INTRODUCTION

IF ANACHRONISM IS THE CARDINAL sin for historians, perhaps historians of science are the most likely sinners. The very nature of their subject pushes them almost irresistibly, no matter what they do to avoid it, toward a conception of scientific discovery that is evolutionary, if not linear. In fact, even if one has challenged the fallacious and ultimately ethnocentric concepts of "cultural progress" and "social progress," one cannot reject the notion of "scientific progress" so easily. Can this theoretical hurdle be crossed, now that we have left behind the Cartesian idea that the sciences developed from an unalterable foundation, and have substituted for it the idea of the history of science as a succession of systematic constructs, each of which, in the words of Karl Popper (1972, 16), "has the character of an approximation towards [a] new theory"?

This is an ongoing dispute in the history of science. How can we talk about the development of a science as the heir of the often metaphysical speculations of ancient authors, who came

long before the "epistemological break" that constituted the science in question? The problem becomes all the more serious to the degree that contemporary scientists perceive those authors as their predecessors.

As the present study encounters this problem from the very beginning, perhaps our examination of the status and functions of the classification of animals in Aristotle's writings will contribute to a better understanding of the progress of human efforts toward knowledge. The two views of scientific progress, Cartesian and contemporary, are in competition but usually are not incompatible. They have, in fact, the same root, since they suppose that the theoretical problems that humanity sets itself remain identical throughout the ages. There is here a subtle and biased anachronism: subtle because it recognizes that the material and intellectual means that an epoch uses for resolving these so-called "eternal problems" are relative and variable; biased because it is all too easy for us to forget that *our* problems are not necessarily those of the whole human race.

Nearly all the important literature devoted to Aristotle's "biology" is guilty of this anachronism. But I maintain that it is irrelevant to think of this biology as incomplete; rather, it is radically foreign to us: produced in a world that is gone, it tried to answer questions that we no longer ask. Interpreters evaluate Aristotle's "taxonomic" efforts from a modern point of view. Given that fact, it does not matter much whether they stress Aristotle's inadequacies or his genius, because their dispute is waged in the wrong territory. One might even say that, in this debate, praise is more suspect than criticism, since those who praise him represent the master of the Lyceum as a precursor. And, as Georges Canguilhem remarks in "L'objet de l'histoire des sciences" (1968, 2): "Agreeing to look for, to find, and to celebrate precursors is the clearest symptom of a lack of talent in epistemological criticism. Before joining two sections of road, it is a good idea to be sure first that they belong to the same road."

Historians and commentators who have dealt with Aristotle's classification of animals have most often neglected to address

this problem of *method,* in the etymological sense of the word. Clinging to the indubitable fact that Aristotle divided animals into distinct groups, they do not ask whether classifying animals was for Aristotle a theoretical task, as it was to be for the taxonomists of the classical era, nor do they ask what functions the several animal classifications had in Aristotle's system of knowledge — for he presents a variety of orderings of animals, according to different points of view.

Of the large number of interpreters of Aristotle's biology, I shall consider two groups that are chronologically, and especially professionally, distinct. According to the first group, recent historians of science and philosophy, Aristotle tried to construct a natural classification of animals, but was not able to succeed. Questions concerning what route he traversed and how far he had left to go to complete his project are controversial issues among these interpreters. For example, here are three passages from *Histoire de la zoologie* by Georges Petit and Jean Théodoridès (1962, 83, 84, 86):

> Aristotle did not know how to codify his attempts at classification, and it would be illusory to draw from his work an ordered classification; it is substantially there, but is not expressed. . . .
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> Relying on the *Historia Animalium* alone, one would be tempted to write that Aristotle, playing with the words *eidos* and *genos*, did not notice the contradictions in giving them different senses from one passage to the next. On the contrary, we think that he was aware of these contradictions or insufficiencies, and was not able to escape them. . . .
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> But Aristotle did not substitute anything constructive for the dichotomous classification that he criticized. . . . We think that this decision to take animals genus by genus, following the example of ordinary people who distinguish a class of birds and a class of fish, was in fact a renunciation.

