

THE JOURNAL OF NEUROLOGY AND PSYCHOPATHOLOGY.

Vol. V.

MAY, 1924.

No. 17.

Original Papers.

CRITIQUE OF THE THEORY OF MENTAL RECAPITULATION.

BY IAN D. SUTTIE, PERTH.

DOES mental development recapitulate mental evolution ?

GENERAL CONSIDERATIONS.

The validity of a theory is judged not merely by its descriptive utility, but also by its functional (heuristic) value to science. If it enables us to generalize beyond the sphere of actual observation, if it suggests new starting points and methods of research, if it co-ordinates and 'explains' many and otherwise unconnected phenomena, or links together previously unrelated theory, above all if it enables us to predict and control events, it has then an interest for us beyond its mere capacity to represent or 'symbolize' facts. This is not to say that a theory can have permanent value for science independent of its correspondence with fact; it must ultimately be judged by its truth. But some of the discredited conceptions of the past have played a most valuable part in the *process* of science, and indeed all theories in their turn must be supplanted by more adequate instruments of thought. In the absence of verification or disproof an assessment of the heuristic value of a theory can profitably and legitimately be made.

The protagonists of the theory of mental recapitulation cannot fairly object to criticism on these grounds, for the theory they defend owes much of its vogue and prestige to its supposed heuristic value. I think it can be shown that the theory has outlived its usefulness, that much that has been promised on its behalf can never be fulfilled, and

that its application to psychology can be of no conceivable value to that science.

There is another reason for keeping before our minds the *value* of the theory. It is not systematically worked out (for psychology) or even definitely stated, and therefore, under criticism, is liable to shift its ground. Now if all resemblance between ontogeny and phylogeny, no matter how general, no matter how caused, is accepted as evidence of recapitulation, then the theory cannot be verified or disproved. Under these circumstances, however, it will have no scientific value; no inference can be drawn from a vague and untested description; it cannot even in that form be the starting point of induction. For example, in development as in evolution the simple (egg) must precede the complex. We do not need the recapitulation theory to tell us this, and in any case the fact is so empty of content as to be quite useless to us. Again, for example, it is accepted that the early phases of Jewish life-history and race-history are alike 'uncircumcised.' Is this recapitulation? Or must we recognise that a false or artificial recapitulation is possible? These examples are extreme to the point of absurdity, but they do show that *even in regard to organic characters* (and how much more in regard to mental—so moulded by tradition) an artificial or 'pseudo-recapitulation' is possible. How are we to distinguish this from the 'real' phenomenon unless we define the theory?

If we insist that recapitulation is a definite phenomenon, due to definite mechanism (discoverable), and if we insist on a corresponding definiteness of evidence and interpretation, we will find the theory undemonstrable; if we leave it a vague and mystical principle we will find it worthless.

There may occur a difference of opinion as to the amount and character of the evidence necessary to establish the *dictum* that mental development recapitulates mental evolution, with its implication that there is a causal connection between the series.

The demonstration of mental recapitulation presents much the same logical problem as the demonstration of 'telepathy.' In both cases the data consist in certain resemblances between the mental products of different individuals. In both cases the thesis is that the resemblance is brought about by a special (and otherwise unknown) mechanism.

Both theories must, therefore, show that 'chance,' that all known agencies which might bring about mental resemblances, are *insufficient* to account for the resemblances actually found.

Now thought products—like human beings—are often similar but rarely absolutely alike, and identification is more certain the more detailed and specific the resemblance. To prove that two thoughts have had a common origin or are otherwise interdependent, one must demonstrate that they have a highly complex, point-to-point resem-

blance. Then only can a causal connection be postulated. As with particular thought products, so with the process of mental development, a close, detailed, intimate correspondence is of infinitely more weight than any empty, general and *abstract* resemblance. Abstract resemblances can always be found; patience, ingenuity and a poetic imagination will achieve anything. We want, however, *concrete* literal identities which unequivocally show the two series as 'functions' of each other, and that the likeness is not merely accidental, simulated (artificial), or imaginary. Since 'mental' recapitulation is a hypothesis of even greater gravity than that of 'telepathy,' we have a right to demand an equally critical scrutiny of the evidence, and that the resemblances upon which it is based shall be shown to be reasonably frequent, precise and not due to known 'external' environmental factors (artificial).

BIOLOGICAL CONSIDERATIONS.

