remaining; if the second receives from the third two dirhems, he will have triple what the third has remaining; if the third receives from the fourth three dirhems he will have four times as much as remains with the fourth; and finally if the fourth receives from the first four dirhems he will have five times as much as remains with the first. How much does each one have?

For several centuries algebra was taught in Europe employing such problems.

By this important document a noteworthy link is placed in the chain which connects the mathematics of early Egypt with Greece and with the algebra of the Hindus, of the Arabs and of our European predecessors in this field.

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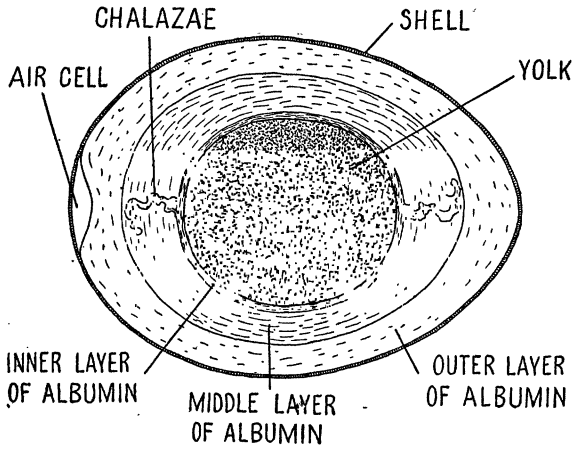
## THE DRY MATTER IN DIFFERENT LAYERS OF EGG ALBUMIN

IF a fresh hen's egg is opened in a careful manner, there can be distinctly observed with the naked eye the three different layers of albumin: outer, middle and inner, as shown on the diagram. The albumin of




the egg represents the secretion of the oviductal glands. It is a complex mixture of organic and inorganic matter. The histology of the albumin is not exactly known, but the very probable theory has been advanced that it consists of a network of fibers containing fluids in their meshes.

The process of formation of albumin is in an intimate relation with the yolk of the egg—to complete the female reproductive cell. When the yolk of the egg or ova leaves the ovary it has a slow revolving movement which is controlled by the peristaltic contraction of the oviduct of the hen. In that long passage-way the yolk of the egg gets its threefold covering of albumin from certain portions of the oviduct. In the upper glandular part of the oviduct is secreted the innermost layer of albumin, which is especially dense and forms a sort of membrane over the yolk. It also extends from each side of it as a twisted cord, the chalazae (see diagram). Later in the passage the second layer or fluid albumin is secreted, which lies next to the dense one. And finally, when the yolk is almost at the end of the long journey—in the area of partially formed shell—the third, watery layer of albumin is formed.

The quantity of the different layers of albumin described above has been studied, and the following table gives an illustration of the relative amounts of fresh albumin of all the three layers in grams and in percentages:

| | Outer | Middle | Inner | Total |
|---|---|---|---|---|
| Amount in grams: | 12.81 | 18.43 | .97 | 32.21 |
| Amount in percentages: | 39.8 | 57.2 | 3.0 | 100.0 |

Their physical characteristics suggest that the water content is very likely to be different.

A little experiment has been carried out in our laboratory of experimental embryology to determine quantitatively the dry matter content in the different layers of albumin. A simple method was employed for the determinations. The egg was broken into a saucer, and each layer of albumin was pipetted into the crucible and dried to a constant weight in Freas electric vacuum oven at 80° C. To prevent frothing of the albumin care was taken to start the vacuum gradually and slowly increase it up to 63.5 cm (25 inches). The table below, on five eggs as an example, gives the data in percentages for the content of dry matter in the three layers of albumin:

| Egg Number | Percentage of Dry Matter | | |
|---|---|---|---|
| | Outer | Middle | Inner |
| 1 | 12.55 | 12.87 | 15.14 |
| 2 | 11.07 | 11.98 | 13.61 |
| 3 | 12.13 | 12.96 | 14.66 |
| 4 | 11.09 | 12.24 | 14.00 |
| 5 | 11.12 | 12.23 | 15.07 |
| Average | **11.59** | **12.45** | **14.55** |

Such an experiment can be performed only with fresh eggs or eggs well preserved. The albumin of old or incubated eggs loses the distinctive physical appearance of the three layers and does not give the variable results upon the analysis.

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