From this point of view, Aristotle could barely have envisaged a rigorous taxonomy, which would have been too ambitious for the period; instead he attempted a less grandiose but more manageable project, leaving the completion of his work to

successive generations, who would be better informed. This continuistic notion runs through the interpretation of Léon Robin (1944, 181):

> The exaggerated hopes that Aristotle had for the possibilities of knowledge, as he had conceived it in its essence and method, were overwhelmed by the volume and complexity of the facts that had to be organized. In truth, we should judge that the criticisms raised against this classification are somewhat unjust, considering all the special studies and failed attempts that were required before a satisfactory natural classification could be developed.

If one accepts Karl Popper's idea that scientific theories are constructed by a method of trial and error, one may readily suppose that if a taxonomic effort had been going on for centuries, later naturalists could have profited directly from Aristotle's efforts and failures. As the saying goes, the successors, standing on the shoulders of their great ancestors, could see farther.

Some might object that the book by Petit and Théodoridès, being a survey, is not grounded in an intimate knowledge of the texts, and that although Léon Robin is a specialist on Aristotle, the biological works are not those he knows best. Neither excuse can be made, however, for Pierre Louis, whose *La Découverte de la vie: Aristote* (1975) was published as a kind of conclusion to his edition of Aristotle's biological texts.[1]

In Louis's view, Aristotle found himself faced with the problem of taxonomy as a necessary consequence of his historic initiative, in the etymological sense of *historic:* "He gave to his research on animals a promising new orientation, for he had opened the way to comparative anatomy." If I wished, I could show the danger in masking the formidable problems of historical affiliations with simple but vague expressions like "open the way." But the relationship that Louis sketches here between Aristotelian zoology and comparative anatomy assumes a special importance, to which I shall return later. Louis continues (p. 29):

> That initiative led [Aristotle] to gather more and more information about animals. But it also led him to set himself a difficult problem that he could not avoid raising in discovering comparative anatomy — that of the classification of living things. Classification is for him the result and consequence of the comparisons to which he devotes himself, but it is also the indispensable tool of his research.

Farther on (p. 149), at the beginning of the chapter on "the classification of animals and the scale of beings," Louis is even clearer:

> The comparative method that Aristotle uses for studying anatomy, physiology, and the habits of animals presupposes a rigorous classification of all living beings. However, we find nowhere in the biological treatises a complete table of the various families of animals.

It is not true that Aristotle failed to indicate the direction that a possible classification of animals might take; as Meno does for virtue (Plato, *Meno* 72a), he proposes a swarm of criteria. Without explicit reference, Louis paraphrases a text from the beginning of the *History of Animals* (1.1.487a11 et seq.) in which Aristotle, having enumerated four principles for distinguishing between animals — their mode of life, activities, characters, and parts — goes on to mention ten or more parameters, from habitat to degree of sexual appetite, and finally talks about the distinction between blooded and bloodless and envisages a possible classification according to modes of reproduction and locomotion. Louis concludes from this (p. 151):

> Thus, there are many possible ways to classify animals. Aristotle ultimately chooses, out of this entire range, a way of classifying according to the subject he is studying. . . . But Aristotle doubtless was perfectly aware of the serious drawbacks of an overly simple method. Its principal defect is in depriving the naturalist of a complete and definitive classification.

Aristotle therefore had to have produced, simultaneously with his own biological project, the need for a natural and universal classification. But he is thought to have lacked the means for

constructing such a classification, and to have settled for a diverse multiplicity of partial criteria. And, to crown his misfortune, he could not have avoided being aware, obviously unhappily aware, of his theoretical prerequisite, and therefore his failure.

