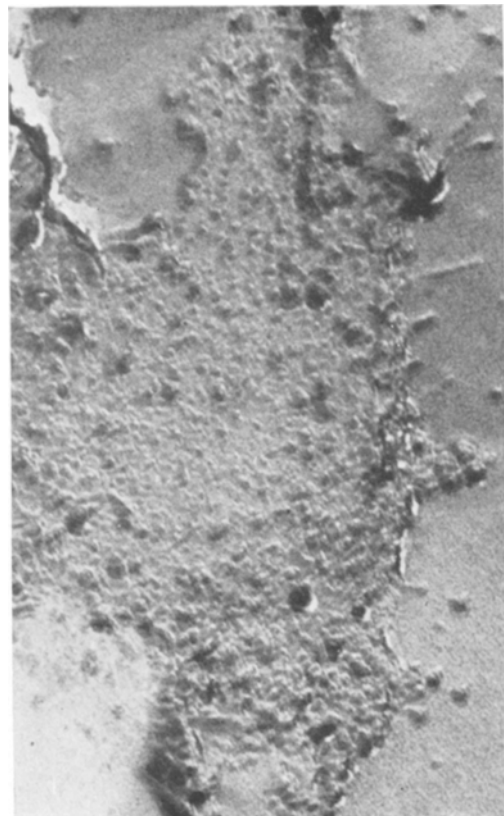
Fragments of glomerular basement membrane have been isolated from porcine kidney as described earlier^{1,2}. In some experiments these fragments were negatively stained by 1% phosphotungstic acid (containing 0.01% serum albumin), and in other experiments they were prepared by the freeze-etching technique.

After negative staining, circular particles, which were surrounded by an electron-dense rim, have been detected on the surface of the basement membrane. They were not sharply delineated. Their diameters varied between 200–600 Å. The corpuscles were distributed unevenly. In freeze-etched preparations similar corpuscles have been demonstrated (Figure). They measured 200–600 Å in diameter too. Most of them had a diameter of 300–400 Å. The corpuscles were scattered irregularly over the basement membrane.

The findings indicate a particulate structure of the glycocalyx of cells in the porcine glomerulus. We could not decide whether the corpuscles belong to epicytes or endothelial cells, and perhaps both cell types have the same particles in their glycocalyx. Similar corpuscles have been demonstrated within the cell coat of thrombocytes, erythrocytes, and intestinal epithelial cells³⁻⁷. This seems to indicate a common particulate structure of the glycocalyx. In our preparations of isolated glomerular basement membranes a large quantity of the cell coat was

detached. Therefore an irregular distribution of the corpuscles with many gaps between them resulted. The wide variation of the particle size may have been due to the following factors: a) technical sources, b) species or cell type differences, and c) an aggregation of small subunits, which build up the big corpuscles.

The glycocalyx, which consists of corpuscles, behaves like a highly hydrated gel, and it is capable of binding both anions and cations^{8,9}. So far other properties of this



Isolated fragment of the porcine glomerular basement membrane. Freeze-etching method. Corpuscles are distributed irregularly over the surface of the basement membrane. Magnification $\times 64,000$.

¹ G. GEYER, W. LINSS, P. SCHAAF, I. MÖLLER and A. MÜLLER, *Acta histochem.*, 35, 67 (1970).

² E. GRUNDIG, H. FEUERSTEIN and G. GEYER, *Acta biol. med. germ.* 12, 75 (1964).

³ H. MOOR, C. RUSKA and H. RUSKA, *Z. Zellforsch.* 62, 581 (1964).

⁴ B. S. BULL, *Blood* 28, 901 (1966).

⁵ R. S. WEINSTEIN and S. BULLIVANT, *Blood* 29, 780 (1967).

⁶ J. K. KÖHLER, *Z. Zellforsch.* 85, 1 (1968).

⁷ C. RUSKA and H. SCHULTZ, *Klin. Wschr.* 46, 689 (1968).

⁸ G. GEYER, P. SCHAAF, I. MÖLLER, A. MÜLLER, W. LINSS and H. FEUERSTEIN, *Acta histochem.*, in press (1969).

⁹ G. GEYER, W. LINSS, A. MÜLLER, CH. MEYER and P. SCHAAF, *Z. mikrosk.-anat. Forsch.*, in press (1969).

carbohydrate coat, containing sialic acid among other chemical constituents, cannot be related to morphological findings.

Zusammenfassung. An der Oberfläche isolierter Glomerulus-Basalmembranen des Schweins konnten durch Gefrierätzung und durch Negativkontrastierung unregelmässig verteilte Partikel nachgewiesen werden. Sie wer-

den als Reste der Glycocalyx von Endothel- beziehungsweise Epithelzellen angesehen und zeigen einen partikulären Aufbau dieser Kohlenhydratschicht an.

G. GEYER, W. LINSS
and P. SCHAAF

Anatomisches Institut,
Friedrich-Schiller-Universität, Teichgraben 7,
DDR-69 Jena (DDR), 29 December 1969.

