

Summer 6-6-1956

Aristotle's View of Biological Evolution: A Study of the Presuppositions of Aristotle's Biology and their Influence on His Biological Inquiries

Howard J. Sherman

Follow this and additional works at: https://digitalrepository.unm.edu/phil_etds



Part of the [Philosophy of Science Commons](#)

Recommended Citation

Sherman, Howard J.. "Aristotle's View of Biological Evolution: A Study of the Presuppositions of Aristotle's Biology and their Influence on His Biological Inquiries." (1956). https://digitalrepository.unm.edu/phil_etds/27

This Thesis is brought to you for free and open access by the Electronic Theses and Dissertations at UNM Digital Repository. It has been accepted for inclusion in Philosophy ETDs by an authorized administrator of UNM Digital Repository. For more information, please contact disc@unm.edu.

378.789

Un3 Osh

1956

cop. 2



THE LIBRARY
UNIVERSITY OF NEW MEXICO



Call No.
378.789
Un30sh
1956
cop.2

Accession
Number
215508

A14406 337872

DATE DUE	
RECD UNM JUN 17 '76	
MAY 25 '80	
RECD UNM MAR 31 '80	
APR -9 '86	
RECD UNM MAY 20 '86	
AUG 14 '86	
RECD UNM AUG -4 '86	
JAN -4 1984	
DEC -6 '93	
MAY -5 1990	
APR 29 1985	
GAYLORD	PRINTED IN U.S.A.

COLLON COME
E Z E R A S
M I T T E R S A V

UNIVERSITY OF NEW MEXICO LIBRARY

MANUSCRIPT THESES

Unpublished theses submitted for the Master's and Doctor's degrees and deposited in the University of New Mexico Library are open for inspection, but are to be used only with due regard to the rights of the authors. Bibliographical references may be noted, but passages may be copied only with the permission of the authors, and proper credit must be given in subsequent written or published work. Extensive copying or publication of the thesis in whole or in part requires also the consent of the Dean of the Graduate School of the University of New Mexico.

This thesis by ... Howard J. Sherman
has been used by the following persons, whose signatures attest their
acceptance of the above restrictions.

A Library which borrows this thesis for use by its patrons is
expected to secure the signature of each user.

NAME AND ADDRESS

DATE

MANUSCRIPT THEORY

Unpublished theses submitted to the Faculty of the University of New Mexico are deposited in the University of New Mexico Library and are open for inspection by the public. The University Library reserves the right of the author to withdraw his or her thesis at any time, but the University will not be held responsible for the sale or disposal of a thesis after it has been deposited in the University Library. Proper credit must be given in subsequent works. Extensive copying or reproduction of the thesis without the consent of the Dean of the Graduate School of the University of New Mexico is prohibited.

This thesis is the property of the University of New Mexico and has been used by the University of New Mexico. The University of New Mexico does not assume any responsibility for the use or misuse of the thesis after it has been deposited in the University Library.

A thesis which borrows the thesis for its own use is expected to return the thesis to the University of New Mexico.

DATE

NAME AND ADDRESS

ARISTOTLE'S VIEW OF BIOLOGICAL EVOLUTION:
A STUDY OF THE PRESUPPOSITIONS OF ARISTOTLE'S
BIOLOGY AND THEIR INFLUENCE ON HIS BIOLOGICAL INQUIRIES

By

Howard J. Sherman

A Thesis

Submitted in Partial Fulfillment of the
Requirements for the Degree of
Master of Arts in Philosophy

The University of New Mexico

1956

ARTICLE 10
A STUDY OF THE
BIBBON AND EARLE



UNIVERSITY OF ILLINOIS
BOARD OF TRUSTEES
CHICAGO, ILLINOIS

1911

Submitted to the Board of Trustees
for their consideration and
approval of the same.

The Board of Trustees

1911

This thesis, directed and approved by the candidate's committee, has been accepted by the Graduate Committee of the University of New Mexico in partial fulfillment of the requirements for the degree of

MASTER OF ARTS

E. Castetter
DEAN

6/1/1956

DATE

Thesis committee

H. G. Alexander
CHAIRMAN

A. J. Bahm
E. Castetter

This thesis directed and approved by the candidate's committee has been accepted by the Graduate Committee of the University of New Mexico in partial fulfillment of the requirements for the degree of

MASTERS OF ARTS

[Handwritten signature]

[Handwritten date]

1952

Thesis committee

[Handwritten signatures]

378.789
Un30sh
1956
cop. 2

TABLE OF CONTENTS

Chapter	Page
I. THE PROBLEM	1
II. ARISTOTLE AS BIOLOGIST	10
III. ARISTOTLE AND EVOLUTION	25
IV. PRESUPPOSITION AND THEORY	34
V. INTERPRETATION	47
BIBLIOGRAPHY	66

215508

378787
1952
copy

Chapter

- I. THE PROBLEM
- II. HISTORICAL DEVELOPMENT
- III. THE PROBLEM IN THE PRESENT
- IV. THE PROBLEM IN THE FUTURE
- V. CONCLUSIONS
- BIBLIOGRAPHY

515208

CHAPTER I

THE PROBLEM

The philosopher is the specialist par excellence at examining the presuppositions of his own activities: so much so that philosophy can be characterized as the reflexive activity of thought examining thought.¹ The philosopher is caught in the continued analysis of the presuppositions of his presuppositions ad infinitum, doomed, perhaps forever to seek a presuppositionless supposition which is denied him by the very presupposition of inquiry itself: that all presupposition rests on further presupposition. Such is the endless torture of the philosopher and the endless enigma of thought: that the nature of thought (and thus of the philosophic enterprise) is self motivation towards ends negated by the very fact of the motivation.

¹ See Richard P. McKeon, "Communication and Community as Philosophy," Ethics, LXIII (April, 1953), 190. Here he refers to a "kind of ontological tautology exhibited in an action which is its own warrant because it is its own subject." As examples he points to "the uses to which Socrates put the Greek dictum, 'know thyself,' the occupation of the Aristotelian God thinking about thinking, the enterprise of Descartes rehabilitating thought by discovering the existence of the thinker implied in his thinking, and the power of the Spinozist God as causa sui. . . ."

The first part of the paper is devoted to a discussion of the general principles of the theory of the structure of the atom. It is shown that the structure of the atom is determined by the laws of quantum mechanics, and that the laws of quantum mechanics are in agreement with the experimental facts. The second part of the paper is devoted to a discussion of the application of the theory of the structure of the atom to the study of the properties of matter. It is shown that the theory of the structure of the atom is in agreement with the experimental facts, and that it is possible to calculate the properties of matter from the laws of quantum mechanics.

The third part of the paper is devoted to a discussion of the application of the theory of the structure of the atom to the study of the properties of matter. It is shown that the theory of the structure of the atom is in agreement with the experimental facts, and that it is possible to calculate the properties of matter from the laws of quantum mechanics.

W. H. RINDEN
1933

Intelligible knowledge demands a firmament not further explainable through the original process whereby that knowledge was yielded. Thus, in approaching the problem of causation Aristotle, for example, rationally exhibits the necessity of a First Cause from the fact that intelligible knowledge does indeed exist as the very starting point of inquiry.² Knowable objects are present and to be present they must be based on more than Protean ideas, each taking the form of its predecessor the moment it is thought.

² Aristotle does not deal with the problem of an infinite regress in relation to causation in general but specifically in connection with the problem of the cause of motion. This problem is dealt with in the Physics 256a22 thru 256b4.

The notion of an infinite regress is generally inadmissible to Plato who reduces the notion to absurdity in the Charmides (167-8) by exploring the notion of vision whose object is vision, hearing which hears no sound but only itself, senses which sense only themselves and no object of sense, desire which desires but itself, a wish which wishes for no good but only for itself, a fear which has no object, etc.

Indeed, as Hubert G. Alexander points out in "Concerning a Postulate of Fitness," Philosophy and Phenomenological Research, XIV (March, 1954), 309, if each knowing is its own object then the knowing process is reduced to absurdity.

Both Plato and Aristotle insist that knowledge results from a process involving both a knower and an object. This is the starting point of the inquiry into knowledge; we start with an intelligible situation, else there would be no inquiry at all, and because it is intelligible we know that an infinite regress is illusory.

See Footnote 4 for Aristotle's treatment of infinite regress in connection with the demonstrability of knowledge as discussed in the Posterior Analytics.

the form of the knowledge and the form of the knowledge
they can be said to have knowledge of the world
industry. Knowledge of the world is not to be
knowledge that is not to be knowledge of the world
necessity of a first knowledge of the world
causation and the form of the knowledge
knowledge was obtained. This is the form of the
that the knowledge of the world is not to be

the form of the knowledge and the form of the knowledge
they can be said to have knowledge of the world
industry. Knowledge of the world is not to be
knowledge that is not to be knowledge of the world
necessity of a first knowledge of the world
causation and the form of the knowledge
knowledge was obtained. This is the form of the
that the knowledge of the world is not to be

W. H. H. H.
1910

Thus for Aristotle a special science -- Metaphysics -- is itself the study of the first principles or presuppositions of each of the other sciences, no one of which can examine its own presuppositions and continue to be a science based on those presuppositions.³ In Aristotle's scheme of the sciences there is no Meta Metaphysics to scrutinize the presuppositions of the science of metaphysics although metaphysics by definition as science cannot examine its own bases.

³ See Richard P. McKeon, "Introduction" in The Basic Works of Aristotle (New York: Random House, 1941), xviii. He here says that the demonstration of the first principles of any science will always fall in another science. For Aristotle "the establishment and criticism of its own first principles are beyond the scope and method of any science." On p. xvix, McKeon writes, "Metaphysics, as Aristotle conceived it, is not the expression of a belief concerning the fundamental nature of being: it is a science, separate from the other sciences, on which the possibility of separate and distinct sciences depends."

The relation of metaphysics to the other sciences may be compared to the relation of the Prime Mover to other sources of movement. Each, the one as science, the other as principle, exists for its own sake alone. Each is "uncaused" in the sense that each is the foundation for all else of its type: the one of knowledge, the other of movement. And just as divinity attaches to the Prime Mover who exerts, at least metaphorically, the power of "attraction," so, too, does divinity attach to metaphysics. For metaphysics is, according to Aristotle, the most divine science (Metaphysics 983a6); it is the only free science, the only one existing for its own sake (Metaphysics 982b27). Indeed, Aristotle even suggests that metaphysics may be beyond human power, for God alone is first principle and cause of all things and perhaps God alone can have a science of first principles (Metaphysics 983a).

is itself the result of the other...
forms of each of the other...
examine the one...
based on those...
the other...
presuppositions of the...
physics by defining...
basis.

3. On the other hand...
works of Aristotle...
He has...
of any...
Aristotle...
principles...
On p. xvii...
ceived...
fundamental...
the other...
and distinct...
the...
to...
as...
caused...
else...
none...
exists...
so...
physics...
(...)
one...
induced...
beyond...
center...
of...
of...
of...

Metaphysics, thus, makes knowledge possible by providing for the other sciences non-reflexive presuppositions; at the same time, however, it restricts knowledge because, having no source for the same kind of criticism of itself, it must necessarily proceed through eternity on the same presuppositions.

One such presupposition of the metaphysics is thus immediately evident: that there exists a set of presuppositions which at rock bottom characterizes the universe (at least as knowable to the sciences) and which are thus eternal ideas (or forms of experience) themselves the source of experience (as the Prime Mover is the source of all movement), and thus an eternal framework within which the sciences exist and within which any object has a rationally definable and demonstrable nature which is deducible from the first principles.⁴

⁴ This view of the place of the sciences in a metaphysical framework is crucial to the understanding of Aristotle's view of the nature and scope of the sciences. Indeed, the demonstrability of knowledge is the basis of all Aristotelian science and for Aristotle this demonstrability is possible only because knowledge itself always serves as the immediately given starting point of the demonstrability of its own possibility. Demonstration is possible for Aristotle only because there are fixed starting points.

Aristotle makes this especially clear in the Posterior Analytics. "All instruction," he says, "given or received by way of argument proceeds from pre-existent

...the first of these is the fact that the
...at the same time, however, it is possible to have
...having no source for the same kind of knowledge itself,
...it must be necessarily true that the knowledge in question
...presuppositions.
...one such presupposition is the knowledge of the
...immediately evident, that there exists a set of objects
...those which are not known to exist, but which are
...least as knowledge of the objects of the world, and
...these for forms of experience, and the knowledge of
...experience (and for this knowledge, the knowledge of the
...world), and thus the knowledge of the world, and the
...exists rather than the knowledge of the world, and the
...definite and hypothetical, and the knowledge of the world,
...the first of these.

...this view of the world, and the knowledge of the world,
...physical knowledge is a knowledge of the world, and the
...Aristotle's view of the world, and the knowledge of the world,
...Indeed, the knowledge of the world, and the knowledge of the world,
...all Aristotelian knowledge is a knowledge of the world, and the
...ability in practice, and the knowledge of the world, and the
...serve as the basis for the knowledge of the world, and the
...ability to be able to do this, and the knowledge of the world,
...able for the world, and the knowledge of the world, and the
...points.
...Aristotle's knowledge of the world, and the knowledge of the world,
...for Aristotle, and the knowledge of the world, and the
...derived by Aristotle, and the knowledge of the world, and the

UNIVERSITY OF
CHICAGO
LIBRARY

This presupposition, namely, that there exists a set of presuppositions which constitutes the framework within which the sciences are possible, is the point of departure of this thesis. For this is not a necessary presupposition of either philosophy or science, but only of some kinds of philosophy and some views of science. It at once determines the form and limitations of science.

knowledge." (71a1). He goes on to assert the nature of scientific knowledge: "The proper object of unqualified scientific knowledge is something which cannot be other than it is." (71b15). "The premisses of demonstrated knowledge must be true, primary, immediate, better known than and prior to the conclusion. . . ." (71b20). The premisses of syllogisms which yield valid scientific knowledge must be true, they "must be primary and indemonstrable . . . ; the premisses must be the 'causes' of the conclusion, better known than it and prior to it. . . ." (71b25-30). Aristotle further clarifies: "In saying that the premisses of demonstrated knowledge must be primary, I mean that they must be the 'appropriate' basic truths. . . . A basic truth in demonstration is an immediate proposition. An immediate proposition is one which has no other propositions prior to it." (72a6).