The origin of the recapitulation theory appears in the observation of Agassiz that there is a general parallelism between the development of embryos and the palæontological series. For pre-evolution thought this conception was not fruitful; but von Baer generalized and formulated the facts. It was claimed for his 'law' that it permitted us to reconstruct phylogeny from a study of ontogeny. "We may draw our conclusions with the utmost certainty as to the nature of the ancestral form, from the features of the form which the embryo momentarily assumes" (Haeckel, *Evolution of Man*). The 'law' therefore became not merely a suggestive observation, but was now supposed to enable us to fill up the gaps in our knowledge of evolution from our observations of individual development.

Resemblances between ontogeny and phylogeny were eagerly sought for, and played a great part in the 'evolution' controversies, and the 'recapitulation hypothesis' undoubtedly won much prestige from its mere association with the triumphant 'evolution theory.' In Haeckel's presentation, however, the 'biogenetic law' attained the zenith of its fame and exercised its maximum influence upon our 'tradition.' He claimed that "phylogeny is the mechanical cause of ontogeny," and consequently that an understanding of the interdependence of development and evolution would give us our most intimate possible insight into the factors and mechanisms of both processes. The precise nature of the causal connection between ontogeny and phylogeny would be the 'key' problem of biology, and the observed onto-phylogenetic parallelism would be the most promising starting point of research. Haeckel regarded the 'biogenetic law' not merely as a general description of facts—extending and consolidating our knowledge certainly, but still only a description—for him it was a

correlation from which the most profound and far-reaching inductions were possible as to the process of evolution, the nature of germinal inheritance and the mechanisms of development. All the problems then engaging the attention of biologists appeared to have the most significant relation to recapitulation.

Systematic examination of the facts, however, has shown that altogether too much was expected of the theory; and a comparison of the 'classics' of biology and contemporary writings shows how far the theory has lost credit and how risky it is to use these classics as text-books. Exceptions to the 'law' predominate, so that the claim that it enabled us to infer from the ontogenetic to the phylogenetic series and *vice versa* had speedily to be abandoned. Obviously, the probability of such inferences is inversely proportional to the ratio of exceptions, and Haeckel himself admits "in most cases the correspondence is very imperfect" (*Evolution of Man*). Sir Archdall Reid—a convinced recapitulationist—says of the resemblance between ontogeny and phylogeny, "it may, and usually does, become unrecognizable, . . . as a result we cannot with any degree of accuracy trace the early ancestry of our race by watching the development of the individual." "No one having an elementary acquaintance with the facts has ever alleged that recapitulation is ever other than incomplete and inaccurate" (*Laws of Heredity*). He refers also to complete obliterations and falsifications of the record. Comparing this with Haeckel's statement above ("We" may infer "with the utmost certainty," etc.), we may see how completely biological opinion has changed in regard to recapitulation as a valid *generalization*.

This is not the only respect in which the recapitulation theory has lost prestige. From the preponderance of exceptions to the 'law' it is obvious that the causal connection between, and the factors common to, development and evolution cannot be so all-important as they were once thought to be, while their investigation must be much more complicated and unpromising. We can no longer regard "phylogeny as the mechanical cause of ontogeny" (Haeckel), and from this (Lamarckian) standpoint investigate the nature of this mechanism. Indeed, the interdependence of ontogeny and phylogeny does not appear sufficient to warrant the postulation of any special mechanism constraining the individual to 'climb his own family tree.'

The *descriptive* value of Agassiz' *observation*, the validity (as extending our knowledge) of von Bæer's *generalization*, and the *inductive* value of Haeckel's *causal interpretation*, are gravely impaired.

But this still does not represent the whole change that has taken place in biological opinion with regard to the recapitulation theory. The *evidence* upon which it was based is universally admitted to have been selected and is even regarded as equivocal. That is to say, the

interpretation of the facts which this theory offers is seriously questioned, the suggestion being made that the resemblance is not so much between embryonic phase and adult ancestral form as between the embryogenies of allied species, all of which, together or separately, may diverge from the course of their common ancestral evolution.

