activity of the interferon in percentage lowering of the control hæmagglutinating titres on the right scale of the diagram. It can be seen that the virus in the control group (Fig. 1) was first detected on the second day after infection. It disappeared on the third day and was not detectable up to the sixth day, in order to disappear again on the seventh day. The lack of the virus in lung suspensions on days 3, 4 and 5 is to be explained by the presence of an interferon on the fifth day[6-8].

In the first test group (Fig. 2) virus was found in the mice lungs from the second up to and including the fifth day. As an interferon could be found in the corresponding lung suspensions only on the seventh day we suggest that exogenous interferon suppressed the interferon production in comparison with the control mice and, as a consequence of it, virus multiplication could occur in the absence of interferon in the mice treated with exogenous interferon to a significantly larger extent than in controls.

In the second test group (Fig. 3) both virus multiplication and interferon production were delayed in comparison with the control group: virus was first detected in the lung suspensions on the fifth day, whereas significant interferon activity could be demonstrated only on the seventh day.

As has been seen in our experiments, exogenous interferon given in a single dose 4 h prior to infection suppressed the interferon production and, consequently, enhanced the virus multiplication, while the same dose of exogenous interferon, when given three times (that is, 4 h prior to, 24 and 48 h after, infection, respectively), suppressed not only the interferon production but also delayed the virus multiplication in the mice lungs.

There arises the question of whether exogenous interferon should have a similar effect also in human beings, and, if applied for a sufficiently long period, would be able to eliminate the virus multiplication at all.

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CYTOLOGY

Structure of Red-Cell Ghosts and the Effect of Saponin Treatment

The molecular organization of the various components of cell membranes, a frequent topic for theoretical speculation[1], is a difficult problem to approach by experimental methods. Little, if any, structural detail has been convincingly demonstrated in the plane of the membranes until the recent electron microscope investigations of Dourmashkin, Dougherty and Harris[2]. These workers discovered regular hexagonal patterns in membranes of various origin (Rous sarcoma virus, human and guinea pig erythrocytes, chicken liver cells), treated with saponin.

We have recently observed similar, and unexpected, hexagonal structures among the liquid-crystalline phases of lipid–water systems (lipids extracted from human brain)[3,4], and we have developed our own conclusions about the possible biological implications of non-lamellar organization of membrane elements. We thus welcomed the work of Dourmashkin *et al.* as a confirmation of our ideas, and thought it worth while to carry out similar experiments using X-ray diffraction techniques. Some preliminary results of this work are reported here.

Human erythrocytes, washed and suspended in phosphate buffer, *p*H 7·2, were hæmolysed either in hypotonic phosphate (0·01 M) or in the presence of saponin (0·05 per cent in water, 30 min at 37° C). The ghosts were then washed and centrifuged (30 min, 40,000*g*) several times and freeze-dried. We ascertained in a few experiments that freeze-drying had no drastic effect on the structures.

The X-ray diffraction experiments were carried out in a small-angle camera of the Guinier type[5] at various concentrations and at two temperatures: 22° C and 37° C. The samples were made by mixing fixed amounts of dry ghosts and water concentrations (c = weight of dry ghosts per gram of sample) were determined by dry-weight after the X-ray experiments.

With 'intact' ghosts, that is, not treated with saponin, two main concentration-ranges could be distinguished. From $c = 0{\cdot}30$ to $c = 0{\cdot}42$ a lamellar structure was present, characterized by 3–4 sharp reflexions, integral orders of a fundamental spacing : 170 Å at 22° C, 205 Å at 37° C. At higher concentrations, $0{\cdot}42 < c < 0{\cdot}70$, a second lamellar structure was found, in equilibrium with the previous one; the repeat distance was 64 Å. Samples at concentrations higher than 0·70 were not examined; at low concentration ($c < 0{\cdot}30$) the scattered intensities became very weak.

In saponin-treated ghosts one type of X-ray diffraction diagram was observed, which varied very little with concentration and temperature. It was composed of a few sharp lines, the spacings of which were typical of a two-dimensional hexagonal lattice (ratios $1 : \sqrt{3} : \sqrt{4}$) (ref. 3), and of some fairly broad bands at spacings close to 58, 40 and 30 Å. The unit cell side of the hexagonal lattice was 165 Å.

The sharpness of the reflexions of the lamellar and hexagonal phases shows that the ordered regions must be fairly large in the three dimensions.

The results of the X-ray diffraction analysis were very similar to the electron microscope observations of Dourmashkin *et al.*[2]. With both techniques hexagonal structures were observed only in saponin-treated ghosts. The parameter of the hexagonal cell was almost identical : 140–160 Å in the electron microscope preparations, 165 Å in the X-ray samples.

The most exciting suggestion of the observations of Dourmashkin *et al.* is that intact membranes are hexagonal mosaics of various elements (lipids, proteins, cholesterol, water). The fact that this structure becomes visible in the electron microscope only after the action of saponin could be explained by assuming that saponin removes some of the membrane elements, leaving 'holes' accessible to negative staining. But such an interpretation can scarcely be reconciled with the X-ray observations: if a hexagonal structure were present in the 'intact' ghosts, it should be detected by the X ray diffraction techniques. We therefore find it difficult to escape the conclusion that the hexagonal structures are artefacts produced by the treatment with saponin.

It should be emphasized that our results are still preliminary. A detailed analysis of the phase diagram[3] and of the structure of 'intact' ghosts must await more complete experimental data. Furthermore, the effect of the various preparative procedures must be carefully investigated.

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