All demonstration, then, rests on indemonstrable self-evident truths. Aristotle tells us (72b8) that if all knowledge must rest on demonstration only, without primary indemonstrable bases, then we are involved in an infinite regress, for "if behind the prior stands no primary, we could not know the posterior through the prior" for one cannot traverse an infinite series. Rather, says Aristotle, "Our own doctrine is not that all knowledge is demonstrative; on the contrary knowledge of the immediate premisses is independent of demonstration . . . since the regress must (*italics mine*) end in immediate truths, those truths must be indemonstrable." (72b20).

It has been the assertion of this paragraph in the thesis (a) that the view that there are self-evident indemonstrable truths is itself a presupposition which determines the nature of knowledge and, furthermore, (b) that the kinds of truth which serve as the starting point of demonstration confine and in many ways pre-determine what can be demonstrated.

This proposition... of presupposition... which the sciences... of this thesis... of other philosophy... philosophy and... since the form...

knowledge... scientific knowledge... scientific knowledge... if it is... must be true... prior to the... agitated with... first, they... premises must... know that it... for the further... demonstrated... be the 'agitated... demonstration... proposition in... if' (VSE).

All demonstration... self-evident... knowledge must... indemonstrable... reason, for... could not... cannot traverse... "Our own... first in the... is independent... (that) (that... must be indemonstrable... It has been... thesis (a... possibly a... since the... the kinds of... demonstration... can be demonstrated...

It is the purpose of this study to describe this "set of presuppositions" as they relate to one science -- biology -- to lay bare, as it were, the framework within which biological knowledge for Aristotle is to be understood. It shall assume that Aristotle, like any philosopher, has two kinds of presuppositions, each of which properly understood may serve to elucidate the other. One kind, of course, consists of views specifically stated to be presuppositions. These may be found throughout the writings. The other kind consists of unstated and perhaps unperceived attitudes which are, more than anything else, habits reflecting the man's motives. They are the product of individual idiosyncrasy, personal influences, cultural patterns. This study shall assume that the philosopher is to be understood only through consideration of both kinds of presuppositions.⁵ It shall thus pass freely from one to the other.

⁵ George Boas, "Presuppositions of Aristotle's Metaphysics," American Journal of Philology, LV, 36-48, lists the assertions which he believes are unproved premisses in Aristotle's metaphysics. He feels that these presuppositions are especially important because in order to understand any ancient thinker we must know (a) what modes of thinking determined his reasoning by forming his basic metaphors, (b) what propositions seemed self-evident to him. He feels, and this study agrees, that it is important to know what a philosopher takes for granted. This follows the Aristotelian (or more properly Platonic) dictum that one has to know what one wants before one can begin to reason. Presupposition in this view is pre-logical and determines both the form and object of inquiry.

It is one thing to say that the
"art of physiology" as they say, is
biology -- as far as it goes, the
which biological knowledge is the
school. It is all things that are
then, but the name of physiology,
only understood as a name to describe
of course, consists of these things
and others. It is not a
The other kind consists of things
attitudes which are, but they are
the main reason. It is the
biology, but it is not
study shall assume that the
only known correlation of
thing. It is not a

George says, "I understand
physiology" as a name for
the association with the
Aristotle's explanation
thing and explain it
about any subject
thinking however
response, (1) the
him. He says, "I
to know what a
the Aristotle
one has to know
person. It is not
determine how

100

Presupposition in any science determines the problem, the form of the inquiry, and sets limits to potential theory. This study shall attempt to demonstrate the influence of presupposition on Aristotle's biological science. It shall be asking, in effect, "What indemonstrable truths serve as the bases of biological demonstrations?" It shall then attempt to show that the effort to set up biology as an empirical science (and which of the sciences is potentially more empirical?) is nullified by presuppositions which simply do not allow Aristotle to follow biological observation wherever it may lead.

* This study shall attempt to demonstrate, for example, that Aristotle did not have a theory of the natural evolution of the species and that, indeed, such a theory is incompatible with the presuppositions. Aristotle firmly rejected suggestions of any such view of biological process that he found in the Ionian philosophers. No matter what the observations may have themselves suggested, no amount of intellectual juggling could have derived a theory of evolution of the species from the presuppositions with which Aristotle approached his data. This study shall attempt to demonstrate the logical incompatibility of the presuppositions of the biology and a theory of biological evolution. If this is true, then biology as a science is made to serve

[Faint Title]

In the lower part of the paper, the theory of the evolution of the universe is discussed. It is pointed out that the universe is not a simple mechanical system, but a complex system in which the parts are interrelated and influence each other. This is the basis of the theory of the evolution of the universe.

The theory of the evolution of the universe is based on the fact that the universe is not a simple mechanical system, but a complex system in which the parts are interrelated and influence each other. This is the basis of the theory of the evolution of the universe.

It is pointed out that the universe is not a simple mechanical system, but a complex system in which the parts are interrelated and influence each other. This is the basis of the theory of the evolution of the universe.

The theory of the evolution of the universe is based on the fact that the universe is not a simple mechanical system, but a complex system in which the parts are interrelated and influence each other. This is the basis of the theory of the evolution of the universe.

The theory of the evolution of the universe is based on the fact that the universe is not a simple mechanical system, but a complex system in which the parts are interrelated and influence each other. This is the basis of the theory of the evolution of the universe.

The theory of the evolution of the universe is based on the fact that the universe is not a simple mechanical system, but a complex system in which the parts are interrelated and influence each other. This is the basis of the theory of the evolution of the universe.

The theory of the evolution of the universe is based on the fact that the universe is not a simple mechanical system, but a complex system in which the parts are interrelated and influence each other. This is the basis of the theory of the evolution of the universe.

The theory of the evolution of the universe is based on the fact that the universe is not a simple mechanical system, but a complex system in which the parts are interrelated and influence each other. This is the basis of the theory of the evolution of the universe.

The theory of the evolution of the universe is based on the fact that the universe is not a simple mechanical system, but a complex system in which the parts are interrelated and influence each other. This is the basis of the theory of the evolution of the universe.

✖

ends extraneous to itself, and its development is limited by prior considerations with which the observational data must accord.

This may or may not be true of the other sciences; such a consideration is beyond the scope of this study. If it is true in this one instance, however, it would seem to involve a peculiar contradiction in Aristotle: that Aristotle sought, on the one hand, to establish an observational science of biology, based as nearly as possible on observed biological phenomena, and, on the other hand, founded the science on metaphysical presuppositions which demand certain characteristics of the data and deny others regardless of what observation itself may show to be the case.

This study shall suggest, but shall not demonstrate, since it, too, is beyond the scope of this study, that the reason for this contradiction lies in the fact that many of Aristotle's presuppositions (especially as world view) were derived, in spite of himself, from Plato but were not understood as such by Aristotle. The study shall suggest that there is a peculiar dichotomy in the work of Aristotle due to the fact that he proceeds on the basis of incompatible motives: his own desire to set up independent, empirically grounded bodies of knowledge and his desire to organize such knowledge into a Platonically oriented, non-empirical world

ends expressed by itself, and the whole
by which the whole is made up of
must be such.

This may be said to be the case
such a consideration as regards the
it is true in this one instance
involve a peculiar consideration
folds each, on the one hand, in
folds each of the other, and the
observed biological phenomena, and
founded the system on a regular
demand certain characteristics of
resistance of which the whole is
case.

This may be said to be the case
since it is true, in general, that
reason for this consideration is
Aristotle's principle of causality
derived, in order of effect, from
stood as such, and the whole is
there is a peculiar consideration
to the fact that the whole is
motion, his principle of causality
grounded in the fact that the whole
knowledge, and the whole is made up

100

view.

This study shall also raise the further problem for future inquiry: if biological conclusion is limited (and even fore-ordained) by the nature of the presuppositions, to what extent is Aristotle's philosophy inimical to naturalistic science?

BOARD OF
DIRECTORS

view.
This bill is a...
future...
even...
to what extent...
relatively...
...

CHAPTER II

ARISTOTLE AS BIOLOGIST

The elder Pliny relates that "King Alexander the Great being fired with a desire to know the nature of animals and having delegated the pursuit of this study to Aristotle as a man of supreme eminence in every branch of science, orders were given to some thousands of persons throughout the whole of Asia and Greece, all those who made their living by hunting, fowling, and fishing and those who were in charge of warrens, herds, apiaries, fishponds, and aviaries, to obey his instructions that he might not fail to be informed of any creature born anywhere."⁶

Though Pliny's account may be only rumor,⁷ it

⁶ Pliny, Natural History, Bk. 8, 44.

⁷ Thomas E. Lones, Aristotle's Researches in Natural Science (London: West, Newman & Co., 1912), p. 8, says that the truth of the story of Alexander's assistance "has been doubted, partly because Macedonia was a poor country and could not bear the expense which the collection of a vast number of animals would necessitate." He suggests, also, that "A passage from Aelian makes the truth of this matter doubtful. He says that Aristotle produced his History of Animals with the aid of the wealth of Philip. . . . The whole question of the supposed aid rendered Aristotle by Philip or Alexander, or both, is involved in obscurity."

THE HISTORY OF THE
SCIENCE OF THE
EARTH

The study of the earth's history is a branch of geology which deals with the changes that have taken place in the earth's crust since it was first formed. It is a science which has developed rapidly in the last few decades, and is now one of the most important branches of natural science. The study of the earth's history is not only of great interest to the general public, but it is also of great importance to the scientist. It is the study of the earth's history which has led to the discovery of the laws of geology, and it is the study of the earth's history which has led to the discovery of the laws of evolution.

The study of the earth's history is a branch of geology which deals with the changes that have taken place in the earth's crust since it was first formed. It is a science which has developed rapidly in the last few decades, and is now one of the most important branches of natural science. The study of the earth's history is not only of great interest to the general public, but it is also of great importance to the scientist. It is the study of the earth's history which has led to the discovery of the laws of geology, and it is the study of the earth's history which has led to the discovery of the laws of evolution.

nevertheless indicates the wide reputation of Aristotle as a student of natural history. For Pliny, writing in the 1st century A. D., Aristotle remains pre-eminently the authority in biological observations.

Pliny repeatedly credits Aristotle with original observations which corrected the fallacious popular opinions of the day: regarding the gestation period of elephants,⁸ the mating habits of the hyena,⁹ the breathing habits of fish,¹⁰ et cetera. Pliny relates that Aristotle denied that sucking fish have feet and in addition pointed out that their limbs resemble wings;¹¹ and that Aristotle observed that raven do not mate with the beak but, rather, that "the billing in question is a form of kissing, like that which takes place between pigeons."¹² Aristotle also denied the popular belief that lizards bear through the mouth.¹³

The authority of Aristotle in biological matters is

⁸ Pliny, op. cit., Bk. 8, 28.

⁹ Ibid., Bk. 8, 105.

¹⁰ Ibid., Bk. 9, 17.

¹¹ Ibid., Bk. 8, 79.

¹² Ibid., Bk. 10, 32.

¹³ Ibid., Bk. 10, 187.

nevertheless indicates the...
a student of...
1st century...
Authority in...
They...
observations which...
ions of the...
phic, the...
basis of this...
denied that...
out that their...
occurred that...
that the...
that which...
denied the...
month.

-
- 11. John...
 - 12. John...
 - 13. John...
 - 14. John...
 - 15. John...
 - 16. John...
 - 17. John...
 - 18. John...
 - 19. John...
 - 20. John...

recognized by Fliny even when the former's views seem absurd. "For my own part," he writes, "I am surprised that Aristotle not only believed but published his belief that our bodies contain premonitory signs of our career. But although I think his view unfounded I will touch upon it, because so great a master of the sciences as Aristotle has not despised it."¹⁴

Indeed, through the years Fliny's praise of Aristotle has been echoed and re-echoed. Thus, Cuvier writes of Aristotle: "In Aristotle everything amazes, everything is prodigious, everything is colossal. He lived but sixty two years, and he was able to make thousands of observations of extreme delicacy, the accuracy of which the most rigorous criticism has never been able to impeach."¹⁵

Referring to Aristotle's History of Animals Cuvier writes: "I cannot read this book without being ravished by astonishment. Indeed, it is impossible to conceive how a single man was able to collect and compare the multitude of particular facts implied in the numerous general rules and aphorisms contained in his work, and of which his

¹⁴ Ibid., Bk. 11, 273.

¹⁵ Cuvier, Histoire des sciences naturelles (Paris, 1841), I, 132, quoted in Richard P. McKeon, "The Philosophy of Aristotle," an unpublished manuscript, p. 39.

recognized by him even when the subject was
absent. "I have seen him," he said, "but I
do not know who he is." This is a very
curious case, and one which has attracted
much attention. Although I think it is
possible to find a number of instances of
this kind, it is not very common. It is
not clear what the cause is, but it
is interesting to note that the subject
has been seen by others who were not
of his family. It is also interesting
to note that the subject has been seen
in various places, and at various times.
It is also interesting to note that the
subject has been seen by a number of
people who were not of his family. It
is also interesting to note that the
subject has been seen in various places,
and at various times. It is also
interesting to note that the subject has
been seen by a number of people who
were not of his family. It is also
interesting to note that the subject has
been seen in various places, and at
various times. It is also interesting
to note that the subject has been seen
by a number of people who were not of
his family. It is also interesting to
note that the subject has been seen in
various places, and at various times.

