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DARWINIANS AT WAR
BATESON'S PLACE IN HISTORIES OF DARWINISM

ABSTRACT. The controversy between Biometricians and Mendelians has been called an "inexplicable embarrassment" since it revolved around the mistaken identification of Mendelian genetics with non-Darwinian saltationism, a mistake traced back to the non-Darwinian William Bateson, who introduced Mendelian analysis to British science. The following paper begins to unravel this standard account of the controversy by raising a simple question: Given that Bateson embraced evolution by natural selection and that he studied the causes of variation within a broadly Darwinian framework of problems and questions, how are we to understand the claim that he was a non-Darwinian? A brief survey of possible responses to this question is followed by an alternative proposal: the controversy will be considered as a struggle among Darwinians about the future course of Darwinism. On this account, Darwin's own work led to the juncture at which Mendelians and Biometricians parted company, indeed, the *Origin* itself prepared the divergent methodological stances subsequently adopted by Bateson and his antagonists. The inexplicable embarrassment is dissolved through the parsimonious reconstruction of the profound substantive conflict between Biometricians and Mendelians as a chapter in the articulation and differentiation of the Darwinian research programme.

1.

In a train on his way to a meeting of the Royal Horticultural Society, William Bateson for the first time read Mendel's paper on peas and thus discovered Mendelian genetics for British biology, immediately incorporating the fruits of his reading into his lecture of 8 May 1900 (B. Bateson, 1928, pp. 73, 171–80). As Bateson went on to apply this rediscovery to the assiduous study of the causes of variation, the Biometricians Raphael Weldon and Karl Pearson continued with their statistical investigations of natural selection. The two groups of researchers had been at odds already, divided not only by substantive quarrels about evolutionary mechanisms but also by a profound animosity between Bateson and Weldon. For these reasons, it might seem, the Biometrical champions of natural selection did not consider the contribution Mendelian genetics could make to their enterprise. And for the same reason, perhaps, the Mendelian champions of variation did not turn to statistical methods in order to explore the interplay of variation, heredity, and natural selection. Indeed, the two strands of

work were brought together only considerably later, in the first stage of the so-called evolutionary synthesis.

From the present-day perspective, the dozen or so years spent in haggling over the apparent conflict between Mendelian genetics and evolutionary theory is an inexplicable embarrassment. (Hull, 1985, p. 805)

David Hull's curt summation expresses a pervasive consensus among historians of science, and it is this consensus which provokes the following inquiry. After reconstructing more fully the standard view on the controversy, a simple question will be raised in Section 4, the remainder of the paper suggesting how Darwin's achievement led Bateson, Weldon, and Pearson to a methodological juncture at which profoundly incompatible options presented themselves as a matter of course.

2.

David Hull's summation juxtaposes two very different beliefs:

- (i) our current belief that statistical methods and Mendelian genetics together yield a powerful extension of Darwin's original research programme; and
- (ii) the belief of the major participants that Bateson's Mendelism and the Biometrical investigations were profoundly at odds with one another.

In this juxtaposition, (i) is uncontroversial and so is the attribution of (ii) to Bateson, Weldon, Pearson et al. Neither will be challenged in the course of this paper. What may need challenging, however, is another feature of Hull's account and of the standard view on the controversy, namely, the judgment that the participants' belief (ii) is more or less obviously false in virtue of its apparent antithesis, current belief (i).

3.

On the standard view, it was simply a mistake for the participants to deem their respective endeavours incompatible. On this view, historians of biology need to explain how and why this mistake was made, i.e., to find its source. A most obvious source for such a mistake would be that our current belief was as of then unattainable. In the case at hand,

however, this is not a plausible source of error. It appears that Bateson, Weldon, and Pearson did, indeed, contemplate (i), that they might have embraced it but failed to do so. If Hull calls the controversy an “inexplicable embarrassment”, he probably refers to just this circumstance. Weldon, for instance, reviewed Mendel’s work, failing to recognize in it the contribution Mendelian analysis might make to the theory of evolution by natural selection (Weldon, 1901–02; 1902–03). And Wilhelm Johannsen, whose work was read by all participants, tried in vain to impress upon them the compatibility of their approaches (Roll-Hansen, 1980, pp. 512f.). If the source of the mistake is not the unattainability of the option to embrace (i), it might be found in antecedent commitments which blinded the participants against this option. In the case at hand, such antecedent convictions concerned the strictly gradual progression of evolutionary history or, alternatively, the admission of saltations. Gradualists like Weldon and Pearson, one might argue, could not very well appreciate the merits of Mendelism as it seemed to go so ‘naturally’ with Bateson’s saltationism; which in turn would strengthen Bateson’s conviction that the Biometricians were on the wrong track entirely (Provine, 1971, p. 58). The mistake of adopting belief (ii) is thus pushed back a step and generalized: the participants mistakenly thought Mendelism to be at odds with gradualism because they saw Bateson’s saltationist Mendelism being at odds with the gradualism of the Biometricians. Having thus identified the source of the mistake, the standard view still needs to explain how this misunderstanding could be sustained over “a dozen or so years”. To this end the antecedent commitments concerning gradualism and saltationism are elevated to the status of unshakable articles of faith, a bottom line leaving no room for negotiation or reconsideration. Indeed, Darwinism itself is said to have been at stake as Bateson’s saltationist non- or anti-Darwinism collided with the gradualist Darwinism of the Biometrical student of natural selection.