We shall see that the all-important point is the question of the *necessary* causal connection between the ontogenetic and the phylogenetic series. It is, therefore, of the greatest interest to see how 'biological' recapitulationists deal with exceptions to the 'law.' Haeckel admitted a whole class of these which he called 'cenogenetic' characters and which had this in common, that they were precise, specific, adaptations to *either* ancestral *or* embryonic *special* conditions. The difference between the two environments (e.g., in regard to nutrition, respiration, locomotion, reproduction, etc.) demands specialized adaptations to each which are incompatible with life in the other. Recapitulation in these important respects is impossible, but we will not follow Haeckel in assuming that otherwise it would have taken place and that these exceptions represent a modification of the otherwise universal 'biogenetic law' due to the paramount 'law of natural selection.' Natural selection, strictly speaking, has nothing to do with *vital* adaptations, and in any case could not have brought about this divergence *unless there had been a fortuitous variability to select from*, i.e., unless recapitulation does not hold. To begin with, the admitted fact here is that recapitulation is *not* true, and this 'explanation,' as also the 'law of anticipation,' are retractions or modifications of the 'biogenetic law.' Exceptions remain exceptions however formulated and explained, and these supplementary formulæ actually presuppose a variability in regard to recapitulation since they do not postulate an influence *causing* ontogeny to diverge from phylogeny but only a *directive selection* of pre-existing divergencies. It is interesting to note, however, that if Haeckel's generalization is correct, that characters specially adapted to adult ancestral or foetal conditions do *not* recapitulate, then we would *not* expect a recapitulation in the mental sphere. This is *the special* 'adaptive' character, and as regards both stimulus and reaction possibilities the foetal and ancestral environments are widely different. *A priori*, therefore, we would expect that the development of the mental function, like that of the respiratory, nutritional and locomotor functions to which it is closely related, would *not* recapitulate its evolution.

It is not possible to criticize the 'biological' aspects of the recapitulation theory here. Enough has perhaps been said to show that the evidence in its favour is by no means conclusive or even unequivocal, and that far from being an accepted truth it is an exceedingly controversial proposition. In applying it to psychology we must, then, remember that we have not a consensus of biological opinion behind us but

that, on the contrary, even in its own home, the recapitulation theory is losing credit.

It is true that many biologists still strive to establish correlations between the ontogenetic and the phylogenetic series—to demonstrate that this or that phase or feature of embryogeny has a true ancestral homology. But even where they achieve their aim, and demonstrate the real parallel, it is obvious that the task of biology has only reached its first stage. These correlations are not explanatory but, on the contrary, demand explanation. They merely introduce us to the problems of the causes of evolution, the mechanism of development and the nature of the interdependence of the two series. These problems are taken up by experimental embryology, which by physiological method aims to furnish us with physicochemical explanations. It is perhaps significant that the exponents of the purely 'evolutionary' method do not always realize the limited value of their interpretations (onto-phylogenetic correlation), and are sometimes out of sympathy with physiology, which is destined to take over and complete their task.

I have insisted upon the importance of a clear and agreed understanding of the implications of the recapitulation theory. We are told that the psychoanalytic contention that mental development recapitulates mental evolution is merely an 'extension' of the 'biogenetic law,' i.e., that the same cause brings about recapitulation in the mental and organic spheres. Now biologists can hardly conjecture how recapitulation can be brought about, but *if the theory has any value* it implies that there is a specific causal connection between ontogeny and phylogeny—that the organism has an intrinsic, inherent *biological* tendency to 'climb its own family tree,' and is not merely passively moulded by environmental influences into a succession of *simulacra* of evolutionary phases. I will show later that such pseudo-recapitulation actually occurs. From the 'biological' point of view it is artificial or 'accidental.'

What, then, do we know or must we suppose to be the *cause* of recapitulation? Whether we hold with Lamarck that ancestral adaptation can directly produce coincident germinal variation, or with Weismann that evolution proceeds solely by the elimination of non-adaptive variations, we must equally, in either case, regard the constitution of the zygote as the factor that relates development (individual) to evolution (racial) and, therefore, as the factor upon which the correspondence between the two (i.e., recapitulation) depends. If phylogeny is the mechanical cause of ontogeny, this can only be because of its effect upon the germ-plasm. If germinal variations (whatever their origin) are the common cause of phylogenetic forms and ontogenetic phases, we must surely regard them as responsible for the sequence in which these two series occur. Since it is the parallel between the two series (especi-

ally in regard to their *order*) that constitutes recapitulation, we may fairly say that the biological theory of recapitulation depends upon the view that the germ-plasm, the 'bearer of heredity,' the 'physical mechanism of inheritance,' is the channel through which ancestral influences affect development (if only by natural selection of a particular germ-plasm, etc.), and is, or contains, the mechanism through which recapitulation is brought about. In biology the germ-plasm is the only connection between, the only factor common to, the organism and its ancestry. Any tendency to recapitulation must operate through this mechanism. Therefore only so far as development is a function of innate endowment (the germ-plasm) is it possible for an organism to recapitulate. So far as the complementary factor—environment—moulds development (by selecting certain potentialities for realization, etc.) a true recapitulation cannot occur. Innate characters may recapitulate, acquired characters do not.