18
18
18

predecessors never had any idea."¹⁶ The anatomist Isidore St. Hilaire has similar praise for Aristotle: "He is in every branch of knowledge like a master who cultivates that one only. He reaches, he extends the limits of all the sciences, and penetrates to their very depths."¹⁷ Darwin, though in many ways opposed to Aristotle, has perhaps the most extravagant praise of all: "Linnaeus and Cuvier have been my two gods, though in very different ways, but they were mere schoolboys to old Aristotle."¹⁸

Aristotle's biological training was probably earlier than that of his training in any other science. There is even a rumor, generally discredited, that he practised medicine before attending Plato's Academy.¹⁹ Aristotle's

¹⁶ Ibid., p. 146 of Cuvier, p. 59 of McKeon.

¹⁷ Isidore Geoffrey St. Hilaire, Histoire generale de regna organiques (Paris, 1854), I, 18, quoted in McKeon, ibid., p. 60.

¹⁸ Charles Darwin in a letter to William Ogle on the publication of his translation of The Parts of Animals, 1882. In Darwin's Life and Letters (New York: D. Appleton & Co., 1896), III, 252.

¹⁹ George Grote, Aristotle (London: John Murray, 1880), p. 3, points out that though this account comes from the earliest witnesses preserved to us (Epicurus and Timaeus) it is still doubtless false because it would have him starting at Plato's Academy at a much later age than appears in other accounts deemed more valid (Hermippus, Apollodorus, etc).

professors never had any idea. The scientific progress
of Huxley has similar progress. It is not only
every branch of knowledge like a man's knowledge, but
one only. He reached, in one way, the limit of his
abilities, and penetrated to the very heart of
things in many ways. His knowledge was not
most extensive part of his knowledge. It has
been by two gods, though in very different ways.
There were mere schoolboys to his knowledge.
Aristotle's biological knowledge was not
than that of his train in any other way. There
even a error, generally, in knowledge. There
medicine before attending to the knowledge.

-
16. Idid. p. 100 of the 1st edition.
17. Idid. p. 100 of the 1st edition.
18. Charles Darwin's *Journal of Researches*, 1845, p. 100.
19. George Engelmann, *Annals of the Entomological Society of America*, 1880, p. 5, points out that Darwin was the earliest who used the term "species" in its modern sense. It is still doubtful whether Darwin was the first to use the term in its modern sense. In other accounts, however, it is stated that Darwin was the first to use the term in its modern sense.

father, at any rate, was court physician to Amyntus II, King of Macedon and father of Philip the Great. As a hereditary member of the guild of Asclepiads, Aristotle was probably intended for a medical career, and, if so, probably had experience in dissection when still quite young. Grote points out (following Galen) that "among the Asklepiads the habit of physical observation, and even manual training in dissection, were imparted traditionally from father to son, from the earliest years, thus serving as preparation for medical practise when there were no treatises to study."²⁰ He suggests that "the mind of Aristotle may thus have acquired that appetite for physiological study which so many of the treatises indicate."

By the time Aristotle came to Plato's Academy at the age of seventeen he had no doubt developed the habit of careful observation so important in biology. At any rate, one finds in Aristotle a certain fidelity to observed fact, and his division of the sciences is based more than anything else on the different kinds of phenomena available to our senses. There can be no doubt -- after reading The Parts of Animals, for example -- that Aristotle was a very careful observer of biological phenomena and that he sought to

²⁰ Ibid., p. 2.

father, at any rate, was a very distinguished man.
Kind of education and habits of living were
very much of the same kind as those of
probably intended to be a very good one, but
had experience in many things, and was
points out (following the same line of
the habit of physical observation, and
in discussion, was very good, and
not, from the fact that he was a very
for natural history, and was a very good
study. It suggests that the kind of
have acquired that reputation for his
as many of the best men in the
By the time he was a student at
the age of seventeen, and he was a very
careful observation and investigation of
one time in Aristotle's course, feeling to
and his division of the natural world,
else on the different kinds of organisms,
senses. There can be no doubt that
of animals, for example, -- but it is
the observer of biology, and it is

base his biological theories, as nearly as possible, on what he actually observed. That theory be formed in this way was, indeed, a basic (and perhaps necessary) prejudice of Aristotle the scientist. He writes, for example, "This seems to be the manner in which generation of bees occurs, both according to argument and according to what seems to take place among the bees. What takes place, however, has not yet been explored sufficiently, but if it ever is, then credit must be given to sensation rather than arguments, and to arguments only if they accord to the observed phenomena."²¹ Indeed, Aristotle suggests that the science of biology has been held up in its development precisely because some of the ancients followed argument rather than sense perception, choosing to accept conclusions about nature deduced from theoretical principles rather than looking to nature itself for the facts. "Reasoning in this way," he writes, "therefore they were led to transcend sense perception, and to disregard it on the ground that one ought to follow the argument. . . ." ²²

Throughout his writings Aristotle emphasizes observations as the first and necessary source of any real

²¹ On the Generation of Animals, 760b27-33. Italics mine.

²² Ibid., 325a10.

base his theory on the fact that, in many cases, the
what he actually observed. The theory he proposed in this
way was, indeed, a rather bold statement, and the
of Aristotle the scientific method. The scientific method
seems to be the main reason for the development of the
both according to Aristotle and to the modern scientific
take place among the bees. The scientific method, however,
not yet been explored sufficiently, but it is clear that
then credit must be given to the scientific method.
method, and to Aristotle's theory of the scientific method.
phenomena. The scientific method is the scientific method
of biology has been held up as the scientific method
because some of the main principles of the scientific method
sense perception, according to Aristotle's scientific method
nature deduced from the scientific method. The scientific method
ing to nature itself for the fact. The scientific method
way," he writes, "therefore they were the scientific method
sense perception, and to Aristotle's scientific method
one ought to follow the scientific method.
Throughout his scientific method, Aristotle's scientific method
visions as the first and necessary step in the scientific method.

"facts." In the Nichomachean Ethics, for example, he argues that "the truth in practical matters is judged from operations and life, for the decisive factor is to be found in them. We must, therefore, examine what we have already said by bringing it to the test of operations and life, and if it is in harmony with those operations we must accept it, but if it disagrees with them we must suppose it to be merely arguments."²³ In On the Movement of Animals (698) Aristotle writes, ". . . this we must apprehend not merely in theory as a general principle but also in its individual manifestations and in the objects of sense perception, on the basis of which we search for general theories and with which we hold that these theories ought to agree."²⁴

²³ Nichomachean Ethics, 1179a16-22.

²⁴ Other places where Aristotle points out that theory must be consistent with sense experience are: Physics 262a17-19; On Generation and Corruption 331b24-26, 336b15-17; Meteorology 344a5-8; On Youth and Old Age 469a20-23; History of Animals 491a23-26; On the Generation of Animals 740a4-5, 788b17-20; Metaphysics 1054a26-29.

See especially Posterior Analytics 99b15-100b15 where Aristotle specifically asks how the basic premises become known. He concludes that "these states of knowledge are neither innate in a determinate form, nor developed from other states of knowledge, but from sense perception." Sense perception is, thus, the basis of all knowledge. Aristotle attributes the fact of knowledge to the congenital discriminative capacity which is called sense perception. Some animals can retain sense impression and out of it "comes to be what we call memory, and out of frequently repeated memories of the same thing develops experience."

"Idea." In the History of Philosophy, the author says that the first in philosophy is the theory of ideas and life, for the idea is the first principle. We must, therefore, examine the theory of ideas by starting with the idea of the idea. If it is in harmony with the idea of the idea, it is, but if it is in disharmony with the idea of the idea, it is not. In the History of Philosophy, the author writes that the theory of ideas is the first principle of philosophy and in the History of Philosophy, the author writes that the basis of which we need to know is the idea of the idea which we hold that the idea of the idea is the first principle of philosophy.

History of Philosophy, the author writes that the theory of ideas is the first principle of philosophy and in the History of Philosophy, the author writes that the basis of which we need to know is the idea of the idea which we hold that the idea of the idea is the first principle of philosophy. The author writes that the theory of ideas is the first principle of philosophy and in the History of Philosophy, the author writes that the basis of which we need to know is the idea of the idea which we hold that the idea of the idea is the first principle of philosophy. The author writes that the theory of ideas is the first principle of philosophy and in the History of Philosophy, the author writes that the basis of which we need to know is the idea of the idea which we hold that the idea of the idea is the first principle of philosophy.

It has already been seen that ultimately science is based on valid demonstrations which proceed from indemonstrable premises. These premises are supplied for Aristotle by experience. This he states explicitly in the Prior Analytics (4ba3-27): "Most of the principles . . . in any particular science, are peculiar to it. Consequently it is the function of experience (italics mine) to supply the principles pertinent to each science. I mean, for example, that astronomical experience is the source of astronomical science, for once the phenomena has been grasped sufficiently, the demonstrations of astronomy were discovered. It is the same way in any other art or science."

It would appear, then, that the foundation of the science of biology is purely and simply "biological experience." If we wish to understand biology, then, we must look first to biological experiences, and secondly to the kind of demonstration which can be based on these most self-evident of experiences. The presuppositions of the science of biology would be, then, nothing more than biological experiences -- experiences which are obvious enough to differentiate for us a kind of knowledge which is derived from and refers back to that kind of experience. This was Aristotle's aim and the reasons for his failure to achieve it will constitute an important part of this thesis.

It has not been shown that the...
based on valid...
stable...
by...
Analysis (1903-1911)...
particular...
the function of...
principles...
that...
science, for...
likely, the...
It is the same way in...
it would...
science of biology...
"..."
look first...
kind of...
self-evident...
science of biology...
logical...
to differentiate...
from...
Aristotle's...
it will...
it will...

Peculiarly enough, it is exactly biological experiences which do serve, so far as Aristotle himself believes, as the basis for his science of biology. And, as Cuvier pointed out, the wealth of Aristotle's biological observation is astounding. Aristotle consciously sought to establish biology, as he did all sciences, on a sound empirical basis, that is, on the basis of "the complex variety of things discernible in the world and in need of classification, in part by the principles and causes which are known after experience of things."²⁵

What, then, are the "biological experiences" from which biological theories are derived and with which they are in turn checked?

I

Biological phenomena, and thus biological problems, are part of the physical world and thus of physical inquiry. However, the essential experience underlying biology is the experience of "life" which is somehow different from experience of physical objects and events which are not alive. When we pass from the physical to the biological we immediately encounter a new complexity of function; this is the

²⁵ McKeon, "Philosophy of Aristotle," p. 43. Italics mine.

scientifically enough, it is...
which is served, no far...
the basis for his...
pointed out, the...
tion is...
essential biology, as...
local basis, that is...
of things...
action, in part...
after...
what, that, and...
which biological...
are in four...

Biological...
are part of the...
However, the...
experience of...
tence of physical...
When we pass...
tially encounter...

52
line.

starting point of Aristotle's biology.

There are the processes of generation, locomotion, growth, and nutrition.²⁶ These are all functions of living things and they represent for us a different kind of experience which calls forth a separate science.²⁷ Living things, however, are in the physical world and the science of biology assumes such principles of physics as motion, form, and matter.²⁸ Indeed, there is really no sharp differentiation between non-living and living matter, and therefore no really clear line of demarcation between physics and biology as sciences. There is a continuous scale of being. "Nature proceeds little by little," writes Aristotle, "from things lifeless to animal life in such a way that it is impossible to determine the exact line of demarcation, nor on which side thereof an intermediate form should lie. Thus, next after lifeless things in the upward

²⁶ On the Soul 412a13: "Of natural bodies some have life in them, others not; by life we mean self-nutrition and growth (with its correlative decay)."

²⁷ On the Soul, the treatise devoted to the cause and principle of living things, envisages the functions of generation, nutrition, growth, sensation, locomotion, and thought. On the Soul, however, concentrates on the processes of sensation and thought. The other functions are emphasized in the four biological treatises.

²⁸ George Kimball Plochmann, "Nature and the Living Thing in Aristotle's Biology," Journal of the History of Ideas, XIV (April, 1953), 170-171

examining point of Aristotle's theory. There are two passages in Aristotle's theory of nutrition. The first is in the *Metaphysics*, where he says that the soul is the cause of life and that it is the cause of nutrition. The second is in the *Nicomachean Ethics*, where he says that the soul is the cause of life and that it is the cause of nutrition. The first passage is in *Metaphysics*, *Book I, Chapter 1*, and the second is in *Nicomachean Ethics*, *Book I, Chapter 1*.

27
On the Soul

Aristotle's theory of nutrition is based on the idea that the soul is the cause of life and that it is the cause of nutrition. This theory is based on the idea that the soul is the cause of life and that it is the cause of nutrition. Aristotle's theory of nutrition is based on the idea that the soul is the cause of life and that it is the cause of nutrition.

28
On the Soul

Aristotle's theory of nutrition is based on the idea that the soul is the cause of life and that it is the cause of nutrition. This theory is based on the idea that the soul is the cause of life and that it is the cause of nutrition. Aristotle's theory of nutrition is based on the idea that the soul is the cause of life and that it is the cause of nutrition.

29
On the Soul

Aristotle's theory of nutrition is based on the idea that the soul is the cause of life and that it is the cause of nutrition. This theory is based on the idea that the soul is the cause of life and that it is the cause of nutrition. Aristotle's theory of nutrition is based on the idea that the soul is the cause of life and that it is the cause of nutrition.