Bateson missed the point that Mendel’s work . . . was not incompatible with Darwinian theories. (Froggatt and Nevin, 1971a, p. 15)

The standard view has thus completed its account of the elementary mistake. By calling Bateson a *non-Darwinian* and juxtaposing him to the *Darwinians* Weldon and Pearson,

- (a) it pits the opponents antithetically against one another, thus

- providing a source for belief (ii), namely, that there is a profound incompatibility between the camps;
- (b) it signals the presence of a mistake: not only because all non-Darwinians are known to be the 'losers' in the historical struggle concerning Darwinism, but also because we now accept (i), namely, the compatibility of Mendelism and Darwinism which makes it a mistake to align Mendelism with non- or even anti-Darwinism; and
 - (c) it invokes a set of historical conditions explaining the perpetuation of the mistake: embroiled in an antagonism of immense proportions, Darwinians and non-Darwinians fought a struggle of principles so grand that, of course, they remained oblivious to the mistaken self-identification upon which their controversy was premised.

4.

So much for the standard view on the controversy between Biometricians and Mendelians, a view more or less explicitly shared by a surprisingly heterogeneous array of historians and sociologists (cf. Nordmann (1991): aside from Provine (1971), Mayr (1973; 1980; 1985), and Hull (1985), the view is adopted by, e.g., Froggatt and Nevin (1971a; 1971b), Farrall (1975), MacKenzie and Barnes (1975; 1979), MacKenzie (1981), Roll-Hansen (1980), and Olby (1988)). While one might fruitfully bring to bear upon the standard view considerations of historiographic methodology (Nordmann, 1991), I wish to raise here a rather more elementary question concerning Bateson's presumed non- or anti-Darwinism: Is it really so? What does it take to establish as fact that Bateson was a non-Darwinian? And, what can be meant by the claim that he was? (Cf. Merton, 1987; Febvre, 1982.) After all, Darwin had transformed the entire domain of biology. He had established a new agenda by shifting the debate from the question of evolution to the question of evolutionary mechanism. He had redefined the field by showing how a heterogeneous variety of scientific disciplines can contribute to the common project. He had set exemplary methodological standards for a professional discourse among evolutionary biologists. In short, Darwin had established a paradigm, inaugurating a research programme devoted to its articulation, a programme which remained unrivaled in its scope. It would thus appear that for the past

century evolutionary biology had to struggle with Darwin's problems, perhaps against many of Darwin's proposals, but always within a Darwinian landscape. And it would appear that, after Darwin, to be an evolutionary biologist was tantamount to living in a Darwinian world, being a Darwinian. Accordingly, it seems unlikely that Biometricians and Mendelians should have confronted each other as Darwinians against non-Darwinians, separated instead by a more or less legitimate, a more or less profound disagreement on how to advance the Darwinian research programme. We have thus arrived at an initial, if as of yet rather principled, doubt concerning the very possibility that William Bateson should have been a non-Darwinian.

5.

A first survey of evidences reenforces this initial doubt, showing that the attribution of a non- or even anti-Darwinian impulse to William Bateson has to contend with a puzzling array of biographical features.

- * In 1883 William Keith Brooks suggests that by overestimating the continuity of variations, Darwin actually underestimates the power of natural selection (Brooks, 1883, p. 302). Having studied with Brooks, Bateson suggests in 1891 that the study of discontinuous variation suggests a way "by which it may be found possible to escape from one cardinal difficulty in the comprehension of Evolution by Natural Selection" (W. Bateson, 1928, vol. 1, p. 128). He thus follows up on his stated intention of 1890 "to pursue Darwin's problems and to employ Darwin's methods" (B. Bateson, 1928, p. 35).
- * To be sure, what Bateson means by "Darwin's methods" differs sharply from the practices of a certain, perhaps predominant, post-Darwinian orthodoxy. Indeed, Bateson blames the "Darwinian writings" and the "triumph of the evolutionary idea" for the subsequent scientific neglect of "specific differences" (W. Bateson, 1909, p. 2; cf. Fisher, 1936; and Cock, 1973). With his reference to "Darwin's methods" Bateson explicitly turns back to Darwin himself, praising his exemplary studies of variation (e.g., B. Bateson, 1928, pp. 277f.).