Thus, according to Louis, the postulate of the identity of problems through time leads directly to the identity of the procedures for resolving them. It is historically correct that comparative anatomy, as it was constituted at the beginning of the nineteenth century, relied on the work of taxonomists of previous generations. One could even say that this was a necessary sequence, in that one can hardly imagine how it could have occurred the other way around. Louis transports that necessary sequence into the past. And, in fact, if one admits that comparative anatomy could, one way or another, have been born several times, then it must have been the same for taxonomy.

The three interpretations presented above are representative of the positions that all Aristotelians have adopted on the problem that concerns us, both in works as old as that of Meyer and in the most recent works.[2] Commentators notice Aristotle's obvious and explicit desire to separate animals into nonarbitrary groups, and they add a presupposition, so indisputable in their eyes that they do not formulate it: namely, that Aristotle had to be trying to achieve that "perfect" classification, the binominal taxonomy, which we call, perhaps erroneously, Linnaean.[3] So if, on the one hand, we suppose that Aristotle had a theoretical project more or less identical with that of Adanson or Linnaeus, and, on the other, we realize (and it is difficult not to) that Aristotle did not develop a rigorous binominal classification, we create from nothing the theoretical problem that confronts us—that is, the problem of the obstacles that supposedly prevented Aristotle from achieving the goal that commentators have assigned him. At that point they cease explicating Aristotle.

It makes little difference whether they then castigate Aristotle's taxonomic weaknesses or try to excuse them: all plead

before the same jury, that of post-Linnaean systematicians, and all plead guilty. At that point the commentators part company, each one proposing his own explanation of Aristotle's classificatory "failure." Let me cite just two of these explanations — first that of W. D. Ross (1949, 115):

> No cut-and-dried classification is to be found in his writings. He is well aware of the difficulties; well aware of the existence of isolated species which fall under no recognized "greatest genus," and of species intermediate between two such genera. But his classification is clear enough in its main lines, and is one which has on the whole stood well the test of time; it was a great advance on anything that preceded it, and no further advance was made before Linnaeus.

Besides the surprising confidence about debates that Aristotle carried on *in pectore,* this passage clearly demonstrates Ross's belief in the continuity of problems through history: if Linnaeus went farther than Aristotle, then they must have been following the same path. According to Ross, Aristotle's effort did not succeed because of the internal difficulty of delimiting genera and species. That explanation is in itself essentially continuist, since this is the same difficulty found by classical taxonomists, and they succeeded just where Aristotle failed.

Another explanation, put forward by Maurice Manquat, Jean-Marie LeBlond, and Pierre Louis, emphasizes an external obstacle to the practice of classification as such. This epistemological obstacle is, they say, that of ordinary language: in not breaking with ordinary language, Aristotle could not develop a rigorous classification. Indeed, what scientific innovation has not run up against the difficulty of expressing its contribution in the language inherited from previous generations? But Aristotle seems in a way to refuse to engage in that struggle. Thus, LeBlond (1945, 168, n. 94), commenting on the passage in *Parts of Animals* (1.2.642b15) in which Aristotle notes that certain groups, although "natural," do not have names, writes:

> Aristotle did not seek to fill this gap in popular terminology, and he did not create names. That is surely one of the reasons for his failure in natural classification; he had no idea of rational terminology, a

necessary tool of classification, which would be the glory of Linnaeus.

This lack of linguistic daring on Aristotle's part is all the more surprising because he himself declares that existing language is often an inadequate tool and one should not hesitate to create terms when the need arises.[4] Doubtless this explains why Louis (1975, 156), unable to account for Aristotle's supposed linguistic conservatism, claims that it was common practice in Aristotle's day:

> This respect for contemporary language is not, in any case, limited to Aristotle. All ancient naturalists share it; unlike modern scientists, they did not use any scientific nomenclature for designating plants and animals.