30
On the Soul

scale comes the plant, and as to plants one will differ from another as to its amount of apparent vitality; and, in a word, the whole genus of plants, whilst it is devoid of life as compared with an animal, is endowed with life as compared with other corporeal entitles. Indeed, as we have just remarked, there is observed in plants a continuous scale of ascent towards the animal. So in the sea, there are certain objects concerning which one would be at a loss to determine whether they be animal or vegetable."²⁹

Aristotle also writes: "Nature passes in a continuous gradation from lifeless things to animals, and on the way there are living things which are not actually animals, with the result that one class is so close to the next that the difference seems infinitesimal."³⁰

For Aristotle, nevertheless, there is a unique difference between natural objects and natural living objects; though we cannot always by observation determine the one from the other, still wherever there is life there is always the presence of a "soul."³¹ In our experiences there are

²⁹ History of Animals, 588b4.

³⁰ Parts of Animals, 681a12.

³¹ On the Soul, 413a22: ". . . what has soul in it differs from what has not in that the former displays life. . . ; living may mean thinking or perception or local movement and rest, or movement in the sense of nutrition, decay and growth."

Scale across the plant, and some of the most important
from another as to the amount of light, and the amount
in a word, the amount of light, and the amount of light
of life as compared with the amount of light, and the amount
as compared with the amount of light, and the amount of light
have just passed, and the amount of light, and the amount
scale of amount of light, and the amount of light, and the amount
and certain objects, and the amount of light, and the amount
to determine whether the amount of light, and the amount
of light, and the amount of light, and the amount of light
your attention from the amount of light, and the amount
way there are living, and the amount of light, and the amount
with the result of the amount of light, and the amount
the difference between the amount of light, and the amount
of light, and the amount of light, and the amount of light
between the amount of light, and the amount of light, and the amount
though we cannot say the amount of light, and the amount
from the other, and the amount of light, and the amount
the presence of a leaf, and the amount of light, and the amount

29 History of the plant, and the amount of light, and the amount
30 Living and growing, and the amount of light, and the amount
31 On the leaf, and the amount of light, and the amount
differs from the amount of light, and the amount of light, and the amount
... ; living and growing, and the amount of light, and the amount
and growth, and the amount of light, and the amount

certain natural bodies which perform certain functions and it is these functions taken together which constitute the soul.³² The analysis of these functions is the subject matter of biology. Therefore any biological theory is derived from our experience of these functions and ultimately must be tested by referring back to them. One of the chief concerns of biology is how to classify these functions, all of which, in terms of our experience of them, are interdependent, and none of which can ever be isolated in experience from the others.

If we start with our experience of living things, however, we can generally distinguish functions. No being lives without nutrition, and thus we can distinguish a "nutritive" part of the soul; living beings grow, they decay, they have sensation, some of them can move. These become the basic data of biology and it is with such data that the biological treatises are concerned. In the History of Animals, for example, animals are classified according to the different ways in which these functions may be

³² On the Soul, 415b9: "The soul is the cause or source of the living body. . . . It is a) the source or origin of movement, b) the end . . . , c) the essence of the whole living body."

412b: "The soul is the first grade of actuality of an organized body."

413f: "The soul is inseparable from its body."

contains natural qualities... it is these functions... soul... matter of biology... derived from... nature... the chief concern of biology... forms, all of which... are independent... in experience... If we start when... however, we can... lives without... "instinctive" part... theory... become the basis... that the biological... of animals, for example... so the different...

32

32 On the Soul... source of the living... origin of movement... the whole living... about the soul... an organism... life: the soul is...

performed.

II

There are, obviously, many different kinds of creatures exhibiting the characteristics of living things. These may be divided into genus, and within the genus into species. The fact that there are different species, classifiable on the basis of similarities and differences, is basic to our biological experience.

Living beings, indeed, differ from one another in many ways: in the kind of environment they inhabit (land, water, air), in structure, in appearance, in anatomy, in the degree of development of certain organs, in the emphasis placed on different functions. These differences the biologist may observe. Aristotle is sufficiently observant of the many differences to avoid isolating a single characteristic as a principle of selection, and one "type" of creature in terms of one function may be another "type" in terms of another function. Classification is not a simple matter.

Aristotle gives us several examples of such classificatory difficulties. The Cetacea "are after a fashion land and water animals in one. For so far as they are inhalers of air they resemble land animals while they resemble water animals in having no feet and in deriving their food from

performed.

These first, and second, and third, and fourth, and fifth, and sixth, and seventh, and eighth, and ninth, and tenth, and eleventh, and twelfth, and thirteenth, and fourteenth, and fifteenth, and sixteenth, and seventeenth, and eighteenth, and nineteenth, and twentieth, and twenty-first, and twenty-second, and twenty-third, and twenty-fourth, and twenty-fifth, and twenty-sixth, and twenty-seventh, and twenty-eighth, and twenty-ninth, and thirtieth, and thirty-first, and thirty-second, and thirty-third, and thirty-fourth, and thirty-fifth, and thirty-sixth, and thirty-seventh, and thirty-eighth, and thirty-ninth, and fortieth, and forty-first, and forty-second, and forty-third, and forty-fourth, and forty-fifth, and forty-sixth, and forty-seventh, and forty-eighth, and forty-ninth, and fiftieth, and fifty-first, and fifty-second, and fifty-third, and fifty-fourth, and fifty-fifth, and fifty-sixth, and fifty-seventh, and fifty-eighth, and fifty-ninth, and sixtieth, and sixty-first, and sixty-second, and sixty-third, and sixty-fourth, and sixty-fifth, and sixty-sixth, and sixty-seventh, and sixty-eighth, and sixty-ninth, and seventieth, and seventy-first, and seventy-second, and seventy-third, and seventy-fourth, and seventy-fifth, and seventy-sixth, and seventy-seventh, and seventy-eighth, and seventy-ninth, and eightieth, and eighty-first, and eighty-second, and eighty-third, and eighty-fourth, and eighty-fifth, and eighty-sixth, and eighty-seventh, and eighty-eighth, and eighty-ninth, and ninetieth, and ninety-first, and ninety-second, and ninety-third, and ninety-fourth, and ninety-fifth, and ninety-sixth, and ninety-seventh, and ninety-eighth, and ninety-ninth, and one hundred, and one hundred and one, and one hundred and two, and one hundred and three, and one hundred and four, and one hundred and five, and one hundred and six, and one hundred and seven, and one hundred and eight, and one hundred and nine, and one hundred and ten, and one hundred and eleven, and one hundred and twelve, and one hundred and thirteen, and one hundred and fourteen, and one hundred and fifteen, and one hundred and sixteen, and one hundred and seventeen, and one hundred and eighteen, and one hundred and nineteen, and one hundred and twenty, and one hundred and twenty-one, and one hundred and twenty-two, and one hundred and twenty-three, and one hundred and twenty-four, and one hundred and twenty-five, and one hundred and twenty-six, and one hundred and twenty-seven, and one hundred and twenty-eight, and one hundred and twenty-nine, and one hundred and thirty, and one hundred and thirty-one, and one hundred and thirty-two, and one hundred and thirty-three, and one hundred and thirty-four, and one hundred and thirty-five, and one hundred and thirty-six, and one hundred and thirty-seven, and one hundred and thirty-eight, and one hundred and thirty-nine, and one hundred and forty, and one hundred and forty-one, and one hundred and forty-two, and one hundred and forty-three, and one hundred and forty-four, and one hundred and forty-five, and one hundred and forty-six, and one hundred and forty-seven, and one hundred and forty-eight, and one hundred and forty-nine, and one hundred and fifty, and one hundred and fifty-one, and one hundred and fifty-two, and one hundred and fifty-three, and one hundred and fifty-four, and one hundred and fifty-five, and one hundred and fifty-six, and one hundred and fifty-seven, and one hundred and fifty-eight, and one hundred and fifty-nine, and one hundred and sixty, and one hundred and sixty-one, and one hundred and sixty-two, and one hundred and sixty-three, and one hundred and sixty-four, and one hundred and sixty-five, and one hundred and sixty-six, and one hundred and sixty-seven, and one hundred and sixty-eight, and one hundred and sixty-nine, and one hundred and seventy, and one hundred and seventy-one, and one hundred and seventy-two, and one hundred and seventy-three, and one hundred and seventy-four, and one hundred and seventy-five, and one hundred and seventy-six, and one hundred and seventy-seven, and one hundred and seventy-eight, and one hundred and seventy-nine, and one hundred and eighty, and one hundred and eighty-one, and one hundred and eighty-two, and one hundred and eighty-three, and one hundred and eighty-four, and one hundred and eighty-five, and one hundred and eighty-six, and one hundred and eighty-seven, and one hundred and eighty-eight, and one hundred and eighty-nine, and one hundred and ninety, and one hundred and ninety-one, and one hundred and ninety-two, and one hundred and ninety-three, and one hundred and ninety-four, and one hundred and ninety-five, and one hundred and ninety-six, and one hundred and ninety-seven, and one hundred and ninety-eight, and one hundred and ninety-nine, and two hundred.

THE UNIVERSITY OF CHICAGO
LIBRARY

the sea. So also seals lie half-way between land and water animals and bats half-way between animals that live on the ground and animals that fly; and so belong to both kinds or neither."³³ Or take the Libyan ostrich. "It has some of the characteristics of a bird, some of the characteristics of a quadruped."³⁴ On the basis of shared characteristics how would one classify the Egyptian hippopotamus which "has a mane like a horse, is cloven-footed like an ox, and is snub nosed . . . , has a huckle bone like cloven-footed animals, and tusks just visible . . . , has the tail of a pig, the neigh of a horse, and the dimensions of an ass [and those] internal organs resemble the horse and the ass?"³⁵

Yet with all the complexities of structure and function, and the resulting difficulty of classifying animals, and although the "boundaries" of particular species may be blurred, it is still possible for Aristotle to recognize a natural scale. There is the continuous, unbroken gradation from lifeless things to animals. It is possible to speak of an "upward" scale, proceeding from lifeless

³³ Parts of Animals, 697b.

³⁴ Ibid., 67914.

³⁵ History of Animals, 502a9.

the fact that the animal is not a true
animal and that it is not a true
ground and that it is not a true
or neither." 25
of the character of the animal, and that
fact of a ground, and that it is not
fact that would be a ground, and that
which has a name like a name, and that
ox, and it is a name, and it is a name
clove-footed animal, and it is a name
the tail of a pig, and it is a name, and
of an ass (and there is a name, and it is
and the name. 25
for with all the names of the animal
function, and the name of the animal, and
tail, and although the name of the animal
may be placed, it is not a name, and it
has a name, and it is a name, and it is
gradual from the fact that it is a name,
to speak of as "upward" and "downward".

-
- 25 fact of animal
 - 26 fact of animal
 - 27 fact of animal

things, to plants, to animals, of "a continuous scale of ascent towards the animal." After enumerating the psychic powers of living things,³⁶ Aristotle indicates a scale according to a degree of complexity: "Of the psychic powers above enumerated some kinds of living things . . . possess all, some less than all, others one only. Those we have mentioned are the nutritive, the appetitive, the sensory, the locomotive, the power of thinking. Plants have none but the first, the nutritive, while another order of living things has this plus the sensory. If any order of living things has the sensory, it must also have the appetitive Certain kinds of animals possess in addition the power of locomotion and possibly another order like man or another superior to him, the power of thinking. . . ." ³⁷

Elsewhere Aristotle bases a natural scale on the degree of development of the offspring at birth.³⁸

³⁶ On the Soul, 413a23-25, b11-13, 21-4.

³⁷ Ibid., 414a28-414b20.

³⁸ Generation of Animals, 732a25-733b16.

CHAPTER III

ARISTOTLE AND EVOLUTION

Evolution as an idea has had a long history.³⁹ It has provided, indeed, one of the basic metaphors with which man has sought to interpret his experience. It can be found in poetry,⁴⁰ science, myth, and legend. It is the core of some religions. As one way of interpreting experience it has been the basis of some philosophical systems.⁴¹

Precisely because it has found such a wide range of expression the idea is difficult to characterize. Indeed, in the history of thought it has been better rhapsodized than analyzed. Evolution is basically a view that ultimate reality is processual, that, furthermore, process is inexorable, divisible only as a practical device, and is

³⁹ Suggestions of the idea can be found in Heraclitus, who believed all things were in a state of flux; Empedocles, who suggested that some forms of life are replaced by others; Anaximander, who held that the fish preceded man and that some fish had adapted themselves to life on land.

* ⁴⁰ Goethe, despite his differences from Darwinism, was one of the forerunners and pioneers of a theory of evolution.

* ⁴¹ E. g., those of Henri Bergson, Lloyd Morgan, Herbert Spencer, John Dewey.

THE HISTORY OF THE
EVOLUTION OF THE

Evolution as a term has been provided, instead, one of the man has sought to understand the found in poetry, ¹⁰ Holmes, and some of some religious, and hence it has been the basis of precisely because it is an expression the fact is difficult in the history of thought to than analyzed. evolution is processual, that reality is processual, division only as a

39 suggestions to the evolution, but, who believed all things are placed by others; and that some on land.

38 Holmes, despite his was one of the evolution.

37 H. S. G. 1880 of evolution, best Spencer, John

"natural." Such a view can, and has been, applied to the cosmos, to human history, to individual development, and even to Gods.

In this study the concern is not, however, with evolution as a philosophical problem, but, rather, with the specialized problem of evolution as a biological theory. Its concern is not with the truth or falsity of this theory, but, rather, with the kind of theory it is and with its assumptions. Adequate or inadequate as a theory to explain complex biological phenomena, it rests, nevertheless, on a certain view of the nature of reality which has furnished the background for the development of "modern" science.

No
It is the counterpart in biology of the Copernican (or more properly Galilean) revolution in physics, representing the same departure from tradition and the same insistence that nature is to be understood primarily as a natural, non-teleological process. Just as Galilean physics rejected the traditional notion that a state of rest is the natural condition of all bodies, so did evolutionary theory in biology reject the tradition of teleologically defined static species. Tradition in both instances had been based on Aristotle (rightly or wrongly understood) and the modern developments in both physics and biology were based on the rejection of a view of reality normally attributed to

"natural." From a view of... common, to human nature, to... even to God.