- * After professing “a full unwavering belief in [Darwin’s] doctrine as originally expressed”, Bateson states that he is “in no way committed to representations of that doctrine made by those who have come after”, i.e., by latter-day Darwinians (W. Bateson, 1928, vol. 1, p. 307). This is as close as he ever comes to publicly and explicitly labeling himself a ‘non-Darwinian’, i.e., a ‘non-Darwinian’ as against certain (mis-)representations of Darwinism.
- * As early as 1894, but even in his (in)famous address of 1914, Bateson expressed the perhaps quintessentially Darwinian conviction that natural selection works upon variation to produce evolutionary change, i.e., he believed in the origin of species through the preservation of favoured races in the struggle for life (W. Bateson, 1928, vol. 1, p. 307; or B. Bateson, 1928, pp. 283f.).
- * According to Darwin, Francis Galton, and Bateson, the seeming fixity or definiteness of type (apparent limits of variability and the persistence of the species-concept) requires explanation (e.g., W. Bateson, 1979, pp. 11f.).
- * Bateson’s work in this direction was inspired by Francis Galton’s Law of Ancestral Heredity. Following Galton’s interpretation of that law, and in this regard explicitly departing from Darwin, Bateson believed that discontinuous variation is required for natural selection to produce evolutionary change. While this belief supposedly renders Bateson a non-Darwinian, Galton is generally considered a staunch Darwinian. Moreover, Galton also serves as an ancestral link between Bateson and the Biometricians since his exemplary employment of statistical methods inspired the ‘pro-Darwinian’ Biometricians.
- * In his chapter on variation, Darwin was inclined “to lay very little weight on the direct action of the conditions of life” (Darwin, 1964, p. 132), a qualification on the exclusive causal power of natural selection strengthened in later editions of the *Origin*. Bateson may only be echoing Darwin when he expresses scepticism “as to the validity of th[e] appeal to changes in the conditions of life as *direct* causes of modification” (B. Bateson, 1928, p. 277; emphasis added).
- * While Darwin’s careful qualifications may have had the pur-

pose to establish latitude and thus to bolster scientific credibility and explanatory power (cf. Kitcher, 1985), Bateson's scepticism appears rather more constitutive of his research programme. "Natural Selection cannot have been the chief factor in delimiting the species of animals and plants" (B. Bateson, 1928, p. 277). Therefore, "it is useless to invoke the control of Selection as the factor to which definiteness of type in general must be referred" (W. Bateson, 1979, p. 134). Instead, Bateson referred definiteness of type to (genetic) unit characters or factors.

6.

In 1859, any proponent of evolution by natural selection would have been Darwin and Wallace themselves or else surely a 'Darwinian'. In 1889, Francis Galton, convinced that evolution cannot proceed by minute steps only, is still a Darwinian.¹ In 1903, William Bateson's search for other causal factors besides natural selection and his rejection of continuous variation as the basis of evolutionary change are supposed to render him a 'non-Darwinian'. How are we to understand that claim? The quick survey of Bateson's intellectual biography indicated already that he did not call himself a 'non-Darwinian', regarding himself instead as one of Darwin's successors. But one can argue, of course, that Bateson failed to meet the criteria of what makes a 'Darwinian', that he was thus a 'non-Darwinian' by definition, regardless of what he labeled or considered himself. Indeed, Bateson becomes a 'non-Darwinian' if one defines 'Darwinism' narrowly as either belief in "gradual evolution, produced by natural selection acting upon small continuous variations" (Provine, 1971, p. x) or, in the words of Ernst Mayr, as "the theory that selection is the only direction-giving factor in evolution" (Mayr, 1980, p. 3).² Agreeing with Mayr's definition, Peter Bowler reduces this approach to its counterintuitive, if not absurd, historiographic consequences. While referring to Darwin's work as a "stimulus" or "catalyst" which "brought the idea of evolution sharply into focus" (Bowler, 1988, pp. 5, 22, 71), Bowler maintains that Darwin's admittedly considerable impact was not particularly 'Darwinian' as defined by modern biologists like Mayr:

Thus when I say that Darwinism was not widely accepted in the late nineteenth century,

I mean that those aspects of Darwin's thought most attractive to modern biologists were not accepted at that time. (Bowler, 1988, p. 7)

