HEREDITY AND MEMORY

Writing in the middle of the eighteenth century on “the efficient cause of the chicken,” William Harvey of Caius College in this university quaintly remarked: “Although it be a known thing subscribed by all...that the egge is produced by the cock and henne, and the chicken out of the egge, yet neither the schools of physicians nor Aristotle’s discerning brain have disclosed the manner how the seed doth mint and coin the chicken out of the egge.” “How much nearer a disclosure,” asks a writer who quotes this passage, “are we to-day?...On the whole we have [still] to confess that we do not know the secret of development, which is part of the larger secret of life itself1.”

Now it is commonly taken for granted that on this great problem—the problem of Heredity—psychology can have nothing to say. But I have come at length to think that, provided we look at the world from what I would call a spiritualistic and not from the usual naturalistic standpoint, psychology may shew us that the secret of heredity is to be found in the facts of memory.

But first of all, in accordance with the observation just quoted, it seems desirable to enounce a few general propositions true "of the larger secret of life itself" and applicable also to this particular part of it.

To begin—we find the processes observable in the world around us can all be ranged in one or other of two classes, as either anabolic processes or katabolic—to use in a somewhat wider sense the terms of a Cambridge physiologist. The former we take
to imply action contrary to, the latter action along, the line of least resistance. The processes of the one order build up: those of the other level down. The one order implies that direction, in the sense of aim or end, which we associate with mind as sensitive and purposive; the other that indifference which we associate with matter as lifeless and inert.

Of such guidance or direction—I would ask you next to note—we have immediate experience only in the case of our own activity, as in building a house or organising a business. It may well seem rash therefore to attribute such processes as the formation of chlorophyll in a blade of grass or of albumen in a grain of corn to guidance in this sense. But at all events they are processes pertaining exclusively to living organisms, and found nowhere else. If these processes
8 The characteristics of life

should some day be artificially repeated in a laboratory, as Professor Schäfer so confidently expects—even this would imply the guidance of the living chemist. But still, it may be asked, what right have we to identify life and mind; what right, for example, to credit plants with souls, as Aristotle did? The right that the principle of continuity gives us. No sharp line can be drawn between plants and animals nor between higher animals and lower.

But here the advocate of Naturalism may intervene. “Continuity is just as complete regarded from below as it is regarded from above,” he may urge; “and if so, surely the proper method of investigation is to begin with the simpler and earlier rather than with the later and more complex.” Not necessarily, we must reply: all depends—as Plato pointed out long ago—upon where the characters we
have to study are clearest and most distinct. In the case of life there can be no doubt that this is where they are the most developed. "It is clear," as G. H. Lewes once said, "that we should never rightly understand vital phenomena were we to begin our study of life by contemplating its simplest manifestations...we can only understand the Amoeba and the Polype by a light reflected from the study of Man."

Moreover if we begin from the material side we must keep to this side all through: if matter is to explain life at all, it must explain all life. But it is evidently impossible to describe the behaviour of the higher organisms in physical terms. Indeed the ablest physicists recognise that the concepts of physics are inadequate to the description of life even in its lowest forms.

We may conclude then, that when, as in the

1 *Problems of Life and Mind*, 3rd Series, 1879, p. 122.
10 The higher forms of life imply wider

case of life, we are seeking to interpret the meaning of a continuous series we must start where that meaning is clearest, where it is best known and most definite, not where it is least known and most inchoate.

Working in this fashion from ourselves downward, what then, we may now ask, do we find as the irreducible minimum which all life implies; and what are the most general characteristics that mark every advance from lower forms to higher? To the first question the answer, I trust, may here suffice that life everywhere implies an individual and an environment. To changes in this environment the individual's behaviour is, or tends to be, so adjusted as to secure its well-being. For—it is worth remarking by the way—throughout the realm of life the category of value, which such terms as well-being and ill-being imply, is relevant, though irrelevant
everywhere else. It is this that gives to what we have called guidance or direction its motive and its meaning.

As to the second question—what are the general characteristics of advancing life?—this is on the whole admirably dealt with in Herbert Spencer's Psychology under the heading General Synthesis. Defining life as the adjustment of internal relations to external relations, he shews how, as evolution progresses, this adjustment extends in range both spatially and temporally; how at the same time it increases in speciality and complexity; how separate adjustments are more and more co-ordinated and unified; and so forth. The interval between the palaeolithic man, whose world was bounded by his river-valley, who knew little of the past and planned less for the future, who lived from hand to mouth content with raw
12  *Social progress implies heredity*

food and possibly no clothing, who possessed only the rudest implements and had but a cave for his dwelling—the interval, I say, between him and civilised man with his long traditions, fixed laws, innumerable arts and organised division of labour, sufficiently illustrates the character of this progress when already far advanced. The inheritance of the permanent achievements of one generation by the next is obviously the main factor of such social progress: this we may call heredity in the literal sense. But we talk also of heredity as a factor in the biological progress from the *Protista* up to *Man*; though here the heir and the inheritance can only be distinguished by calling the individual the heir and his organism the inheritance, that is to say by regarding as two what the biologist conceives as one. It is this biological heredity that is our problem.
Individual progress implies habit

Before attempting to attack this problem directly there is however still a characteristic of life or experience that we may for a moment consider, which seems to throw some light upon it. Experience I once proposed to define as the process of becoming expert by experiment; and recent elaborate observations\(^1\) of the behaviour of the *Protozoa* shew that these microscopic creatures frequently succeed, as we do, only by way of trial and error. Even plants prove capable to a great extent of accommodating themselves to changes in their environment. All this presupposes a certain plasticity, which in turn implies retentiveness: in other words, just as later generations inherit from earlier generations so later phases of the individual inherit, as it were, from earlier phases. In

14 Habit means that function

our own case we get a good deal of insight into this process in what we can observe of the growth of habit. What was originally acquired by a long series of trials and failures, engrossing all our attention, becomes at length “secondarily automatic”—to use Hartley’s now classic phrase. Of this such feats as skating or piano-playing are familiar examples. This mechanization of habit is aptly described in the saying that “use is second nature.” It sets attention free for new advances which would else be impossible. So natura naturata is the condition of further natura naturans. The organism gives us a warrant for the term “mechanization” in the permanent modification of brain and muscle which the acquisition of new dexterities entails; and mutatis mutandis, the same holds true of the knowledge we know so thoroughly that, as Samuel Butler said, we have ceased