In this study, the... factor as a philosophical problem... specialized problem of... its concept is not with... but, rather, with the... assumptions, and... complex biological... certain view of the... the background for... It is the counterpart... properly defined... some departure from... nature is to be understood... teleological process... traditional notion that... dition of all... reject the tradition... species. Tradition... Aristotle... developments in... rejection of a view of...

Aristotle and the substitution of a new and different view of reality. In both physics and biology this involved also a different conception of the nature of "theory" in relation to fact and a revised conception of the role of methodology in scientific investigations. In physics this was more important than in biology, for the revolution in modern physics was to a greater extent a revolution in methodology: the discovery of that quantification makes precise prediction possible.

I have already proposed the question of whether or not the presuppositions of Aristotle's biology could allow a theory of the natural evolution of the species (as propounded by Darwin and his followers) even if biological observation justified such a theory. Aristotle himself had insisted, as pointed out, that all theory involves some observation and in turn must be checked by it. This would itself sound like the kind of presupposition which would permit any theory which was consistent with "fact." Paradoxically, however, I have suggested that regardless of biological "fact," a theory of natural evolution of the species would be impossible in Aristotle's biology. It is to this problem that we now must turn.

I

The following are the chief features of the writer

... and the ... of reality. In both ... a different conception of ... to fact and a ... in scientific ... important ... physics was ... the discovery of ... tion possible. ... I have already ... not the ... a theory of ... founded by ... observation ... treated, as ... observation and ... itself could ... permit any ... doubtless, however, ... biological ... species would ... to this problem ... the following ...

of a theory of the natural evolution of the species:

- (1) The species are mutable.
- (2) "New species may result from the selective action of external conditions upon the variations from the specific type which individuals present."⁴²
- (3) Biological process, like physical process, operates independently of aims, goals, purposes.⁴³ Changes in species due to natural

⁴² I quote this sentence from Sir William Dampier, A History of Science (Cambridge and New York: The Macmillan Company, 1939), 277, because it is an excellent statement of one essential feature of the theory.

⁴³ The claim that modern science, either in physics or in biology, has eliminated "purpose" is, of course, open to some criticism. Some philosophers of science suggest that modern science continues to retain the notion of purpose, merely substituting one set of purposes for another. Cassirer, for example, in The Problem of Knowledge (New Haven: Yale University Press, 1950), p. 166, after praising Darwinism for carrying through a "strictly unitary causal explanation with no assumption of any type of causality equal or superior to the physico-chemical," goes on to assert that it is absurd to claim "that it has finally overcome the purposive way of looking at things, that it has succeeded in dispensing with all concepts of purpose in scientific research. . . . Here the concepts of purpose have their secure place; they prove themselves to be not only admissible but absolutely indispensable. Not only the answer that Darwinism yields but even its formulation of the problem is indissolubly bound up with the purposive idea. The concepts of 'fitness,' 'selection,' 'struggle for existence,' 'survival of the fittest' -- these all have plainly a purposive character and they exhibit a theoretical organization quite different from that of the concepts of

of a theory of the mind...
(1) The question is...
(2) The question is...
(3) Biological process...
operated in...
posses...

History of...
of one essential...
The...
or in...
to some...
that...
loss, nearly...
Gessner, for...
Havens Yale...
lawyer for...
explanation...
equal on...
agent that...
overcome the...
succeeded in...
scientific...
have their...
only...
answer that...
problem as...
The concepts...
existence...
finally a...
organization...

selection are not necessarily cumulative. The theory discards "straight line" trends under the influence of some inner "force" or "urge."

Trends never continue in a straight line for the whole of their course. Indeed, they are never single: they are composed of many separate

the mathematical sciences. The constant use that Darwinism makes, and must make, of these concepts would alone suffice to show that in opposing a definite form of metaphysical teleology it in no way renounces 'critical teleology.' Indeed, one can go even further and assert that no earlier biological theory ascribed quite so much significance to the idea of purpose, or advocated it so emphatically, since not only individual but absolutely all the phenomena of life are regarded from the standpoint of their survival value. All other questions retreat into the background before this one." On p. 167 he writes: "Darwinism chose from the totality of all these relationships but one group of them alone for attention, asking only: 'What has survival value for the individual and the species?' Value for selection is glorified as the real, in fact, the only criterion, by which the meaning of every vital phenomenon is to be discerned and by which alone it can be understood. In this sense the critics of Darwin have rightly emphasized that its disciples, who boasted of having overthrown the idols of purposiveness, were 'the greatest teleologists of all' both in their fundamental concept of life and in the conceptual language they used." I believe Cassirer is basically wrong: external, disinterested factors provide the conditions of survival; in a significant sense it is not critical to Darwinism to say that each creature even "desires" his own survival, but merely that statistically some characteristics are more likely to result in survival under certain conditions than are others. It is external chance condition rather than internal purpose which determines modification, and this is a fact which may be statistically stated without reference to any concept of purpose. Certainly each science has, as science, some goals and purposes, but it is not logically incompatible for the scientist who desires to "know" about phenomena to insist that the phenomena follow processes independent of his desires.

collection of...
theory...
influence of...
There is...
whole of...
situation...

the mathematical...
makes, and what...
to show them in...
biology is...
Indeed, one...
biological...
the idea of...
not only...
are...
All other...
one...
rarity of...
for attention...
individuals...
like...
the meaning...
and by which...
the center...
classified...
propositions...
in...
language...
without...
types of...
to...
own...
factors...
conditions...
from...
them...
without...
science...
not...
"know"...
processes...

trends.

As partial authority for these three views, I offer the following statements by Darwin as to his own conception of his theory.

(a) Describing the circumstances under which a theory of evolution first occurred to him, Darwin writes, "In October 1838 I happened to read for amusement Malthus on Population, and being well prepared to appreciate the struggle for existence which everywhere goes on from long continued observation of the habits of animals and plants, it at once struck me that under these circumstances favorable variation would tend to be preserved, and unfavorable ones to be destroyed. The result of this would be the formation of new species. Here, then I had a theory by which to work."⁴⁴

(b) "I had two distinct objects in view"; writes Darwin, "firstly, to show that species had not been separately created, and, secondly, that natural selection had been the chief agent of

⁴⁴ Dampier, op. cit., p. 276.

1920

The following information is being furnished to you for your information and is not to be distributed outside of the Agency.

(a) In addition to the information furnished to you in the letter of the 12th day of August, 1920, the following information is being furnished to you for your information and is not to be distributed outside of the Agency.

(b) It is noted that the information furnished to you in the letter of the 12th day of August, 1920, is being furnished to you for your information and is not to be distributed outside of the Agency.

Very truly yours,
Special Agent in Charge

change."⁴⁵

(c) "I was not able to annul the influence of my former belief, then almost universal, that each species had been purposely created; and this led to my tacit assumption that every detail of structure, excepting rudiments, was of some special though unrecognized service . . . ; if I have erred in giving to natural selection great power, which I am very far from admitting, or in having exaggerated its power, which is in itself probable, I have at least as I hope done good service in aiding to overthrow the dogma of separate creations."⁴⁶

(d) Darwin writes: "Authors of the highest eminence seem to be fully satisfied with the view that each species had been independently created. To my mind it accords better with what we know of the laws impressed on matter by the Creator, that the production and extinction of the past should have been due to secondary causes, like those determining the birth and death of the

⁴⁵ Charles Darwin, Descent of Man (New York: A. L. Burt & Co., 1874), 69.

⁴⁶ Ibid.

individual."⁴⁷

The three essential features of evolution theory were reached by Darwin through a partly inductive, partly deductive method. Julian Huxley⁴⁸ points out that Darwin's theory of natural selection is based on three observable facts of nature and two deductions from them. Fact one: the tendency of all organisms to increase geometrically. Fact two: in spite of this the numbers of a given species tend to remain more or less constant. Deduction one: there is struggle for survival. Fact three: all organisms vary appreciably. Deduction two (on the basis of deduction one and fact three): natural selection -- i.e., some variations are favorable in the struggle for survival, some are not, and a higher proportion of individuals with favorable variations will survive and reproduce offspring more like themselves than like the others.

II

So far in our discussion of Aristotle there is nothing that need necessarily conflict with a theory of natural evolution as sketched above. We have seen that

⁴⁷ Charles Darwin, Origin of the Species (New York: Philosophical Library, 1951), p. 504.

⁴⁸ Julian Huxley, Evolution, the Modern Synthesis (New York and London: Harper & Brothers, 1943), p. 14.

The first...
were...
deductive...
win's theory...
this fact...
one: the...
fact two: in...
tend to remain...
in struggle...
appreciable...
and fact...
are favored...
and a higher...
relations...
selves than...

So far...
nothing...
natural...

Philosophical...
New York...

Aristotle, like Darwin, was a prodigious observer; he insisted that theory follow observation. We have also seen that Aristotle had a notion of the continuity of living forms and was well aware that there are different species which may be ranked in terms of their "powers," in the sense, at least, that more complex functions depend upon simpler functions. That Aristotle himself did not set forth a theory of natural evolution, one could argue, is due not to any basic antagonism but to the primitive stage of the science at that time. Yet I have asserted not merely that Aristotle did not have a theory of evolution, but, further, that he could not have such a theory. For explanation we must turn to a closer analysis of Aristotle's "empiricism."

Aristotle, like Plato, insisted that there is a realm of forms and was not a dualist in the sense which may be implied by the term, at least, at least in the original Platonic sense. Aristotle's theory of nature, however, is not a theory of nature, but a theory of nature, to any basic sense, and is not a science at that time. Aristotle did not see a science of nature that he could not see, and he was not seen from a different point of view.

CHAPTER IV

PRESUPPOSITION AND THEORY

X Many scholars have found the rudiments of evolutionary theory in Aristotle's biology; others have not. Torrey and Felin in a comprehensive article⁴⁹ have gathered together such of the significant comment on this question. On the basis of the same evidence some scholars have seen Aristotle as the father of evolution; others have seen him in sharp opposition to the idea. H. F. Osborn, for example, believed that Aristotle "was the first to conceive of a genetic series," and that "his conception of a single chain of evolution from the polyps to man was never fully replaced until the beginning of this century (19th)."⁵⁰ E. Clodd, basing his judgment largely on what he had read of Osborn rather than on Aristotle himself, referred to Aristotle's "pioneer work in evolution," and thought that in "the

X⁴⁹ Harry Beal Torrey and Frances Felin, "Was Aristotle an Evolutionist?" The Quarterly Review of Biology, XII (March, 1937), 1-18.

⁵⁰ Henry Fairfield Osborn, From the Greeks to Darwin; The Development of the Evolution Idea Through Twenty-four Centuries (Second edition, revised, New York and London: C. Scribner's Sons, 1929), 44.

any theory in evolution... and fall in a... together... On the basis of... Aristotle... in early... believed that... genetic... of evolution... until the... being his... rather than... "pioneer work in..."

by... to be an... III (1901)...
The Development of...
Germans...
U. S. ...

question of the origin of life forms" Aristotle "was nearest of all to its modern solution."⁵¹ W. A. Lacy agreed that Aristotle "believed in a complete gradation from the lowest to the highest, and that man is the highest point of one long and continuous ascent."⁵² On the other hand, T. E. Lones says that nowhere "does Aristotle show that he had any ideas of a development of higher forms of life from common ancestors, at all resembling the Darwinian idea of the origin of the species."⁵³ A. E. Taylor goes even further in stating that Aristotle "turned his back on evolutionary ways of thinking."⁵⁴

Like these commentators, Aristotle, too, was a critic; indeed, his usual approach to any scientific question was to first ask what his predecessors had to say about it. His account of the "oppositions of the doctrines of his predecessors serves as a dialectical basis for the

⁵¹ E. Clodd, Pioneers of Evolution from Thales to Huxley (London: G. Richards, 1903), 18.

⁵² W. A. Lacy, Biology and Its Makers (New York: H. Holt and Company, 1908), 12.

⁵³ T. E. Lones, op. cit., 82.

⁵⁴ A. E. Taylor, Evolution in the Light of Modern Knowledge (London: The Macmillan Company, 1925), 144.

question of the... of all the... Aristotle... for the... long and... Jones says... ideas of a... answers... origin of... in stating... ways of... like... official... also was... it. His... his...

Burley...
M. John and...
...
...
Knowledge...

[Faint handwritten signature]

exposition of his own conception of scientific method."⁵⁵
 Aristotle was very much aware of historical tradition, and although he reacted against the Pythagorean tradition as culminating in Plato, he also criticized the Ionian physiologists who held evolutionary views of the nature of physical and biological process. Aristotle knew what he was criticizing and, as we shall see, he had his reasons. In Physics 187a20 he criticizes Anaximander, Empedocles, and Anaxagoras for "producing things from their mixture by segregation." He cannot accept the view that "everything arises out of everything." In Parts of Animals 687a5 he disputes the view of Anaxagoras that "it is his possession of hands that makes man the most intelligent of the animals," (a view obviously consistent with natural selection) saying that it is "surely the reasonable point of view that

⁵⁵ Richard F. McKeon, "Aristotle and the Origins of Science in the West," an essay in Science and Civilization (Madison: University of Wisconsin Press, 1949), edited by Robert C. Stauffer. Also Richard F. McKeon, "Aristotle's Conception of the Development and the Nature of Scientific Method," Journal of the History of Ideas, VIII (January, 1947), p. 3: "Aristotle frequently begins an inquiry or formulates a problem by reviewing the doctrines of other philosophers, for although the method appropriate to a problem is determined by the subject matter on which it is to be employed, the varieties of theory and of theoretical construction may be suggested by historical examination of what men have said concerning a subject of inquiry or by dialectical exploration of possible formulations."

exposition of the...
Aristotle...
although he...
maintaining...
philosophy...
was...
In physics...
and...
aggregation...
excess...
disputes...
of...
said...
saying...