Aside from rendering Brooks, Galton, and (in Bowler's case) even Darwin himself 'non-Darwinians', the definitional approach precludes from the outset that Bateson and the Biometricians may have been embroiled in a controversy among Darwinians about the direction of the Darwinian research programme. To Mayr's and Bowler's credit, they provide a historical rationale for their definitional approach. Darwin's *Origin* is said to amalgamate a multitude of theories, influences, and trajectories (Bowler, 1988, pp. 6, 22; and Mayr, 1985). Among these, Darwin's theory of descent with modification (including, perhaps, a role for natural selection) became an evolutionary commonplace that had already been 'in the air'. Though Darwin was instrumental in gaining its acceptance, this theory was not considered specifically 'Darwinian'. In contrast, Darwin's gradualism or his suggestion that selection may be the only direction-giving force in evolution fell into disrepute and were vindicated only in the twentieth century (Mayr, 1976, pp. 7ff.), and it was these aspects of Darwin's thought that were considered by Darwin's orthodox successors as distinctively 'Darwinian'. This suggests a third interpretation of the claim that Bateson was a 'non-Darwinian'. Relying neither on self-identifications nor on definitional *fiat*, David Hull employs a telling turn of phrase when he remarks that

early Mendelians found themselves in opposition to the Darwinians. (Hull, 1985, p. 805)

Indeed, Bateson may have "found" himself in opposition to an orthodoxy that had appropriated for itself the honorific 'Darwinian', an orthodoxy that claimed for itself the power to pick out the relevant features of Darwin's thought which define a 'Darwinian'. In other words, given how the battle-lines were then drawn and his own protestations notwithstanding, Bateson happened to fall into the camp of so-called 'non-Darwinians'. And still, proponents of this account would agree that, loosely speaking, Bateson's work contributed to an overarching research programme inaugurated by Darwin and extending through the evolutionary synthesis to this day. And they might agree with Julian Huxley, who describes Bateson's opposition against a self-proclaimed 'Darwinian' orthodoxy as a revitalization of Darwinism proper:

Late nineteenth-century Darwinism came to resemble the early nineteenth-century school of Natural Theology. Paley *redivivus*, one might say, but philosophically upside down, with Natural Selection instead of a Divine Artificer as the *Deus ex machina*. . . . A major symptom of revolt was the publication of William Bateson's *Materials for the Study of Variation* in 1894. . . . he turned to a task which, however different it might seem, he rightly regarded as piercing nearer to the heart of evolutionary problems. (Huxley, 1943, p. 23)

7.

But be that as it may. Instead of adjudicating the extent to which self-proclaimed Darwinians and supposed non-Darwinians deserve, after all, the honorific 'Darwinian',³ I wish to probe for the remainder of this paper what can be gained by treating as a Darwinian everybody whose work contributes to the Darwinian research programme, broadly conceived. We shall thus arrive at a rational reconstruction of the controversy without denying that much more was at stake for Bateson and the Biometricians than the future of a research programme. Relying neither on self-identifications, nor on antecedent definitions, nor on who managed to get the upper hand in the struggle for the honorific 'Darwinian', this proposal will end up agreeing with the participants' self-identifications, it will salvage the intuition that Bateson's researches represent an important chapter in the history of Darwinism, and it will show how a momentous struggle between incommensurable belief-systems can revolve around a fairly ordinary juncture in the history of a research programme. And instead of assuming that Darwin held a variety of distinct positions, only some of which are characteristically 'Darwinian', this proposal begins with a unified view of Darwin's achievement, which consisted in providing a variety of trajectories for further research within the general framework of a theory of descent with modification by natural selection.⁴ In short, this proposal aims for greater parsimony and clarity: instead of becoming entangled in a multitude of 'Darwinisms', it observes the progressive articulation and differentiation of evolutionary biology after Darwin's catalytic *Origin* had sharply focused scientific attention on the idea of evolution.

8.

Bateson need not be considered a 'non-Darwinian', and the belief of Mendelians and Biometricians that their approaches were incompatible

need not be considered false. And instead of rendering an inexplicable embarrassment explicable, one might show that nothing particularly embarrassing was going on. But then, instead of finding the source and perpetuation of a mistake, we have to find the source and development of a profound and legitimate disagreement. Within the shared framework of Darwinism, broadly conceived, the parties held truly incompatible views about the proper mode of Darwinian inquiry.⁵ I will show this for the case of Bateson by reading the most notorious document of Bateson's supposed 'anti-Darwinism' as a defense of what he considers an appropriate epistemological stance towards the Darwinian research programme, a stance diametrically opposed to the one adopted by the Biometricians. But, in order to establish that both stances evolved within a shared commitment to Darwinism, I have to show first how Darwin's achievement prefigures both, i.e., how divergent trajectories for further research issue from the *Origin of Species*.

