II. OSMOTIC PHENOMENA OF YOLK OF EGG.

By WILLIAM ALEXANDER OSBORNE AND
HILDA ESTELLE KINCAID.

From the Physiological Laboratory, University of Melbourne.

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The following short research arose from an attempt to employ yolks of eggs as models illustrating the osmotic behaviour of red corpuscles. An unbroken yolk immersed in distilled water slowly swells, the contents become cloudy and ultimately the membrane bursts. If another yolk be placed in 0.9 % sodium chloride no change is observable. A third yolk floated on glycerol will shrink and display marked corrugation. So far there is close parallelism and these three experiments can be used for class demonstration. With strong salt solution however and with organic solvents the behaviour of the yolk is widely different from that of corpuscles, as might in part be inferred from the sclero-proteid nature of the vitellin membrane.

If the yolk be floated on to 10 % NaCl, or greater concentrations, there is a marked swelling and not the shrinking which one might expect. As is well known the chief protein, or lecithoprotein, of yolk is soluble in strong saline. When dissolved it permeates either not at all or with great difficulty through the vitellin membrane and so conditions an osmotic effect. A series of 2M. solutions of NaCl, CaCl₂, MgCl₂ and MgSO₄ all gave this swelling effect. With the sulphate solution the rate of distension was slightly greater. If a 50 % CaCl₂ solution or a higher concentration be employed, shrinking can nevertheless be seen owing to the rapid extraction of water.

With the following solvents more or less interesting effects can be observed.

(1) Ether. The yolk sinks and slowly swells. About the end of the second day an accumulation of ether, deeply pigmented but transparent, may be observed in the upper part of the yolk. This ethereal solution increases in volume and produces a doming of the yolk. In some cases the latebra is beautifully displayed in the form of a tent attached to the vitellin membrane at the cicatricula. Eventually the membrane bursts liberating the contents.

But as long as the membrane is intact the ether outside is unstained and indeed does not contain even a trace of solid matter. The dissolved substance is therefore imprisoned in the yolk and exerts its osmotic effect. If the yolk be placed in ether which has for some time been shaken up with broken yolk and separated from this, the swelling may be completely absent and no collection of ethereal solution may be observed.

(2) Chloroform. The yolk floats on the fluid but the sequence of events is very similar to that with ether except that the growing volume of coloured chloroform is found at the bottom of the yolk. So long as the membrane is intact the outside chloroform is unpigmented.

(3) Carbon disulphide. In every particular the action of this solvent is similar to that of chloroform.

(4) Alcohol. The yolk which sinks in this fluid does not swell and very soon the outside fluid is seen to be pigmented, though the membrane, as far as the eye can judge, is intact. Apparently the alcoholic solution can pass through the membrane just as alcoholic solutions of soap can diffuse through parchment paper; hence no osmotic effect is obtained.

(5) Petroleum ether. The yolk sinks in this but does not change. There is no extraction of pigment nor accumulation of solution inside. If broken yolk be shaken up with this solvent nothing but a mere trace of fatty matter is dissolved. The absence of osmotic effects is due therefore to an absence of solution. Boiling petroleum ether can however exert a solvent action on some yolk constituents and an unbroken yolk placed in this under a reflux condenser will show swelling and formation of a globule of solution under the membrane.

(6) Benzene. This acts in a manner almost identical with that of petroleum ether.

(7) Acetone. There is a gradual extraction of colour from the yolk; prolonged action may give a slight globule. If boiling acetone be employed the extraction of pigment proceeds more rapidly.

(8) Olive oil. No change is observable.

(9) Isotonic urea solution. The yolk swells fairly quickly and a globule is formed on the top as in ether. If a 4% solution of urea in 0.9% NaCl be employed there is no effect. Urea solution can therefore be added to those mentioned at the outset of the paper as giving effects similar to those observable with red blood corpuscles.