

The Colors in Turtles. The coloring of the lowest strata of the epidermis, the so-called Malpighian layer, has not yet, so far as I know, been the object of a special investigation. I deem it, therefore, worth our while to take up this point more fully than other parts of the ordinal characters. The uppermost dry part of the epidermis, the stratum corneum, which is so extensively developed in Turtles, exhibits as usually by far the smallest part of the colors; the most beautiful colors being included chiefly in the Malpighian layer. That stratum, on the contrary, is transparent, with a grayish lustre, like mica. Thus far only one Turtle is known in which this dry, horny layer contains all the coloring matter, at least as far as the colors are visible from outside, namely, *Eretmochelys imbricata*; and it is owing to this extraordinary circumstance that in the dry plates of this Turtle (the tortoise-shell) all their beautiful colors are preserved, even after the plates have been removed from the Malpighian layer. A homogeneous brownish lustre may be seen with the microscope in the epidermal cells, in all those places of the plate where it appears brown; there is, however, no trace of pigment cells, nor of any fluid, and that brownish color belongs only to the walls of the cells.¹ Still more intense colors, often black, produced in the same way, are found in the thick plates of nearly all land Turtles, for instance, in *Testudo radiata*, *polyphemus*, *indica*, etc., and in some Chelonioideæ, as in *Chelonia Caouana* and *Mydas*, but in all these the Malpighian layer, lying beneath the plates, also takes part in forming the colors which appear outside.

The Malpighian layer, also called the pigment layer, is not only the matrix of the epidermis, but at the same time the bearer of the pigment in Turtles. It is moist and soft, and of very different thickness in different families, generally however thick enough to be readily separated as one continuous membrane from the dry, horny stratum which lies above it, as well as from the corium or bone which lies below. It is composed of large, round, transparent cells, lying not in plane layers, but rather imbricated. On, between, and beneath these cells lies the pigment, either in cells or as a free fluid in lacunes, or in one continuous layer. Thus we have to distinguish two different forms, under which the pigment occurs in Turtles: first, real pigment cells, which are always black or blackish brown, and filled with brownish pigment molecules, upon the amount of which in a cell depends its more or less dark tint; and secondly, a colored oily fluid, moistening generally the whole Malpighian layer, and not contained in regular cells. Under this second form appear the most various colors, such as the yellow, red, brown, and also sometimes black tints of our different kinds of Turtles. The most diversified play of colors is produced by the combinations of these free fluid colors, by their superposition

¹ As we find it also in some places of the human body. See Kölliker *Gewebelehre*, p. 98, § 43.