9.

Philip Kitcher provides this description of Darwin's achievement:

Darwin's theory is a collection of problem-solving patterns aimed at answering major families of questions. So construed, the theory plainly makes no definite predictions which can be evaluated by relatively direct observation. Indeed, the relation between theory and observation is doubly loose. In the first place, the theory does not dictate the particular Darwinian histories which are to be constructed. In the second place, individual Darwinian histories will not always imply definite claims about expected observational findings. . . . the assessment of individual Darwinian histories must be undertaken with the aid of ancillary theories. (Kitcher, 1985, p. 159)

On this view, Darwin's achievement was to inaugurate a dynamic of research which gravitated around the main Darwinian claim that in contexts of evolution, biogeography, etc., there is always some Darwinian explanatory history to be found (Kitcher, 1985, p. 157). So, while demonstrating the heuristic and explanatory power of his theory of evolution by natural selection, Darwin also had to maintain an artful lack of definiteness. For instance, he did not firmly commit himself to the view that "selection is the only direction-giving factor in evolution". Instead, he would carefully circumscribe the remaining room for doubt and inquiry by anticipating objections or by stating that he was inclined "to lay very little weight on the direct action of the conditions of

life” (Darwin, 1964, p. 132). And most importantly, perhaps, Darwin appealed to different philosophical and methodological temperaments⁶ by leaving a particular conceptual juncture for subsequent research to fruitfully negotiate. Indeed, he suggested at least two plausible strategies for further Darwinian research. To see just how artfully Darwin intertwined both suggestions, one can turn to the famous last (“tangled bank”)-paragraph of the *Origin*. It invites the reader firstly

to reflect that these elaborately constructed forms, so different from each other, and dependent on each other in so complex a manner, have all been produced by laws acting around us. (Darwin, 1964, p. 489)

The laws he refers to all belong to a “grand and untrodden field of inquiry”, encompassing, for instance, “the causes and laws of variation” (Darwin, 1964, p. 486). Their exploration, and with them perhaps the discovery of hitherto unknown natural forces, was to be the aim of Bateson’s causal analysis. But, aside from contemplating causal secrets which future inquiry may reveal, Darwin also points to a “grandeur in this view of life” which arises from even the superficial appreciation of phenomenal relations directly accessible to the statistical analysis of the Biometricians:

[F]rom the war of nature, from famine and death, the most exalted object which we are capable of conceiving, namely, the production of the higher animals, directly follows. . . . whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved. (Darwin, 1964, p. 490)

The schemata or explanatory histories suggested by Darwin were thus kept open and indefinite as to their further theoretical development. Indeed, Darwin managed to sustain within a single sentence the tension between the alluring promise of causal analysis and the sufficiency of purely phenomenal analysis:

[T]he variations of each creature are determined by fixed and immutable laws; but these bear no relation to the living structure which is slowly built up through the power of selection (Darwin, 1887, vol. 2, p. 236)

Fruitfully mixed messages like these have furthered Darwin’s achievement and prepared for competing strands of Darwinian research. In the absence of any definite knowledge concerning the laws and causes of variation, Darwin showed that evolution by natural selection was not premised on any strong presuppositions concerning these matters.

While being compatible with directed mutations, his theory presupposed only minute 'individual differences' as products of chance (but cf. Darwin, 1903, vol. 1, pp. 208f.). Darwin thus proposed that his theory of evolution could be articulated more fully by phenomenologically or biometrically tracing the workings of natural selection. Aside from saving his theory from potential objections, this proposal carried definite anti-metaphysical appeal. By the same token, however, Darwin had to acknowledge that his theory was incomplete as long as the laws and causes of variation are unknown.

I have hitherto sometimes spoken as if the variations . . . had been due to chance. This, of course, is a wholly incorrect expression, but it serves to acknowledge plainly our ignorance of the cause of each particular variation. (Darwin, 1964, p. 131)

The explicit dismissal of chance as an ultimately acceptable explanation of variation recommends a causal analysis of the initial conditions upon which natural selection operates, catering to, e.g., Bateson's empiricist ideal according to which science uncovers the hidden forces of nature.

10.

Remaining artfully indefinite and promoting various methods of further analysis, the Darwinian explanatory histories all revolve around an open, i.e., not fully defined concept, 'natural selection'. After showing how it operates in his explanatory schemata, Darwin left several ways of specifying or further investigating its content.⁷

As in time the term must grow intelligible the objections to its use will grow weaker and weaker. (Darwin, 1903, vol. 1, p. 184; cf. 1962, pp. 91f.)

