dung eines hydrostatischen Druckes der Fall wäre, die Membran mechanisch beansprucht wird.

Beispielsweise weist eine Dialysierlösung, welche neben den Salzen 4% einer Carboxymethylzellulose vom mittleren Molekulargewicht 12000 enthält, einen osmotischen Druck von etwa 2–3 m Wassersäule auf. Mit Hilfe dieses Druckes lassen sich dann bei Verwendung des in der vorhergehenden Mitteilung beschriebenen Dialysators pro Stunde etwa 400 ml Wasser aus dem Organismus eines Patienten entziehen.

Die Unterzeichneten danken der Fritz-Hoffmann-La-Roche-Stiftung zur Förderung wissenschaftlicher Arbeitsgemeinschaften für die Mittel, die sie für diese Arbeiten zur Verfügung gestellt hat.

W. KUHN, H. MAJER,
H. HEUSSER und B. ZEN RUFFINEN

Aus dem Physikalisch-Chemischen Institut der Universität Basel und der II. Chirurgischen Abteilung des Bürgerspitals Basel, 1. August 1957.

Summary

Addition of polyelectrolytes, in particular of the sodium salt of carboxymethylcellulose, makes it possible to obtain for the use in artificial kidneys dialyzing liquids which are in thermodynamic equilibrium with blood, both with respect to salts and water, or which even permit removal of water from the blood, as well as urea and related substances (the dialyzing liquid being at will hypertonic with respect to blood), the salt content of blood remaining in all these cases unaffected. These dialyzing liquids might be particularly useful for cases combined with oedema.

A Fluid Drop Model of the Elliptical Red Blood Cell

Current studies in this laboratory are concerned with the occurrence and significance of form differences between homologous cells of polyploid animals. Especially interesting are the alterations in form of the red cells of the salamander, *Triturus viridescens*.

Triploid larvae (3–4 finger stage) were obtained and identified according to FANKHAUSER[1]. The elliptical areas of the fresh red cells were traced on standard weight cards with the camera lucida. The areas of the cells were determined from the proportional weights and recorded together with the ratio of the major to minor semi-axes (a/b) as an index of the eccentricity of the elliptical cells. It is evident from the Table that the areas of triploid blood cells are almost exactly 1·5 times greater than those of diploid controls, a fact consistent with the view that the cell thickness has remained the same. A similar situation has been reported by FANKHAUSER for epidermal cell nuclei which also remain of constant thickness[1]. In addition to the differences in area there are obvious differences in the eccentricities of the cells ($a/b = 1{\cdot}55$ in the diploids and 1·82 in the triploids). Employing the property that $x^2/a^2 + y^2/b^2 = 1$, it is possible to construct the mean form of the cells in Figure 1.

The blood cell exists in a system of cylinders, the blood vessels. The many similarities between protoplasmic structures and fluid drops have long been appreciated[2]. These considerations suggest an examination of the

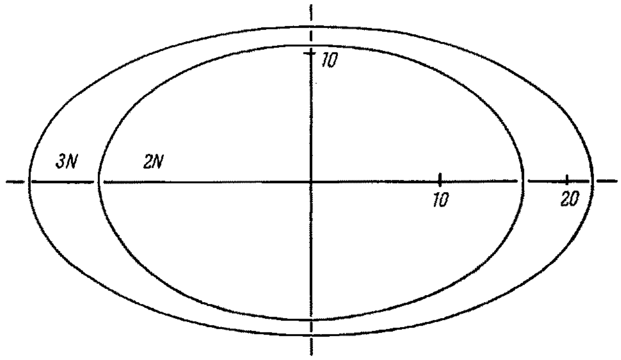

Fig. 1.—The mean forms of triploid and diploid blood cells. The ellipses were constructed on coordinate paper from the measured areas and eccentricities employing the property that $x^2/a^2 + y^2/b^2 = 1$. The coordinates are in microns.