In the context of LeBlond's general interpretation of Aristotle, the taxonomic failure is no small matter. If a rigorous classification is necessary for a coherent "biology," and if it is really in the study of living things that Aristotle forged most of his philosophical concepts (which is what LeBlond thinks), then the failure in classification is fundamentally the failure of Aristotle's philosophy in general.

> It is incontestable . . . that Aristotle's logic and his whole philosophy were inspired in large part by a classificatory ideal: syllogism and definition, in theory as in practice, are determined by the notions of genus and species, which are decidedly biological in character and do not find their perfect application other than in the realm of living things. In biology proper, however, the classificatory effort appears not only less successful than the explanatory effort, but also less carefully thought out. Even the theory is developed less confidently. *(LeBlond 1945, 59, n. 3)*

Finally, we can reproach Pierre Louis, who knows the texts very well, for not having taken his own discoveries seriously enough. As a matter of fact, in an article (Louis 1956) written long before the work cited above, he lays out all the procedures that Aristotle used for not getting too far away from the vernacular. That vernacular, as Manquat properly emphasizes, seems to

us scientific only by a retrospective illusion.[5] Louis gives examples of periphrastic descriptions, uses of the participle ***kaloumenos*** ("so-called") with less-used names, and so on. Aristotle intentionally spoke the language of his informers — travelers, hunters, fishermen, farmers. If Aristotle was careful to stay close to ordinary language in his discussions of animals, no doubt it was primarily (as Louis suggests) because he wanted his hearer (or reader) to be able to immediately identify the animals named. But that Aristotle would sacrifice his scientific project itself to the goal of popularization is a truly incredible idea. As a matter of fact, Aristotle does resort to neologisms, whether invented by him or by others, when necessary: for example, the noun *entoma,* "insects," which is etymologically clear, and the term *selache,* "selachians," which Pliny the Elder (9.40) assures us Aristotle created.[6] And Aristotle clearly innovated the fundamental division between blooded and bloodless animals.[7]

We can grant to Louis and LeBlond that Aristotle could not achieve a rigorous taxonomy, in the modern sense, without breaking with contemporary language. But we can avoid falling into their aporias by simply supposing that, since Aristotle did not break with the linguistic usage of his time, he did not have any such taxonomic project. David Balme (1975, 188), correctly observes: "The belief that there must be a classification in the background rests on the assumption that Aristotle, like every good pre-evolutionary zoologist, put systematics first in zoology and morphology first in systematics." A critique of the linguistic explanation of Aristotle's supposed taxonomic failure could take us very far afield. To adequately appreciate the force of the argument presented by LeBlond and Louis, we would first have to ask, "What is the theoretical function of naming?" Let us simply say that for the Greeks in general, and for Aristotle in particular (as we shall see later), naming cannot have an epistemic function, since naming is not defining. In fact, name-giving has not had a really theoretical function in natural science except during a rather brief period, approximately the last two-thirds of the eighteenth century, and this is well known to historians of

science. To suppose that Aristotle intended such a function is mistaken — the Greeks would say *atopon:* without significance, because uprooted from the place in which it can be significant.[8]

Let us turn now to a second group of commentators, very different from the modern Aristotelian scholars we have been discussing, but whose conception of his taxonomic project is no less instructive. These are not so much the creators as the heirs of the triumph of animal systematics — those who received a completed taxonomy from the hands of their predecessors and turned to look at new problems.[9] The most representative member of this group is doubtless Georges Cuvier, the last great fixist, but nevertheless the founder of biology, as I shall explain later. (By "fixists" I mean those classical taxonomists who believed that the kinds of living things are denumerable and permanent.) The common practice of his predecessors, even of the greatest, such as Buffon, was to dismiss the history of their science with mere summary doxographies. Cuvier, by contrast, was a true historian of science, and this part of his work influenced his own original contributions. Thus, we should look closely at the two lectures that he devotes to Aristotle in his *Histoire des sciences naturelles.*[10] Here are several passages:

> We should consider Aristotle one of the greatest observers who ever lived; but without any doubt his genius for classifying was the most extraordinary ever produced by nature. *(Vol. 1, p. 133)*

> The *History of Animals* is not exactly a treatise on zoology, that is, a set of descriptions of various animals; rather, it is a kind of general anatomy, in which the author treats the general organizational features that various animals present, and in which he describes their differences and similarities, relying on a comparative examination of their organs, and in which he lays the foundation of the great classifications with the most perfect exactitude. *(Vol. 1, p. 147)*

> However, since Aristotle did not think it necessary to draw up a zoological chart, some people have supposed that his work lacked method. Assuredly, those people have only a very superficial understanding. *(Ibid.)*

> Aristotle, right from the beginning, also presents a zoological classification that has left very little to do for the centuries after him. His great divisions and subdivisions of the animal kingdom are astonishingly precise, and have almost all resisted subsequent additions by science. *(Vol. 1, p. 148)*
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> Notice that Aristotle's groups are formed in a very natural way, and that only their disposition leaves room for criticism. *(Vol. 1, p. 149)*

This is a surprisingly enthusiastic appreciation from that scrupulous and often critical spirit. Georges Pouchet (1884, 353) finds in it "an almost suspect exaggeration." Doubtless, Cuvier falls into the anachronism that we denounced above, seeing in Aristotle a systematician in the modern sense. But it is astonishing to find Cuvier regarding Aristotle as the author of a rational classification, an appreciation far in excess of the most indulgent emanating from recent scholars. As I shall show, a precise understanding of Cuvier's judgment of Aristotle led me to an interpretation of Aristotle's biological project that will perhaps be more accurate and more precise than those developed heretofore.

This is because, in a way, Cuvier was right. The classifications of animals proposed by Aristotle are not ordered subjectively, and they do have an unarguable systematic value. Thus, for example, the distinction between blooded and bloodless animals, even if displaced by the distinction between vertebrates and invertebrates, remains one of the great points of articulation in modern classifications.[11] For another example, the distinction between animals based on the degree of development of their offspring, proposed in *Generation of Animals* 2.1, shows an embryology that is more advanced—in the sense that it is less metaphysical—than that of the partisans of preformation and epigenesis. Ernest Haeckel (1900, 54) was right, then, in saying of Aristotle's embryological ideas that "it was not until our own day that many of them were fully appreciated, and, indeed we may say, discovered afresh." And the anthropocentric classifications that prevailed from Theophrastus to the seventeenth cen-

tury give a negative measure of the objective integrity of Aristotle's distinctions.

It is not, in any case, a matter of indifference that the praises cited above flow from the pen of Cuvier, the incontestable father of comparative anatomy, that is, a biologist who had taxonomy (natural history) behind him and who made of it a tool and not the end of his research. Aristotle seems to use his classifications in the same way, without appearing to look for them for their own sake. Thus, although every construction of a classification is at least partly inductive, Aristotle more willingly leaves vague the distinctions that are most immediate, and consequently easiest to establish, than the more general, which he ought to have derived from the first. For example, he does not distinguish reptiles, a class that he neither isolates nor names, from the batrachians, a class that he also does not name.[12] If one sticks to the texts, one would have to agree with Balme (1975), who gives a section of his article the heading "Evidence That Aristotle Did Not Classify Sub-Genera." That states a fact that is impossible to understand if one thinks Aristotle had a taxonomic project. We shall meet many facts of this kind in succeeding pages.

Indeed, one might be led to believe that Aristotle had developed a relatively rigorous classificatory method, but did not use it for classificatory ends. We shall begin by studying this classificatory procedure, which utilizes, on the one hand, the logical instrument of division *(diairesis)*, which Aristotle borrowed from the Academy, and on the other, the three concepts of *genos, eidos,* and *diafora,* which an entire tradition has read as "genus," "species," and "specific difference." We can then try to see the status and functions that animal classifications had for Aristotle.