Treating 'natural selection' like 'attraction of gravity' or 'undulation of light', the Biometricians restricted themselves to the precise articulation of its conditions of operation.⁸ And treating 'natural selection' like 'denudation' or 'hepatic sensation', the Mendelians had to look for underlying properties of matter which, so to speak, causally enable the surface-regularities.⁹ Moreover, leaving open different ways to confront the problem of variation and different ways to interpret 'natural selection', Darwin would not and could not make a definite distinction between continuous and discontinuous variation, thus also leaving open whether or not his terms 'individual differences' and 'sports' designate a difference in kind.¹⁰ Indeed, this question constitutes yet another

aspect of the conceptual juncture negotiated by Biometricians and Mendelians. The assumption of nothing but slight, uncaused individual differences served the anti-metaphysical Biometrical account of the ways by which natural selection evolves beauty from simple beginnings. And sports or causally significant mutations provided a focus for the Mendelian study of the forces of nature which enable natural selection to lawfully produce elaborately constructed forms.¹² Given this state of fruitful ambiguity, both Biometricians and Mendelians could trace themselves back to a shared Darwinian framework (cf. Farrell, 1975, p. 279). But, given this state of fruitful ambiguity, Biometricians and Mendelians could also embark upon mutually exclusive or incompatible, even incommensurable, methods of analysis, each of which is arguably a progressive step in the articulation of Darwinism.

11.

As William Coleman works out in considerable detail, Bateson was rooted within a physical tradition, proposing undulatory theories of inheritance, looking for forces in matter, treasuring exceptions and exceptional individuals, rejecting the (positivist) “lawyer-politician”-scientist who regards any population “as a simple aggregate of similar units” (Coleman, 1970, p. 297). Quite possibly along the ideological lines suggested by MacKenzie (1981) and MacKenzie and Barnes (1975; 1979), Bateson thus responded to that pre-structured strand of Darwinism which involved the causal analysis of matter:

[V]ariation and heredity instead of being merely postulated as axioms should be minutely examined as phenomena. (Bateson, 1979, p. 1)

Accordingly, Bateson argued in his Presidential Address of 1914 that his Mendelian studies take up Darwin’s problems by providing the required minute analysis of variation and heredity:

If we cannot see how a fowl by its egg and its sperm gives rise to a chicken or how a sweet pea from its ovule and its pollen grain produces another sweet pea, we at least can watch the system by which the differences between the various kinds of fowls or between the various kinds of sweet peas are distributed among its offspring. By thus breaking the main problem up into parts we give ourselves fresh chances. This analytical study we call Mendelian because Mendel was the first to apply it. (B. Bateson, 1928, p. 279)

Studying the system by which differences are distributed among offspring, Bateson hopes to discover the forces by which variations arise

for natural selection to work on, i.e., he attempts to formulate causal hypotheses which delimit and define the work that remains to be done by natural selection:

In face of what we now know of the distribution of variability in Nature the scope claimed for Natural Selection in determining the fixity of species must be greatly reduced. The doctrine of the survival of the fittest is undeniable so long as it is applied to the organism as a whole, but to attempt by this principle to find value in all definiteness of parts and functions, and in the name of science to see fitness everywhere is mere eighteenth-century optimism. Yet it was in application to the parts, to the details of specific difference, to the spots on the peacock's tail, to the colouring of an orchid flower, and hosts of such examples, that the potency of Natural Selection was urged with strongest emphasis. Shorn of these pretensions the doctrine of the survival of favoured races is a truism, helping scarcely at all to account for the diversity of species. Tolerance plays perhaps as considerable a part. By these admissions almost the last shred of that teleological fustian with which Victorian philosophy loved to clothe the theory of Evolution is destroyed. Those who would proclaim that whatever is is right will be wise henceforth to base this faith frankly on the impregnable rock of superstition and to abstain from direct appeals to natural fact. (B. Bateson, 1928, pp. 284f.)¹³

Here, then, is Bateson at the height of his 'anti-Darwinism'. Still believing with Darwin that natural selection selects the fittest as it operates upon the material provided by variation, he goes on to propose that variation itself is governed by a linear causal process of "unpacking" (Huxley, 1943, p. 24): variation presents natural selection with material which successively diminishes in genetic complexity (B. Bateson, 1928, pp. 292ff.). Though Bateson just barely suggests this hypothesis and remains extremely tentative about it (and in his lifetime he pursued several other such speculations), the notion of diminishing complexity and increasing conservatism stands in clear opposition to the Victorian optimism he ridicules.