IMPLICATIONS FOR PSYCHOLOGY.

Now for psychology this is tantamount to saying that so far as mental development recapitulates mental evolution in the biological sense, it shows itself dependent upon the physicochemical endowment and independent of the special characters of environment, upbringing, etc. And the corollary of this position is, that we must turn to cytological and biochemical methods for an understanding of the antecedents of infantile behaviour. Since the proximal link in the chain of causation stretching back from the child to his ancestry is the fertilized ovum, and since ancestral recapitulatory tendencies all act through this, we must seek in this developmental mechanism the explanation of all behaviour that is recapitulatory.

This may be so, and psychoanalysis may thus be on the point of defining earlier than we dared hope the respective *rôles* of heredity and environment in mental development. At the same time, and in so far as psychoanalysts succeed in demonstrating recapitulation, they are limiting the ætiological significance to be attached to the function of 'nurture.' Now the most important achievement of the psychoanalytic movement has been the demonstration of the pathogenic effect of certain emotional relationships, etc., in childhood. The working rule which has enabled it to make its unique contribution to psychopathology is the *canon* (not principle) of psychic determinism, which asserts that the causes of acts and thoughts should be sought in the antecedent 'experience' of the individual, i.e., in 'nurture.' It is to be hoped that the exponents of psychoanalysis will have further success in relating mental characteristics and abnormalities to factors and abnormalities of upbringing, thus adding to our prophylactic, therapeutic and

educative resources. It seems, however, that in claiming that biological recapitulation holds in the sphere of mental development they are admitting a restriction in the applicability of their method. This is surely not a triumph.

It is true there is no logical contradiction involved in asserting recapitulation *and* psychic determinism; they are merely mutually exclusive, mutually limiting. Each may hold in its own sphere, but not both together. In the absence of conclusive proof, however, I suggest that it would be sound method for psychology to scrutinize very critically any hypothesis assigning to nature as against nurture a preponderant rôle in mental development.

Sir Archdall Reid deduces the recapitulation theory as a necessary consequence of the modern evolution theory (*op. cit.*, p. 24); "we perceive that the theory that every individual in his own development climbs his own genealogical tree must *necessarily* be true. Given the unquestionable fact that the child recapitulates the development of the parent, any method other than by a recapitulation of the life-history of the race is not only impossible but actually unthinkable. One truth necessarily involves the other." On p. 28 of the same work we find: "As a fact we should know the doctrine of recapitulation as true even if an embryo resembling a lower type had never been seen, and it had been ascertained merely that the embryos of different generations resembled one another as much as the adult individuals."

In *Development and Evolution* J. M. Baldwin, says: "If we hold that mind and brain processes are parallel as well in the species as in the individual, and also hold that the brain series in the individual's development recapitulates in the main the series gone through by his species in race descent or evolution, then it follows that the law of recapitulation must hold also for the mental."

If we accept these findings we must admit that mental recapitulation is a necessary inference from the fundamental and universally accepted biological truths. Reid says it is unthinkable—logically impossible—that organic development should not recapitulate organic evolution. Baldwin says that given organic recapitulation, mental recapitulation must follow unless we are to believe that mind can exist and function independently of matter.

This chain of reasoning, formidable as it appears, will not stand examination at any point. Organic recapitulation is not a corollary of the evolution theory, and does not in fact obtain. The argument for mental recapitulation from the principle of psychophysical parallelism has, therefore, the ground cut from under it. But it is itself intrinsically erroneous, for it does not follow that functional development proceeds *pari passu* with organic development.

Dealing with Baldwin's argument first, we must note that as worked

out by himself (*Mental Development in the Child and the Race*, third edition, pp. 15–16), the theory of mental recapitulation equates the infant's first reactions with the racial phase of "simple contractility with the organic analogue of pleasure and pain." That is to say, he regards human mental development as beginning at the very beginning—on a psychological level with the protista. The "child begins in its prenatal and early postnatal experience with blank sensation and pleasure and pain with the motor adaptations to which they lead." On the most favourable construction, he is arguing that the evolutionary parallel to the stage of mental development of the human being at birth is to be found among the invertebrata, and so on for later phases.