form assumed by fluid drops in contact with a cylindrical surface. In order to obtain a fluid drop of mercury approximating the blood cell in relative dimensions, it is necessary to employ a very large glass cylinder (290 mm in diameter) placed with the axis horizontal. After introducing a known weight of mercury, the cylinder can be tipped and levelled to bring the drop to rest over a coordinate system of millimeter graph paper cemented to the outer surface of the cylinder. The major and minor axes of the drop are then measured by means of the graph paper. The eccentricity (a/b) and area ($\pi\, ab$) are determined. Knowing the weight and hence the volume of the introduced mercury, the average thickness may be calculated assuming the drop to be a flat elliptical cylinder of thickness d and volume πabd. Both eccentricity (a/b) and thickness (d) are plotted against drop area in Figure 2. Eccentricity steadily increases while thickness increases only slightly (2%) over the range of eccentricities characteristic of the blood cells. A 'diploid' drop with an eccentricity of 1·55 has an area of 740 mm². A 'triploid' drop (1·5) times greater volume has an area of 1080 mm² and an eccentricity of 1·89 a value comparable to 1·82 for the triploid blood cell. The ratio of areas is also very similar being 1·49/1 for the cell and 1·47/1 for the mercury model.

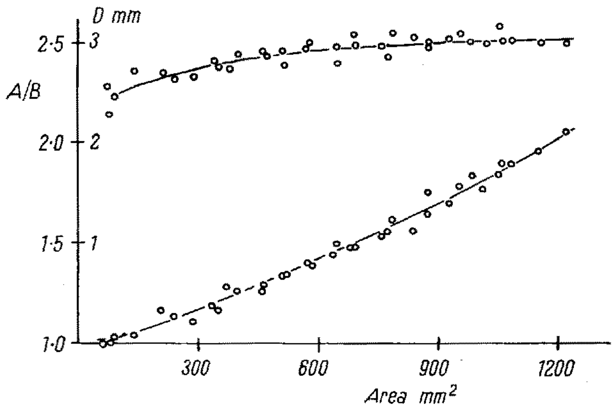

Fig. 2.—The form assumed by mercury drops in a glass cylinder. a/b (lower points and left ordinate) and calculated thickness d (upper points and right ordinate) plotted versus area of the ellipse (abscissa). Inside diameter of the cylinder = 290 mm. Temperature = about 20°C.

[1] G. FANKHAUSER, Int. Rev. Cytol. *1*, 165 (1952).

[2] THOMPSON, D'ARCY, *On Growth and Form* (Cambridge 1942).

The use of the model as an explanation of the red cell form requires that the red cell be in contact with a cylindrical surface as is the mercury drop. While passing through the gill capillaries one elliptical surface of the red cell is usually applied to the capillary wall although this is not the case in larger blood vessels. It is also required that capillary diameter be no greater in triploids since, other factors remaining constant, the larger the diameter of the cylinder the less eccentric will be the fluid drop. Measurements of gill capillary diameters disclosed no differences between diploids and triploids. FANKHAUSER reports constant diameter for another tubular structure, the kidney tubule[1].

The model lacks the bulging nucleus characteristic of the amphibian red cell. However, salamanders of the genus *Batrachoceps* are characterized by anucleate blood cells (erythroplastids) formed by cytoplasmic division from circulating nucleated erythrocytes[3]. As EMMEL's figures show, these blood elements are clearly elliptical in form with larger cells tending to be more eccentric but no greater in thickness. The presence of a nucleus does not alter the basic similarity between red cell form and the equilibrium form assumed by a fluid drop in contact with a cylindrical surface.

	$2n$	$3n$
No. of Cells	42	40
Area/cell u^2	560 ± 102*	843 ± 123
Eccent. a/b	1·55 ± 0·17	1·82 ± 0·21
	$\frac{\text{Area } 3n}{\text{Area } 2n} = \frac{1{\cdot}49}{1}$	

* S.D. = $[S(\text{dev})^2/N]^{\frac{1}{2}}$

By maintaining the cell thickness constant the oxygen exchanging properties of the red cell undergo little change with increased cell volume. As already noted skin epidermis as well as lens epidermis remain of constant thickness. Considered as a diffusion barrier the properties of the epidermis are probably not altered by polyploidy. Similar considerations apply to the kidney tubule which remains constant in diameter and wall thickness. Stated in general terms: *cell dimensions perpendicular to physiological surfaces remain unaltered.* Consequently, the physiological properties of the polyploid animals themselves probably undergo little if any change.