For them the unknown was a rich mine of possibilities on which they could draw freely. For us it is rather an impenetrable mountain out of which the truth can be chipped in rare and isolated fragments. (B. Bateson, 1928, p. 285)

Darwin found "grandeur" in a view of life indifferent to the causes of variation, and like the Biometricians or Bateson's dreaded "lawyer-politician" he could therefore see progress emerging from populations conceived as "simple aggregate[s] of similar units" (B. Bateson, 1928, p. 414). Convinced by Galton that evolutionary progress cannot be explained without recourse to saltations, the cultural pessimist Bateson agnostically chipped at the impenetrable mountain of ignorance, attempting to explore the "fresh chances" provided by Mendel, fresh

chances to appropriately amend and complete Darwin's causal account of evolutionary history. Having begun his lecture by praising the "genius of individual men of science, giant variations from the common level of our species" (B. Bateson, 1928, p. 276), he ends by singling out three such – "if you will, abnormal – intellects" as he summarizes the results of his own endeavours:

The outcome, as you will have seen, is negative, destroying much that till lately passed for gospel. Destruction may be useful, but it is a low kind of work. We are just about where Boyle was in the seventeenth century. We can dispose of Alchemy, but we cannot make more than a quasi-chemistry. We are awaiting our Priestley and our Mendeléef. In truth it is not these wider aspects of genetics that are at present our chief concern. They will come in their time. The great advances of science are made like those of Evolution, not by imperceptible mass-improvement, but by the sporadic birth of penetrative genius. (B. Bateson, 1928, p. 296)

12.

Awaiting his Priestley, the quasi-evolutionist Bateson hardly dared to dream yet of Lavoisier or an evolutionary synthesis.¹⁴ The groundwork for his fledgling science was laid by the penetrative genius of Darwin, who had sharply focused scientific attention on the idea of evolution, who had provided explanatory schemata, who had impressed upon Bateson a theory of evolution by natural selection. It was for Bateson's generation to further direct Darwinian research and further articulate Darwin's paradigm: Is natural selection the only direction-giving factor in evolution; are there causes of variation, and should they have a place in Darwinian explanatory schemata; will the term 'natural selection' become more intelligible if treated as a placeholder standing in for a causal account in terms of underlying properties; and, is there a difference in kind between 'individual differences' and 'sports'? Bateson's response to Mendel was preceded by his convictions concerning these Darwinian questions, these convictions, in turn, rooted in his empiricist ideals and his cultural conservatism, if not pessimism. Meanwhile, the statistical analyses by the Biometricians thrived upon a contrary set of answers, which may have also been rooted within a larger ideological context (see, e.g., MacKenzie, 1981; and MacKenzie and Barnes, 1975; 1979). Premised upon such profoundly different assessments concerning the further direction of Darwinian researches, Mendelians and Biometricians each explored the heuristic potential of their approaches.

Their personal animosities and their ideological and cultural differences may have accentuated substantive disagreements and sharpened their focus. Indeed, these external factors may have been constitutive of their researches rather than merely dysfunctional. From the present-day perspective, then, the dozen or so years spent probing the various trajectories and dimensions of Darwinism are neither inexplicable, nor embarrassing. They represent an important exploration of Darwinian themes, perhaps a necessary prelude to the evolutionary synthesis.

NOTES

¹ Note, for example, how Provine words the issue: "Why did Galton break so decisively with Darwin on the issue of discontinuity in evolution?" (Provine, 1971, p. 19). The wording implies that one can break with Darwin on this particular issue without therefore leaving the framework of Darwinism. This is especially noteworthy since Provine defines Darwinism as a belief in "gradual evolution, produced by natural selection acting upon small continuous variations" (Provine, 1971, p. x). Based on this definition, Provine treats Bateson as a non-Darwinian (Provine, 1971, pp. 40–45; cf. Cock, 1973, pp. 20–22).

² Bateson becomes a 'non-Darwinian' also on Norton's claim that Darwin's theory entailed "the following two assertions: (1) that, in nature, death rates were often selective in respect to the different types of individual differences manifested by the members of populations; (2) that 'single variations' were evolutionary [sic] inconsequential" (Norton, 1973, p. 287).

³ Such adjudication is by no means innocent. As contemporary evolutionary biology develops, different aspects of Darwin's thought may prove to be "most attractive" to different groups of modern biologists. For example, the exclusion of saltationists (like Bateson) from the 'Darwinian' heritage helps draw the battle-lines in the more current debate concerning punctuated equilibria (see, e.g., Mayr, 1985, p. 771).