Science in the...
[Medical University of...]
Robert G....
Conception of...
Method...
1977...
philosophy...
problem...
to be...
construction...
what...
dialectical...

it is because he is the most intelligent animal that he has got hands." The crucial point here is, how can Aristotle possibly justify his view that man's intelligence (function) precedes in the order of being his possession of hands (a related structure)? Aristotle's answer here is quite astounding considering his insistence that hypothesis follow observation, for his answer is that "hands are an instrument" and that Nature, like a sensible human being, always assigns an organ to the animal that can use it, (as it is more in keeping to give flutes to a man who is already a flute player than to provide a man who possesses flutes with the skill to play them)." Here we have a view completely opposed to evolutionary theory: that the fitness of man is prior to any subordinate function of man and that man has attributes as man not because these have developed in response to "situation" but because of the nature of man. "Thus it is," he says, "to that animal man who has the capability for acquiring the greatest number of crafts that nature has given the instrument (viz. the hand) whose range of uses is the most extensive." The implication here is that the species man is somehow outside of nature, with an already established being. How does Aristotle justify his conclusion? He does it by citing a principle. "Nature has provided that which is less as an addition to that which is

It is because of this that the...
not only...
possibly...
precisely in the...
related structure...
assuming...
observation...
ment" and...
assigns an...
more in...
This player...
with the...
player...
of men...
not has...
in response...
had...
capability...
nature...
of use...
that the...
already...
conclusion...
provided...

greater and superior; not vice-versa." That this is the way in which nature works is one of the presuppositions of the biology, and here we see the way in which presupposition determined conclusion and does it, in Aristotle's mind, in the name of common sense. The proof of Aristotle's view of the nature of man in relation to the structure of man (that nature determines structure, not structure determining nature) rests on the argument: (a) if this is the better way, and (b) if nature always does the best she can in the circumstances, then (c) it is not true to say that man is the most intelligent animal because he possesses hands, but he has hands because he is the most intelligent animal. Though Aristotle's premises are meant to be obvious from experience, they belong not to experience but to a conception of nature which determines the way in which things are observed. In this instance a theory about nature -- no matter how warranted it might be by the facts -- which contradicts the statement, "nature always does the best she can in the circumstances," could not be accepted by Aristotle.

Here Aristotle is rejecting not merely one view of one philosopher; he is rejecting also a whole tradition of scientific investigation, a scientific temper which was empirical but with which he was in basic disagreement; his

greater and greater...
way in which...
the biology...
tion...
in the name of...
of the nature of...
(that nature...
ing nature)...
better way...
in the...
and...
hants...
animals...
obvious...
to a...
things...
nature -- no...
-- which...
best...
Aristotle...
one...
scientific...
epirical...

* disagreement and thus his rejection was based on the neglect of final causation in that tradition. He rejects it because in his opinion it failed to see that no scientific explanation can be complete which neglects to consult final causes. The passages quoted, indeed, serve to ridicule the point of view.

* In Parts of Animals, 640a15, Aristotle attacks Empedocles, and in attacking him shows his familiarity again with a scientific tradition towards which he is hostile and, in this instance, towards a view of the species with which he strongly disagrees. The view he attacks is again a view of evolution. The difference here, again, is basic; treating the same biological phenomena as does Empedocles, his attitudes take him in the opposite direction, that is, away from an evolutionary view. He starts by asking which of two quite different questions we should consider: (a) what is the process of formation of each animal? (with which ancient writers had concerned themselves), or (b) what are the characters of a given creature when formed? He proposes to start with the characters presented by each group of animals and then to state the causes of these characters and deal with their evolution. This he tells us is the true sequence, just as it would be in house building. In house building, for example, we would

disagreement and... of final... in his opinion... tion can be... courses. The... the point of view.

In the case of... Hypothesis, and in... again with a... this and, in... with which he... again a view of... basis; treating... cases, his... that is, very... asking which of... considered: (a)... with which... on (b) what... formed? He... presented by... assessed these... this he... in these...

start with the plan of the house, the form, and we would say that because it has this particular form the construction is carried out in a certain manner. "The process of evolution," he writes, "is for the sake of the thing finally evolved and not this for the sake of the process. . . . Empedocles, then," he goes on to say, "was in error when he said that many of the characters presented by animals were merely the results of incidental occurrences during their development."

Aristotle has indicated his criticism of Anaxagoras that the fully formed individual is prior in the order of being to its subordinate structure. Here, in his criticism of Empedocles, we see that Aristotle does not admit natural selection nor does he admit natural process which does not aim at some end. He is aware of both of these ideas and he rejects them. The starting point for Aristotle, as with his example of the house, must always be a plan and this plan serves as an end, and, rather than being determined by process, it determines process. Ultimately each species is just such a plan, just such an end; each form in the universe is ultimately inviolable, because each form is the source of its own processes and therefore could not conceivably be altered by those processes. This view is deep in Aristotle's thinking: for any action there must be a starting

... with the ...
... that ...
... in ...
... that, he ...
... evolved ...
... Impediment, ...
... he said ...
... were merely ...
... their ...
... that the ...
... being ...
... of impediment, ...
... selection ...
... aim at ...
... he rejects ...
... his example ...
... plan serves ...
... process, it ...
... that such a ...
... in ...
... of its own ...
... altered by ...
... coffee's ...

point. The Prime Mover is just such an ultimate starting point, untainted by the processes for which it is ultimately at the same time master plan and end. In the same way each form -- whether it be a species or the plan of a house -- is essentially inviolable; for that is the nature of form or end. In Parts of Animals, 640b, Aristotle makes this clear in terms of species when he writes, "man is an animal with such and such characters, therefore is the process of his development necessarily as it is; therefore is it accomplished in such and such an order, this part being formed first, that next, and so in in succession; and after a like fashion should we explain the evolution of all other works of nature." On the presupposition that all evolution is for the sake of the thing evolved, how could one possible account (a) for one species ever developing out of another, or (b) for any species undergoing change? It is not form, plan, or end to be changed by the process of its own fulfillment. And that is really the only process Aristotle will permit. No species could develop into another unless the individual members of that species changed. But for Aristotle the individual could not change unless the species (form) changed because for Aristotle the fuller form is prior in the order of being to any subordinate part or function and therefore no subordinate can change the

point. The first part of the paper is devoted to a discussion of the
point, which is the first of the two points mentioned in the
at the same time. The second part of the paper is devoted to a discussion
four -- whether it is a point or a line. The third part of the paper
is devoted to a discussion of the point, which is the first of the two
or end. The fourth part of the paper is devoted to a discussion of the
clear to carry out the work. The fifth part of the paper is devoted to
with each and every thing. The sixth part of the paper is devoted to
his development. The seventh part of the paper is devoted to a discussion
plished in each and every thing. The eighth part of the paper is devoted
first, that next, and so on. The ninth part of the paper is devoted to
fashion should be adopted. The tenth part of the paper is devoted to a
of nature. The eleventh part of the paper is devoted to a discussion
for the rest of the paper. The twelfth part of the paper is devoted to
account (a) for the first part of the paper. The thirteenth part of the
on (b) for the second part of the paper. The fourteenth part of the
plan, on and so on. The fifteenth part of the paper is devoted to a
element. The sixteenth part of the paper is devoted to a discussion
will permit. The seventeenth part of the paper is devoted to a discussion
the individual aspect of the paper. The eighteenth part of the paper is
Analogic the individual aspect of the paper. The nineteenth part of the
species (form) changed. The twentieth part of the paper is devoted to a
form is given in the paper. The twenty-first part of the paper is devoted
on paper and so on. The twenty-second part of the paper is devoted to a

fuller form.

In criticizing Empedocles' account of how the backbone might become divided into vertebrae by natural means, Aristotle would remind Empedocles that all propagation implies a created seed endowed with certain formative properties, and, furthermore, "that the parent animal pre-exists not only in idea but actually in time. For man is generated from man; and thus it is the possession of certain characters by the parent that determines the development of like characters in the child."⁵⁶ What chance for mutability of the species here? As Aristotle says, "the formal nature is of greater importance than the material nature."⁵⁷

In the Physics, 198b-200a, Aristotle also ridicules views of natural process which overlook end as the determination, indeed the source, of process. "Action for an end is always present in things which come to be and are by nature"; wherever a series has completion, all the preceding steps are for the sake of that which results. No scientific explanation, then, can be complete without a consideration of final cause; last to be realized, they form, nevertheless,

⁵⁶ Parts of Animals, 640a25.

⁵⁷ Ibid., 540b29.

our first consideration. They are the starting point.

The opening book of Parts of Animals is one of the clearest and most comprehensive statements of Aristotle's teleology in the whole corpus. "There are more causes," he says, "than one concerned in the formation of natural things: there is the Cause for the sake of which the thing is formed, and the Cause to which the beginning of the motion is due. . . . The first is what we call 'Final Cause', since that is the logos of the thing -- its rational ground -- and the logos is always the beginning for products of nature as well as those of Art."⁵⁸ He goes on to distinguish between method in theoretical and natural science: the theoretical sciences begin with what is, the natural sciences with what is going to be (with processes of actualization, assuming that there is that which is actualizable).

The role of teleological thinking in Aristotle's philosophy, and particularly in the biology, is extremely important. Biological phenomena are approached by a principle of ends, or final causes, or that for the sake of which something exists, or forms, or, more simply, plans which, like the plan of a house, are actualizable and actualized. Species for Aristotle are such plans. Given

⁵⁸ Ibid., 639b15.

our first consideration
The origin of language
distinct and well established
taxonomy in the world
says, "This one aspect
things that is the same
is formed, and therefore
notion is due to
Lange, since the
ground -- and the
of nature as well as
distinction between
the theoretical
sciences with
lation, asserting
The role of
philosophy, and
important, biological
style of art, or
which something
which, like the
actualized.

such a view, what is the source for the change of an end?
The answer is, simply, there is no external source. Ends
do not change. They are not reciprocal with process but are
ultimate determinants. Species are ends, and thus species
cannot change. Since the teleological presuppositions of
Aristotle's biology demands that ends be fixed, and since
species are ends, it is obvious that such a presupposition
is logically incompatible with any theory (no matter what
the facts warranting it) that the species themselves
evolve.

The problem of the nature of species in Aristotle
can be approached in yet another manner. We may ask what
Aristotle means by ranking species in a natural scale and,
moreover, the significance of the continuity of the various
forms in the scale. Does not a continuous natural scale
provide at least hints of a theory of natural evolution?
Are not the two views at the very least compatible? Was
not Aristotle the biologist concerned with minute observa-
tion of a great variety of living individuals and have we
not seen that he admits, as in the case of the Libyan
ostrich, that an individual may fit into one form in one
respect and yet another form in another respect? Here
again, however, as has been pointed out in the discussion
on teleology, form or species is not arbitrary description

such a view, which is in fact the case, and the
The answer is, simply, that it is not possible
do not change. They are, in fact, the same
ultimate determinants. The only way in which
cannot change. The only way in which
Aristotle's biology is not a biology of
species are not, in fact, the same. The
is biologically incommensurable with the
the facts concerning the fact of the
evolve.

The problem of the nature of the
can be approached in a different way.
Aristotle seems to imply that the
moreover, the significance of the
forms in the world. There are not
provide at least hints of a theory of
are not the two views as the only
not Aristotle has biological
tion of a great variety of living
not seen that he writes, as
certain, than an individual
respect and yet another form
again, however, as in our
on teleology, form of species is not

on the basis of observed characteristics. Species is not defined by describing the characteristics which some animals share in common, but, rather, characters are recognized and intelligible because they can be referred to the common form. With all Aristotle's fidelity to sense impression, still, in order to have any knowledge, even of sense impressions, we must think of the many individuals in terms of class groupings. What is the relation of the individual to a particular class of individuals? How does the knowing process mediate between them: passing from knowledge of the one to knowledge of the other and back again? And with what justification? I have already indicated that the relationship of form to individual is not, epistemologically at least, reciprocal. Form determines individual; individual does not determine form. In Metaphysics, 99a25, Aristotle raises this question: "If, on the one hand, there is nothing apart from individual things, and the individuals are infinite in number, how then is it possible to get knowledge of the infinite individuals? For all things that we come to know, we come to know insofar as they have some unity and identity, and insofar as some attribute belongs to them universally." Our knowledge of individuals, then, is made possible by our knowledge of the type. The individual animal cannot, for Aristotle, "be eternal as an

on the basis of observation...
defined by describing...
there in common...
labelable because...
form...
still, in order...
provision, we...
class groups...
a particular class of...
process...
one to knowledge...
what...
relationship...
at least...
that does not...
this raises the question...
nothing...
are infinite in number...
knowledge of the...
we come to know...
only and...
to them...
is made possible...
which...
X

individual . . . but it is possible for it as a species.
 This is why there is always a class of men and animals and
 plants."⁵⁹

Aristotle's presupposition, then, as to the nature
 of the knowing process itself demands, again, unchanging
 forms. And no matter how we may rank the forms in a natural
 scale, recognizing that they are continuous with each other,
 still this is a metaphysical ranking of unchanging enti-
 ties. There is nothing in a natural scale to suggest that
 one species develops out of the species below it. As Royce
 has said, Aristotle may recognize evolution of the indivi-
 dual being whose life obviously is a process of genesis to
 corruption, "But the forms which are responsible for the
 evolution of individuals are . . . eternal. . . . They
 therefore do not evolve."⁶⁰ "This conception of the eter-
 nity of the forms is . . . by far the most significant
 opponent that the philosophical doctrine of evolution has
 ever had or ever can have."⁶¹

⁵⁹ On the Generation of Animals, 731b36.

⁶⁰ Josiah Royce, Herbert Spencer, An Estimate and
 Review (New York: Fox, Duffield & Company, 1904), p. 28.