The Radioprotective Effects of Psychotropic Drugs

Our earlier investigations showed that psychotropic drugs (neuroleptics) like the benzodiazepines Librium and Valium, or the thioxanthene Taractan, depress body temperature in mice¹ and protect mice against lethal doses of X-rays². Thymoleptics proved to be ineffective³. The following neuroleptics have now been included in these studies: Melleril® (Thioridazin; 3-Methylthio-10[β -1'-methyl-2'-piperidyl]-ethyl]-phenothiazine; manufacturer SANDOZ), Lidanil® (Mesoridazin; methyl-1-[methylsulfinyl-2-dibenzothiazinyl-10]-2-ethyl]-2-piperidine; manufacturer SANDOZ), Fluanxol® (Flupenthixol; 2-trifluormethyl-9-[3-(4-(2-hydroxyethyl)-1-piperazinyl)-propyliden]-thioxanthene; manufacturer Lundbeck) and Sordinol® (Clopenthixol; 2-chlor-9-[3-(4-(2-hydroxy-

ethyl)-1-piperazinyl)-propyliden]-thioxanthene; manufacturer Lundbeck). The compounds have been kindly supplied by the industrial firms.

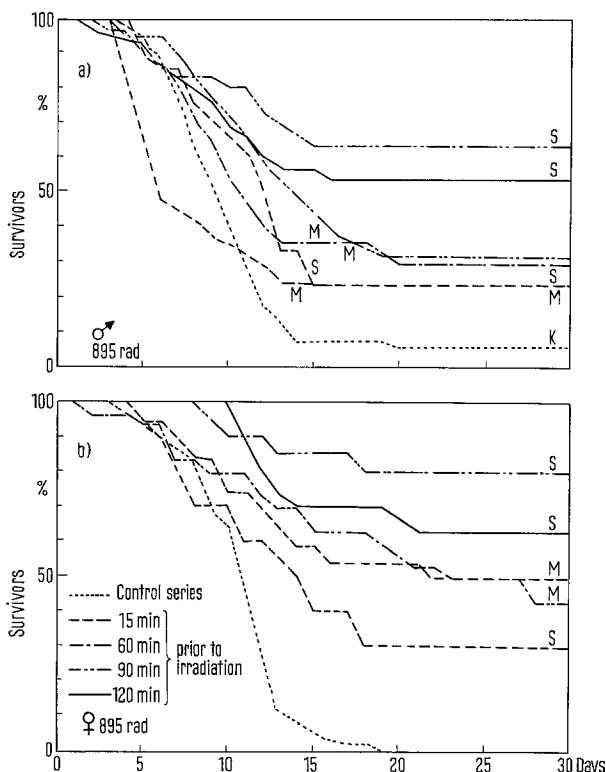
The mice (GP-Swiss, both sexes, weight ~25 g) were pretreated by i.p. injection of the compounds dissolved in Ringer's solution (0.5 ml/20 g body weight). Whole-body irradiation was carried out with γ -rays of a ⁶⁰Co-source, the doses applied once were 715 or 985 rad, respectively. Dose rate: 150 rad/min. Irradiation started either 15 min after injection of the drug or at another time (indicated in the results).

Some results on Melleril are depicted in Figure (a). It can be seen that after the pretreatment with the dose of 18.75 mg/kg there is a significant improvement of the percentage survival results, as compared with the control series, i.e. the survival of the untreated animals. Sordinol (15 mg/kg; Figure, b) is able to enhance the percentage survival even more, up to 80%. Similar results are obtained with Fluanxol (10 mg/kg), whereas Lidanil exhibits no radioprotective effect. Since all the compounds, with the exception of Lidanil, cause a decrease in metabolism (O_2 -uptake) and a depression of body temperature, the amount of which increases with time, it is evident that radioprotection is, at least partly, dependent upon these processes: Figures (a, b) reveal that in general the more time elapsed between injection and irradiation, the better the radioprotective effect. Similar findings, indicating also a certain correlation between hypothermia, hypometabolism (both in common being an expression for hypoxia in the radiosensitive organs) and amount of radioprotection have recently been made with cholinomimetics^{4,5}.

Zusammenfassung. Die Neuroleptika Melleril®, Sordinol® und Fluanxol® senken bei Mäusen dosisabhängig Körpertemperatur und O_2 -Verbrauch und erhöhen bei i.p. Applikation vor sub-letaler oder letaler Bestrahlung mit γ -Strahlen den Prozentsatz Überlebender innerhalb des Zeitraums von 30 Tagen signifikant (und zwar bis über 80% bei 0% in den Kontrollreihen).

A. LOCKER and P. WEISH

Institut für Strahlenschutz,
Reaktorzentrum Seibersdorf,
(Österr. Studiengesellschaft für Atomenergie GmbH),
Wien (Austria), 19 December 1969.



Percentage survival of male (a) and female (b) GP-Swiss mice (ordinate) after γ -irradiation (once with 985 rad) within 30 days (abscissa). Untreated control series and animals pretreated with several doses of neuroleptics: Melleril (M), 18.75 mg/kg; Sordinol (S), 15 mg/kg applied once 15 min before irradiation or at the time indicated. Average number of animals in each experimental series, 30-40; in the control series, 50-70. The detailed statistical evaluation according to the χ^2 -test will be presented elsewhere⁴.

¹ A. LOCKER and E. KOFFER, *Experientia* 18, 28 (1962).

² A. LOCKER and H. ELLEGAST, *Experientia* 18, 363 (1962); *Strahlenther.* 129, 273 (1966).

³ A. LOCKER, *Verh. Deutsch. Ges. exper. Med.* 1968 (Pharmakologentagung Dresden).

⁴ A. LOCKER and P. WEISH, *Strahlenther.* (im Druck).

⁵ A. H. STAIB and K. EFFLER, *Studia biophys.* 6, 9 (1968).