⁴ Considering the same historical evidence as Provine, Mayr, Bowler et al., I am simply adopting an inverted conceptual perspective upon them. Bowler writes that "the 'Darwinian Revolution' may have been completed by forces that were only indirectly set in motion by the *Origin of Species*" and that Darwin's "theory acted as a stimulus to the development of nineteenth-century evolutionism, but did not altogether control the direction of that development" (Bowler, 1988, pp. 6, 22). For Bowler, these statements underscore that 'Darwinism' proper cannot be defined by looking at Darwin and the various brands of 'pseudo-' and 'anti-Darwinism' in the nineteenth century. To me, these statements indicate that Darwin's achievement and the Darwinian transformation of biology consist in the fact that the *Origin* indirectly set into motion a process which attracted for its completion the contribution of other (e.g., Mendelian) impulses, i.e., that Darwin stimulated the subsequent struggle for the proper articulation, direction, and refinement of the Darwinian research programme.

⁵ Indeed, the common framework notwithstanding, their views may well have been incommensurable. See Karl Pearson's "Mr. Bateson and I do not use the same language"

(Pearson, 1902, p. 331) and distant repercussions even as late as Bateson's "We and the systematists have to devise a common language" (W. Bateson, 1922, p. 60; also in B. Bateson, 1928, p. 397). Looking back at the controversy, Froggatt and Nevin also conclude: "[T]hey were speaking different languages" (Froggatt and Nevin, 1971a, p. 14). The suggestion that Mendelians and Biometricians were divided by profound disagreements (within a broadly Darwinian framework) can be found, e.g., in Norton (1973; 1975a; 1975b), Cock (1973), Farrall (1975), and Darden (1977).

⁶ "Darwin's success had come at least in part because his theory had been skillfully presented to a potentially hostile audience" (Bowler, 1988, p. 71).

⁷ Darwin's introduction of an open concept (followed by a definite series of decisions concerning its further development) may match a general structural pattern in the development of scientific concepts (cf. Nordmann, 1990).

⁸ Darwin writes about his critics: "I generally throw in their teeth the universally admitted theory of the undulation of light, – neither the undulation nor the very existence of either being proved, yet admitted because the view explains so much" (Darwin, 1903, vol. 1, p. 184).

⁹ "I use [the term 'natural selection'] much as a geologist does the word denudation – for an agent, expressing the result of several combined actions" (Darwin, 1903, pp. 126ff.). Compare George Romanes's comment:

To say that the liver selects the elements of bile, or that nature selects specific types, may both be equally unmeaning restatements of facts; but when it is explained that the term natural selection, unlike that of 'hepatic sensation', is used as a shorthand expression for a whole group of well-known natural causes – struggle, variation, survival, heredity – then it becomes evidence for an almost childish want of thought to affirm that the expression is figurative and nothing more. (Romanes, 1896, p. 334)

¹⁰ Hull notes that Darwin never uses 'continuous' or 'discontinuous' to qualify 'variation' (Hull, 1985, p. 812). And Mayr points out that it was for the evolutionists of the synthesis to establish the important fact "that there is no difference between large and small mutations – that is, between de Vriesian mutations and Darwin's individual variation" (Mayr, 1980, p. 19).

¹¹ Accordingly, Pearson's attempt at a theory of heredity proceeded from "undifferentiated like organs" which, however, "possess a certain variability". For Pearson, the facts had to come under this description in order to serve as the foundation for a Biometrical or phenomenological theory of heredity which would not posit other forces or causes besides 'natural selection' (cf. Provine, 1971, p. 59).

¹² Looking for *kinds* of variations which provide causal clues for the problem of evolution (and natural selection), Bateson would not see Pearson's universal "undifferentiated like organs" (see previous note). Instead, he had to urge upon Pearson the important 'fact' that there is a difference between "specific" and "normal" variations (see Provine, 1971, p. 62). This difference in the perception of 'facts' further substantiates that Bateson and the Biometricians may have assumed incommensurable positions within the Darwinian framework.

¹³ Julian Huxley's assessment of Bateson (quoted above at the end of Section 6) may have been formulated with this passage in mind. While Bateson debunks 'natural selection' as a progressive *deus ex machina* appealing to the optimism of the Biometricians (through it, "from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved"), he stops well short of denying it. His 'Darwinism' still goes well beyond the acceptance merely of some notion of descent with modification.

(And even certified 'Darwinians' of today are asking in which sense the theory of natural selection is a truism.)

¹⁴ Bateson did consider Mendelian analysis a necessary precondition for the eventual construction of "a true synthetic theory of Evolution" (W. Bateson, 1979, p. 1). "That synthesis will follow on an analysis, we do not and cannot doubt" (B. Bateson, 1928, p. 398).

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