⁶¹ Ibid., p. 29.

Individual... This is why...
of the known...
form...
state...
this...
the...
one...
has...
that...
corruption...
evolution...
therefore...
ity...
opponent...
ever...

52 In the...
60...
51...

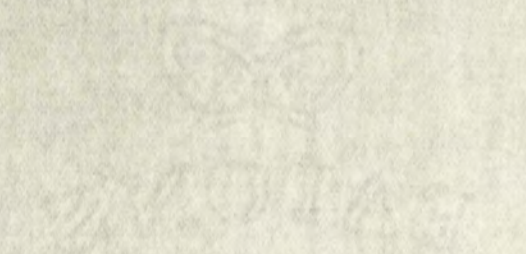
CHAPTER V

INTERPRETATION

Early Greek science (6th Century B. C.) regarded man as a product of natural material processes, his powers of speech and thought as a product of his life and society, his science as part of his technique of the control of his natural environment. In its beginning it is an attempt to supply a purely naturalistic interpretation of the universe as a whole. This naturalistic interpretation is evolutionary. The following extended quotation from an unidentified pre-Aristotelian⁶² is an excellent statement of the naturalistic evolutionism of this tradition:

"At the time of the original constitution of the universe heaven and earth had but one form, their elements being mixed together. Then their substances separated, and the cosmos completely assumed the order we now observe in it, but the Air continued in a state of agitation. As a

⁶² This quotation is from the history of Diodorus Siculus, Bk. I, chaps. vii and viii. It is quoted in Benjamin Farrington, Thales to Aristotle, Vol. I, Greek Science: Its Meaning for Us. (New York: Pelican Books, 1949), pp. 79-82. It has been attributed to Democritus, but may be pre-atomic.



Faint, mostly illegible text forming the main body of the document.


at the bottom of the page, possibly a signature or footer.

result of this movement, the fiery portion of the Air collected in the upper spaces, its nature tending to rise on account of its lightness, and for this reason the sun and all the rest of the heavenly bodies were caught up in the general rotary movement. The more dense and turbid portion of the Air joined the moist element and settled into the same region with it by reason of its weight. When this heavier matter had long crowded and revolved upon itself, it formed the sea out of its moist elements and the earth out of its more solid elements.

"The earth at first was muddy and quite soft. It was only owing to the action of the sun's heat that the earth began to harden. Then, on account of the heat, some of the moist elements swelled and the earth began to bubble up at many places. At these places there formed fermentations enclosed in delicate membranes, a phenomenon still to be observed in marshes and bogs when a rapid rise in the temperature of the air supervenes suddenly on a chilling of the earth. In this manner, through the action of the heat, the moist elements began to produce life. The embryos thus formed got their nourishment at night from the mist which fell from the surrounding air, while by day the action of the sun's heat imparted firmness. At the end of this stage, when the embryos had got their full development and the

result of this movement, the...
located in the...
account of the...
all the rest of...
General...
of the air...
same region...
heavier...
it formed...
one of its...
"The...
was only...
earth...
of the...
up at...
ions...
be observed...
temperature...
the...
the...
formed...
fall from...
the...
when the...

membranes had been dried up by the heat and had burst, all sorts of living things came forth. Of these, those which had the largest share of heat went off into the upper regions and became birds; those which had a greater admixture of earth formed the class of creeping things and other land animals; while those which had more of the moist element went off to the region skin to them and became what we call fish. But the continuing action of the sun and wind hardened the earth still more, until it was no longer able to bring to life any of the larger creatures, but each of the larger living things was reproduced through intercourse of life with like."

The myth continues with an account of the development of society, of the emergence of different languages by convention, of the discovery of fire and other conveniences, and the development of the arts, concluding with the statement that, "Necessity is the intimate guide who conducts man through every lesson and necessity has in man a naturally apt pupil, equipped as he is with hands, speech, and mother-wit for every purpose." Farrington points out that this myth applies an evolutionary concept to the origin and development both of life and of society. It implies a view of the human being which holds that he has no definite nature: that he is not by nature a political animal but 

mentions and how...
sorts of living...
and the largest...
regions and...
ture of each...
lent...
ment...
call...
handed...
to bring...
the larger...
of life...
of society...
vent...
and the...
ment...
men...
ally...
rather...
this...
development...
of the...
actual...

becomes so, that he is not endowed with a gift of speech but "becomes a talking animal through a process of historical development," that man is not by definition a rational animal but becomes so (largely because of his hands). This is still, of course, evolution within a species. Cornford, ~~X~~ pointing out that the cosmological myths found in all societies exhibit two main patterns -- evolutionary and creational -- also suggests that the myths of 6th Century B. C. Miletus were evolutionary.⁶³ They held generally to an original condition of things (such as water or mist); this view culminated in the atomism of Democritus, was adopted with modifications by Epicurus, and reproduced by Lucretius.

In this evolutionary Greek tradition Thales had held that everything was once water and that the earth and everything else had been formed out of water by a natural process. Anaximander had held that fish, as a form of life, preceded land animals; as the dry land appeared, some fish adapted themselves to life on land. He goes on to state clearly the evolution of one species from another. "Living things," he said, "sprang from (the moist element) evaporated by the sun. Man sprang from a different animal, in fact

~~X~~ ⁶³ Francis M. Cornford, "Greek Natural Philosophy and Modern Science," in Joseph Needham and Walter Pagel, Background to Modern Science (Cambridge: The University Press, 1949), pp. 3-22.

backbone, then the ...
"becomes a ...
development, ...
and the backbone ...
still, of course, ...
pointing out that ...
also existed ...
factors -- ...
Hilbert were ...
original ...
view ...
with ...
In ...
that every ...
thing else ...
case. ...
passed ...
adapted ...
clearly the ...
change," ...
by the ...

of ...
and ...
backbone ...
press, ...

from a fish, which at first he resembled."⁶⁴ Empedocles, in an ancient statement of the survival of the fittest, had said that the earth when younger had produced a much greater variety of living things; many of these races of living things must have been unable to continue their breed, and in the case of every species which continues to exist craft, courage, or speed has from the beginning of its existence protected and preserved it.⁶⁵

Plato was aware of this naturalistic tradition of long standing and he describes it in the Laws, Book X (889): "They [the philosophers] say that the greatest and fairest things are the work of nature and of chance. . . . They say that fire, and water, and earth, and air all exist by nature and by chance, and none of them by art, and that as to the bodies which come next in order, -- earth, and sun, and moon, and stars, -- they have been created by means of these absolutely inanimate existences. The elements are severally moved by chance. . . . After this fashion and in this manner the whole heaven, as well as animals and all plants, and all the seasons come from these

⁶⁴ Charles M. Bakewell, Source Book in Ancient Philosophy (Revised edition, New York: Charles Scribner's Sons, 1939), p. 6.

⁶⁵ Empedocles, Fr. 244 and following, in Milton C. Nahm, Selections from Early Greek Philosophy (New York: Appleton-Century-Crofts, Inc., 1947), p. 136.

from a line, which is...
in an...
said that the...
variety of living...
plants and...
in the case of every...
plants, however...
existence...
Plants were...
long standing...
(1889): They...
faintest...
They say...
by nature and...
as to the...
and, and...
means of these...
sects are...
fashion and...
animals and...

of...
geography (level...)
1889, p. 8.
of...
Hahn, California...
Aphidum...

elements, not by the action of mind, [italics mine] as they say, or of any God, [italics mine] or from art, but as I was saying, by nature and chance only."

We have seen in Chapter Two that Aristotle sought to establish empirical sciences; no theory, for him, could be admitted which was not consistent with observed fact. We have seen in Chapter Four that Aristotle is familiar with the scientific tradition described in the preceding paragraphs but that, rather than embracing it, he attempts to destroy it as the starting point of his own "empirical" speculations. Why did he so violently oppose a tradition with which, in terms of his own empirical principles, he should have been congenial? Why did he, as we have seen in the last chapter, oppose its views by showing their inconsistency with principles instead of attempting to provide more valid observations to supplant them? Cherniss points out that Aristotle generally subordinates the empirical arguments to the "theoretical objections derived from his own philosophical system," and that his "acute skill as an observer is frequently vitiated by his belief that all natural occurrences must somehow comply with his philosophical axioms."⁶⁶ We have seen that in doing this

⁶⁶ Harold Cherniss, Aristotle's Criticism of Pre-Socratic Philosophy (Baltimore: The Johns Hopkins Press, 1935), p. 327.

elements, none of the kind which
any, or a few, of the kind which
was said, by some, to be
We have seen in the case of the
essential empirical basis of the
admitted which was not admitted
have seen in the case of the
the scientific transition between the
graphs but that, rather, in the
destroy it as the scientific basis of the
speculations. We did not see the
with which, in terms of the
should have been admitted, and
in the last quarter, appeared
inconsistent with the scientific
side more valid recognition of the
points out that scientific
of arguments in the empirical
own philosophical system, and
observer in the empirical
natural occurrence and with
aphical nature.

to avoid the
scientific
1937.4.27



Aristotle violates his own dictums; we have further indicated what some of these axioms are and have seen their non-empirical basis.

There is the axiom, as stated on p. 42, that the formal cause is more important than the material cause, and it is this axiom (which belongs to the system of beliefs rather than to scientific observation) which is the spring-board for Aristotle's criticism of the pre-Socratic and, in turn, the construction of his alternative theories. His essential criticism is that they ignore the cause for the sake of which the thing exists and do not go beyond the mechanical causes found in the elements themselves. Empedocles argues, for example, that the survival of a species is due to chance. He maintains that each species is a chance combination of organs and that some of them, unable to survive in their environment, perish without reproducing themselves. Under changing conditions for Empedocles there would be different species. Aristotle's only refutation of such a view is theoretical: organic parts (as we have seen in his refutation of Anaximander's view of hands) are determined by final cause. The proof that this must be so rests in turn not on observed fact but on a basic presupposition of the philosophy: that in all processes which result in a final term the successive stages are performed for the sake

epistemic violence...
called that such...
non-epistemic...
there is...
formal sense...
it is this...
rather than...
heard for...
in turn, the...
essential...
sake of which...
mechanical...
does appear...
is due to...
chance...
to survive...
themselves...
would be...
such a view...
in the...
method by...
in turn...
of the...
final term...

of that term.⁶⁷

Aristotle attacks both the evolutionary views of the earlier scientists and the whole set of presuppositions on which the earlier science rests. His own theoretical framework cannot tolerate their evolutionary views. The question of evolution -- turning on the problem of causality -- is the critical point in Aristotle's difference from this tradition. If the species evolve, the Ionian tradition is right; if the species are static, Aristotle is right. Aristotle himself realized this. To admit in his biology, therefore, the possibility that species could evolve would be to capitulate to his philosophical protagonists -- his relatively primitive predecessors on whom, paradoxically, his own intellectual development is based -- and to give up the philosophical orientation which satisfies his deepest motives as philosopher. Since he can do neither he does what he criticizes the Pythagoreans for doing; he tries to

⁶⁷ Physics, 199a26: "If then it is both by nature and for an end that the swallow makes its nest and the spider its web, and plants grow leaves for the sake of the fruit and send their roots down (not up) for the sake of nourishment, it is plain that this kind of cause is operative in things which come to be and are by nature. And since 'nature' means two things, the matter and the form, of which the latter is the end, and since all the rest is for the sake of the end, the form must be the cause in the sense of 'that for the sake of which'." "Nature, indeed, is a cause, a cause that operates for a purpose." (199b32).

of this form.

A kind of a...
 earlier...
 which the...
 work cannot...
 tion of evolution --
 in the critical point...
 position. It...
 right it...
 to be...
 therefore, the...
 be...
 relatively...
 his own...
 up the...
 active as...
 what he...

23

and for...
 other...
 trail...
 conditions...
 five...
 since...
 of which...
 for the...
 sense of...
 as a...

accommodate observations to theory.⁶⁸ It would appear that one presupposition -- the primacy of observation -- is in conflict with another -- the necessary truth of principle which, in this case demands, prior to observation, the fixity of species.

Aristotle must not, in short, eliminate final and formal cause, as he thought the Ionians had done. These are the basic principles of his order. They are the cornerstones of his philosophy. The essential difference from the Ionians is just this view which insists that generation is due to essence, rather than essence to generation (evolution is for the sake of the thing evolved). We have seen in his criticism of Empedocles that Aristotle cannot admit that the form (species) can be explained as a consequent of the accidents of process. The ancients in his view were primitive and unsophisticated (and wrong) just because they had not advanced to the stage of intellectual development where they could recognize formal and final causes. Being unable to distinguish the essence of an object from its material they could not recognize that matter could be

⁶⁸ De Caelo, 293a25. Aristotle criticizes the Pythagoreans because "they are not seeking for theories and causes to account for observed facts, but rather forcing their observations and trying to accommodate them to certain theories and opinions of their own."

associated with the...
one proposition -- the...
conflict with...
which, in this case...
fifty of...
Artistic...
formal cause...
and the basis...
responses of his...
the...
is due to...
action is...
in his...
that the...
the...
primitive and...
had not...
where they...
unable to...
astrol... they...

of...
Pythagorean...
cases of...
their...
theories...

determined by some cause other than matter. The knowledge that there were other causes which could be demonstrated was considered by Aristotle to be his great innovation in relation to the ancients. His more sophisticated philosophy, a development, incidentally, in his own view from theirs, provided this knowledge.

Aristotle saw in evolutionary theory the enemy of his teleological system. His evidence to refute such an earlier, and therefore in his eyes more primitive, view is sometimes absurd. Indeed, his teleology appears to sometimes blind him to the possibility of evolution of the species. Thus, in attacking Empedocles' view that aquatic animals originated on land he objects to the absurdity that each individual fish should have migrated to water, especially since none of them have feet.⁶⁹ He either did not see that Empedocles meant this to apply to the original ancestors of fish or, seeing it, he attempted to dismiss it by a reply which is meant to deliberately reduce the notion to absurdity (as in his reply to Anaximander concerning hands). In either case presupposition is operative: in the first case, as blinding Aristotle to the possibility that this could refer to original ancestors; in

⁶⁹ Parva Naturalia, 477a.