Leaving out of account the difficulties raised by the consideration that more primitive animals (than man) are born with more highly developed minds, we wish to know how Baldwin's own statements are consistent with the principle of psychophysical parallelism from which they are mainly supposed to be deduced. Baldwin tells us (in the two books cited) again and again with an explicitness peculiarly his own that gaps in *either* the physical *or* psychical series can be filled up from our knowledge of the other: "either series is sufficient to carry us over the critical point" (the gap).

If, however, we endeavour to fill in the gaps in our knowledge of mental development in the infant by a study of the physical correlate of mind, we must credit him with a mentality not substantially inferior to that of an adult man. In complexity, the brain already exceeds that of the adult of any non-human species. If, on the other hand, we were to make inferences about his brain from an observation of his behaviour, we might well conclude that it is simpler, more primitive than the central nervous system of many invertebrates. Yet, if the principle of psychophysical parallelism were a trustworthy guide—as Baldwin expounds it—we should reach identical results from either side.

The real source of Baldwin's error lies in the meaning he attributes to the principle of psychophysical parallelism. It is a safe and necessary postulate that mental process does not take place apart from brain function, and that, conversely, the latter corresponds invariably and specifically to mental process. But after (unnecessarily) demonstrating the above principle as universal, etc., Baldwin tacitly alters its meaning and now uses it to imply that *mental process corresponds always and absolutely with brain structure*—an entirely different proposition. For although it is true that brain structure determines the *potentialities* of brain function (and hence, by our agreed principle, of mind), nevertheless it cannot be absolutely paralleled therewith. For example, the same brain under different conditions of stimulation may function in different ways, and by habit and accommodation pursue widely different alternatives of mental development. Again, resting and embryonic phases of brain life

may be non-functional, and in fact it is roughly true that *mental development begins where cerebral development leaves off*. At any rate, there can be little *definite* mental process before birth, and there can be no organic recapitulation after about the age of three. Baldwin overlooks the fact that structures do not necessarily function at the time and in the order in which they appear and, therefore, that cerebral recapitulation need not imply mental. It is also quite inconceivable that cultural evolution, with its periodic involutions, fusions and renaissances, has been paralleled by changes in cerebral endowment; it is quite reasonable to suppose that it may reach undreamt-of heights with the same cerebral potentialities as at present.

Recapitulation in the affective sphere is not possible, inasmuch as no demonstrable *evolution* has occurred. What development does take place here consists in cultural refinements and sublimations which are obviously in opposition to biological tendencies. Any parallel between cultural history and individual assimilation to that culture (which is really what mental development means) is not a biological phenomenon and requires a psychosocial interpretation. I have called it pseudo-recapitulation and will deal with it more fully in another article. In the unique case of sex the reverse of recapitulation takes place. For while we must suppose the primitive form of the instinct to have had that fixity and definiteness necessary for the achievement of its biological purpose, and while human inheritance (sex-instinct) consists, as psychoanalysis has shown, of a heterogeneous *collection* of vague feelings and impulses, the course of development is partly towards the primitive integrated and definitely directed disposition, partly a dispersal into cultural channels. The course of evolution has been from the definite and integrated instinct to the diffuse impulse bundle, the course of development the opposite way; how the psychoanalysts reconcile this with the 'biogenic law' I cannot see.

It remains to deal briefly with the assertion that recapitulation (organic) is a logical corollary of the evolution theory. What Sir Archdall Reid asserts is true, but amounts only to this: that the ontogeny of the offspring recapitulates the ontogeny of the parent *where variation has not occurred*. The recapitulation theory asserts a very different proposition, viz., that ontogeny recapitulates phylogeny, i.e., reproduces as successive phases that series of *variations* which is the race history. Now where this difference between the parent and his variant offspring consists in the addition of a phase or stage to the parental development, the carrying of some process a step further, then the parental ontogeny is repeated and the variation added. So far as evolution proceeds in this mode—where each variation is a further step at the end of a developmental process—ontogeny must reproduce each phase in ancestral history, must record faithfully and in their correct

order each successive variation that goes to make up phylogeny. If we represent an ontogeny by the phases A, B, and C, and one of these additive variations by D, so that the development ABC is changed into ABCD, and so on by the addition of other characters, then obviously we are symbolizing a recapitulatory evolution. Even if we add a character which carries the involution of a previous character, i.e., ABC, ABCD, ABCD-D, ABC, we still preserve in ontogeny a record of the gain *and the loss* of a character.