J. A. DAVISON

Division of Physiology, Department of Biological Sciences, Florida State University, Tallahassee, June 13, 1957.

Zusammenfassung

Der Flächeninhalt der elliptischen Erythrozyten des triploiden *Triturus viridescens* ist bei gleichbleibender Dicke der Zellen ungefähr 50% grösser als bei diploiden Kontrolltieren. Als Ellipse betrachtet, zeigt die triploide Zelle eine grössere Exzentrizität als die diploide. Im Kontakt mit der Wand eines horizontal gelagerten Zylinders vergrössert sich die Exzentrizität elliptischer Quecksilbertropfen mit zunehmendem Volumen; sie gleichen den Blutkörperchen auch insofern, als ihre Dicke weitgehend konstant bleibt. Diese Beobachtungen unterstützen unsere Ansicht, wonach die endgültige Form der Erythrozyten weitgehend durch die physikalischen Kräfte bestimmt wird, welche während ihrer Reifung in den zylindrischen Blutgefässen, vor allem in den Kapillaren, wirksam sind.

[3] V. E. EMMEL, Amer. J. Anat. *33*, 347 (1924).

Evidences for the Bipartite or Diploid Nuclei in Conidia of *Streptomyces griseoflavus*

Two kinds of mycelia, primary and secondary, are known in the life cycle of *Streptomyces* fungi[1]. In 1947, KLIENBERGER-NOBEL proposed in her study of strains of *Actinomycetes* that the primary mycelium might correspond to the haploid and the secondary to the diploid phase of her strains. But, owing to the technical limitation of studying such minute organisms by cytological means, conclusive evidences were not presented for the state of ploidy in the mycelia or in the conidia. In our study, the conidia of one strain of *Streptomyces griseoflavus* proved to be apparently uninucleate, but the nucleus seemed to be bipartite or diploid.

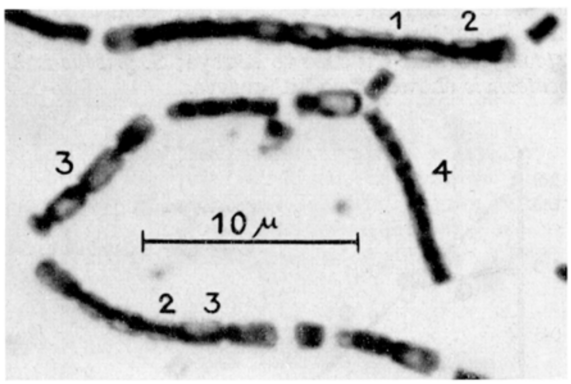

Fig. 1. A late stage of conidia formation in the order 1 to 4.

For cytological study, the strain was cultivated on a modified Krainsky's medium, supplemented with 0·25% yeast extract and 1% peptone, and the nuclei were stained by Robinow's technique. After 24 h at 30°, so-called initial cells (corresponding to the nest-like structure in KLIENBERGER-NOBEL's paper) were distinctly observed under a microscope. When the secondary mycelia developed from the initial cells, the behaviour of nuclei in the mycelia was as follows: at the beginning the chromatinic substances were fragmented, but later, they turned into threads or slender dumbell forms and finally into thick rods. Upon spore formation, the rod-shaped substances divided into smaller parts so that every conidium was charged with two units. The figure soon after the segmentation is twisted and dumbell-like; occasionally, figures are apparently showing two stainable bodies (Fig. 1). As time passes, the spheres of the dumbell unite and, after maturation, only one nucleus is found in each conidium (Fig. 2).

[1] E. KLIENBERGER-NOBEL, J. gen. Microbiol. *1*, 22 (1947). – J. F. McGREGOR, J. gen. Microbiol. *11*, 52 (1954).