But this is not the only conceivable type of variation. Variation may consist in the simple deletion of an early phase or the substitution of another ; it might take the form of a reversal of the process of development, and so on. Thus ABC might become AC or AXC or ACB. It must be admitted that the probability of variation giving rise to a viable, biologically efficient variant is smaller in proportion as it affects the earlier stages of development. Just as the radical alteration of the foundations of a building must alter the whole plan, so a divergence from the specific pattern in the early phases of ontogeny is apt to disorganize all balances and to produce a monstrosity. Very probably the elimination of such variations will bring it about that evolution is mainly dependent upon variations taking effect near the end of development, i.e., upon variation compatible with recapitulation. But this is quite a different thing from saying that non-recapitulation is inconceivable (is not logically possible), and in the long run these rare but radical variations probably account for the admitted fact that recapitulation is never exact and, indeed, is the exception rather than the rule.

Neither the evolution theory nor any other biological principle is logically compelled to assume recapitulation ; neither are there any *facts* which compel us to assume that it *must* occur. On the contrary, the preponderance of "obliterations and falsifications of the record" shows plainly that recapitulation need *not* occur, and that even in regard to organic characters onto-phylogenetic parallelism cannot be relied upon. If, then, the theory does not hold for *structure* either as a generalization or as indicating some mechanical cause for the parallelism, surely we cannot rely upon it in regard to *function*, which is so much more dependent upon the accident of special stimulation. Surely we cannot postulate *mental* recapitulation upon *biological* grounds.

CONCLUSIONS.

I have indicated that biological opinion is not united as to the adequacy of the evidence for recapitulation or even as to the necessity of this interpretation of the onto-phylogenetic parallelism. I have also shown that *pari passu* with this loss of credit the theory has suffered a progressive diminution of *value* as a description, a generalization, and as

an induction (causal). I have argued that inasmuch as ancestral and infantile environments differ and consequently lead to a divergence between ontogeny and phylogeny in regard to special adaptive phases and characters, therefore this most plastic and adaptive of all characters, mind, should be the least likely to recapitulate, i.e., there is no *biological* ground for anticipating that recapitulation will hold in the mental sphere. Since the phylogenetic and the ontogenetic series are related through the germ-plasm, the latter must be the mechanism which maintains the parallelism between development and evolution. The *biological* process (and mechanisms) of recapitulation, therefore, affects characters only in so far as they are germinally determined. That is to say, specific forms and functions tend to recapitulate only in so far as they depend on germinal variations. In other words, the biological theory implies that the recapitulatory tendencies come within the sphere of that developmental factor we call heredity. So far as development is moulded by the (complementary) environmental or 'nurtural' factor, biological recapitulation cannot occur. To say that a reaction or phase of infantile development is 'recapitulation' (in the biological sense) is to imply that its immediate cause lies in the germ-plasm and its remote causes in the evolutionary (ancestral) series. If this is true, *psychological* investigation of these antecedent causes is irrelevant, and we must turn to *organic* lines of research. The consequences of this position for psychopathology, psychotherapeutics and mental hygiene have been briefly indicated.

I have, then, examined the more purely logical and metaphysical arguments for mental recapitulation and shown that they break down in many places. Recapitulation is not a necessary consequence of any established biological theory, nor are the germinal mechanisms of non-recapitulatory evolution 'inconceivable.' Even were recapitulation the rule in regard to structural characters and to brain in particular, it would not follow from the principle of psychophysical parallelism that mental development also recapitulates mental evolution.

There is, then, no *a priori* probability that mental development recapitulates mental evolution. The 'biogenetic law' in its psychological application must stand or fall by psychological evidence. There must be no bias in its favour from the glamour of its history or its (imagined) biological prestige. Alternative interpretations must be sought for on heuristic grounds, and indeed we may conclude, so far as biological considerations carry us, that mental development is more closely related to culture evolution than to brain evolution, and that any parallel between the first two has no biological significance—has nothing in common with recapitulation as biologists understand the phenomenon.