... of ...
... that there were ...
... was concerned ...
... relation to ...
... phy, a ...
... theatre, ...
...
... his ...
... earlier, and ...
... sometimes ...
... times ...
... species. Thus, ...
... animals ...
... each individual ...
... fully ...
... see that ...
... ancestors of ...
... it by a ...
... notion to ...
... certain ...
... lives in the ...
... ability that ...

the second case, as indicating that the view is so far-fetched that it simply cannot be treated seriously. At any rate, he treats here as the history of the individual what was meant to refer to the history of the species. Aristotle's teleology demands that "when we are dealing with definite and ordered products of Nature, we must not say that each is of a certain quality because it becomes so, but rather they become so because they are so and so, for the process of becoming attends upon being and is for the sake of being, not vice versa."⁷⁰ Species are, and individuals of a species become what they are; if the Ionians say that the species themselves develop then, for Aristotle, they are wrong.

To understand how Aristotle could so readily reject an "empirical" tradition when he sought empirical science himself, to understand how he could, furthermore, attempt to set up empirical science in such a way that empirical principles are violated, it is necessary to understand something of Aristotle's inheritance and something of his motives. He is himself the culminating expression of a tradition he thought he had rejected and he is motivated by

⁷⁰ Generation of Animals, 778b1-6.

the second case, as we have seen, is
founded upon the simple truth that
before we speak we must first
was meant to refer to the fact that
before a sentence is uttered, the
definition and context, which are
that each is of a certain kind,
but rather, they possess a certain
the purpose of knowledge, and
acts of value, for which
basis of a special method, and
any such method, however
they are wrong.

to understand the nature of
an "artistic" method, we must
himself, to understand the nature
to see an empirical method, and
principles are violated, and
thing of artistic method, and
motives. He has not, however,
tradition he thought he had

desires he thought he had outgrown. The explanation lies in his relation to his immediate predecessor, Plato.

Cornford's second kind of cosmological myth was the creational. To this pattern he assigns Plato and Aristotle.⁷¹ In contrast to the evolutionary, the creational myth, generally preferred for moral and religious reasons, holds that the world is like a thing born not made, containing evidences of intelligent and intelligible design, with necessity and chance subordinate to the purpose of divine reason. For such myths the cosmos does not have a beginning in time, nor will it ever come to an end; there is only one world. Elsewhere⁷² Cornford distinguishes two traditions in Greek philosophy -- the Ionian and the Pythagorean (or Socratic) -- and places Aristotle in the Pythagorean tradition as the direct descendant of the form this tradition took starting with Socrates. He holds that Plato and Aristotle are the chief followers of Socrates, attempting to carry into the interpretation of the world the consequences of Socratic ideas. The unique contribution of Socrates, in Cornford's opinion, was the fact that he turned the study of external nature to the study of Man and the purposes of

⁷¹ Cornford, op. cit., pp. 7, 8.

⁷² Francis Cornford, Before and After Socrates (Cambridge: The University Press, 1950).

... in his relation to the world...
... occasional...
... in contrast to the world...
... the world is like...
... sense of individuality...
... ally and chance...
... for such of the...
... line, not with...
... world...
... the Greek philosophy...
... for Aristotle...
... tradition as the...
... this book...
... Aristotle was...
... carry into the...
... of Aristotle...
... Aristotle's...
... of external...

71
72
73
74
75
76
77
78
79
80

human action in society. His views, as expressed in the Phaedo, show the concern not with the question of how an event came into being, but why. Socrates assumes that the reason of any order is to be found not in some previous state of things, from which it had emerged, but in some end or purpose that it could be shown to serve.

In Socrates we find a change in the subject matter of thought. He is not interested in the Nature of the Ionians, not interested in facts about the external world, but is concerned, rather, with man's soul. Socrates' reaction was, no doubt, against the excessive materialistic drift of the sciences. For this science had assumed that the whole universe is natural and that it is potentially within reach of knowledge; but the Ionian tradition had described a history of the birth of a world order out of an initial state of things which left out the Gods (ends).

The Ionians had described how an ordered world was evolved out of an undifferentiated initial state of things; this had led to an atomism which held that nothing is real except tangible bodies composed of atoms. Socrates, in reaction, turned his attention from the past to the future, conceiving of the universe and human life as processes towards an end: i.e., realizing how good one's soul is. Against the materialists he insisted that the true life is not the body but the soul, that the soul, furthermore, can know good from

evil and will infallibly choose the good.

Plato further developed the central germ of Socratic morality, spiritual aspiration.⁷³ The constant effort of the soul towards an ideal of perfection is the central human experience; this ideal can be defined and known and is, indeed, a non-temporal object of thought. Conford points out that in his 40th year Plato contacted Pythagorean communities, and thereafter begins to formulate a Platonic doctrine with greater concern for the nature of the Ideal than for the processes of aspiration towards it. He now comes to represent a complete break with the Ionian tradition of seeking the key to nature in mechanical cause impelling from behind; the ideal towards which we strive becomes a final cause which performs its function through its power of "attraction." Through contact with the Pythagoreans, Plato also became preoccupied with the character of mathematical form and saw in it the possible bridge between morality and science; mathematics became the necessary condition for any science of inanimate matter. This was not anthropomorphism, for inanimate matter was not construed as subject to our desires and our aspirations, but form

⁷³ Henri Bergson, The Two Sources of Morality and Religion (New York: Henry Holt & Co., 1946) describes Socratic morality as that of aspiration.

Handwritten scribbles in the top left corner.

Main body of the document containing several paragraphs of text, which is extremely faint and mostly illegible.

Religion (New Testament) ...
Scientific morality as that of ...

which was the clue to spirit was also, conceived in a different sense, the clue to the physical world.

It was after Plato's contact with the Pythagoreans that Aristotle, at the age of 17, entered the Platonic Academy. He remained until he was 37 and never ceased, thereafter, to be something of a Platonist. Indeed, he provides for us, ultimately, the final excess of the Socratic tradition; he carried it too far. Jaeger⁷⁴ and Case⁷⁵ have described in detail the course of Aristotle's development as a thinker: the long period of wholehearted acceptance of Platonism and reverence for Plato, the attempt, following his own compelling genius, to break with his master and his tradition, and eventually the achievement of an originality of his own which, in spite of his denial of it, retained the chief features of Plato and of the Socratic tradition. As Farrington points out,⁷⁶ Aristotle not only retains the Platonic Ideal Theory but attempts to transform it into an instrument for the study of the whole of nature. Though Farrington himself does not make the suggestion, it

⁷⁴ Werner Jaeger, Aristotle (Revised edition, Oxford: The Clarendon Press, 1948).

⁷⁵ T. Case, "Development of Aristotle," Mind, XXXIV (January, 1925).

⁷⁶ Farrington, op. cit.

is the conclusion of this study that in so attempting to extend the Platonic Idea Aristotle carried the whole Socratic notion to an excess by going beyond the scope to which Socrates and Plato had restricted it and therein lies the reason for the kind of dichotomy between form and individual we have seen in Aristotle.

See Midgely
 For he attempts to apply moral principles to the physical world and the attempt to build science on such a basis led Aristotle into the position of having to reconcile incompatible goals. Modern science as we know it could not develop until this excess was corrected and until, in Physics at least, there was a return to Plato's dictum, so completely denied by Aristotle, that mathematics is the necessary avenue of approach to any science of inanimate matter.

Throughout his mature life, after a period of writing Platonic dialogues himself in almost complete imitation of his master, he wrestled with the idea of Platonic Form. He himself, no doubt, believed that he denied separate existence to the Form and, further, he no doubt regarded this as the central point of his dissent from Platonism. For he did insist that forms could not have any existence apart from the visible and tangible things which embody them, that the substantial reality of things must

to the conclusion that this world is not
extended by itself. It is not
possible to say that the world is
which extends itself. The reason for
this is that the world is not
virtual in itself.

For in the world, the world is
physical world, and the world is
extended by itself. It is not
possible to say that the world is
extended by itself. The reason for
this is that the world is not
virtual in itself.

Throughout the world, the world is
extended by itself. It is not
possible to say that the world is
extended by itself. The reason for
this is that the world is not
virtual in itself.

reside in the things themselves, and that the world is not a fleeting likeness of unchanging reality, but is itself real and substantial. But his thought continues to the end to be governed by the idea of aspiration inherited by Plato from Socrates: i.e., that the true cause or explanation of things is to be found not in the beginning but in the end. Curiously enough, he retained the final causes and yet rejected the mathematics.

It is the suggestion of this study that Aristotle misunderstood Plato. The Form or the Idea in Plato did not have a substantial reality to begin with, and therefore Aristotle was fighting a straw man; it was ultimately a description of the fact that consciousness which is always in process is yet always coherent. The Idea is that towards which consciousness moves (i.e., its own fulfillment) and, acting in our experience as if it were real, it becomes for us the most real thing in the universe. But its reality lies only in the process. It is a description, ultimately, of the nature of human experience. Paradoxically, it is Aristotle who formulates the very notion to which he so strongly objected in Plato and which Plato himself never had: idea as substantial reality outside of process. For this is precisely a description of Aristotle's Prime Mover: outside of process and thus of experience (and for

...in the first instance, and then the second...
...a feeling of...
...real and...
...to be...
...from...
...things to...
...Curiously enough, he...
...referred the...

...it is the...
...independent...
...have a...
...Aristotle...
...description of...
...in process is...
...which...
...acting in our...
...as the most...
...the only...
...of the nature...

Aristotle who...
...strongly...
...but also...
...this is...
...most...
...of process...

this reason, for Plato at least, unknowable and irrelevant). In Aristotle the ultimate goal of aspiration is finally lifted out of process, and what was a meaningful metaphor to conceive of human moral experience becomes corrupted.

For Aristotle each species is a form; there is no overall form of the species. He apparently believed this for two reasons: (1) the Platonic precedent for a multiplicity of forms, and (2) because he had observed many different species and had never observed change in a species itself. Furthermore, for Aristotle, full form is prior to any subordinate part or function -- not in time but in order of being. Since this is so, no subordinate can change the fuller form; the individual is just such a subordinate part of the form of the species to which it belongs. A change of subordinate individuals would be necessary to change the form but the individuals could not change if the form did not. Change of species is therefore impossible. Given the assumptions, then, that each species is a form, and that full forms are prior to subordinate parts, a theory of evolution of the species becomes logically impossible.

The Platonic metaphor as given ontological status becomes Aristotle's basic presupposition, and because of

This reason, for...
...is...
...finally...
...respect to...
...concluded.

For...
...overall...
...for two...
...plenty of...
...different...
...itself.

any subordinate...
...order of...
...the fuller...
...pairs of...
...change of...
...change the...

the four did not...
...sided. Given...
...four, and...
...a theory of...
...inaccessible.

The...
...because...

* the constraint thus placed on empirical science Aristotle cannot have a theory of natural evolution; for this presupposition demands that the movement of life can be intelligible only when we conceive of process as governed by an inner end towards which it moves. The Form of the species, outside of process, can be, unfortunately, nowhere else than in the world of eternal reality, as the ideal limit to which individuals approximate, the perfect model of which they are imperfect likenesses.

* This is Aristotle, not Plato. Aristotle has thus set for himself an impossible task: the establishment of empirical sciences on presuppositions which have already determined the truth of what is to be observed. A theory of natural evolution of the species is one of the victims.

The general principle of the
cannot have a theory of
opposition does not mean
1818) only the
lines and curves
outside of the
when in the
which is
they are
This is
set for himself
empirical
determined
of natural

BIBLIOGRAPHY

Books

- Agassiz, Louis. The Structure of Animal Life. New York: Scribner, Armstrong and Company, 1874.
- Bakewell, Charles M. Source Book in Ancient Philosophy. Revised edition. New York: Charles Scribner's Sons, 1939.
- Bergson, Henri. The Two Sources of Morality and Religion. New York: Henry Holt and Co., 1946.
- Boas, George. Major Traditions in European Philosophy. New York and London: Harper & Brothers, 1929.
- Burnet, John. Early Greek Philosophy. Fourth edition. London: A. & C. Black, 1930.
- Cassirer, Ernst. An Essay on Man. New Haven: Yale University Press, 1944.
- _____. The Problem of Knowledge: Philosophy, Science, and History Since Hegel. New Haven: Yale University Press, 1950.
- Cherniss, Harold. Aristotle's Criticism of Plato and the Academy. 2 vols. Baltimore: The Johns Hopkins Press, 1944.
- _____. Aristotle's Criticism of Pre-Socratic Philosophy. Baltimore: The Johns Hopkins Press, 1935.
- Clodd, Edward. Pioneers of Evolution from Thales to Huxley. London: G. Richards, 1903.
- Cooper, Lane. Aristotle, Galileo, and the Tower of Pisa. Ithaca: Cornell University Press, 1935.
- Cornford, Francis Macdonald. Before and After Socrates. Cambridge: The University Press, 1950.

Agassiz, Louis, The Fishes of the United States, 1825
Baltimore, A. S. Lea & Co., 1825.

Bakewell, Thomas, The History of the English Language, 1790
Revised edition, New York, 1800.

Barton, John, The History of the English Language, 1790
New York: 1800.

Bass, George, The History of the English Language, 1790
London and Oxford: 1800.

Barnet, John, The History of the English Language, 1790
London: A. S. Lea & Co., 1800.

Cassiter, James, The History of the English Language, 1790
New York: 1800.

The History of the English Language, 1790
London: A. S. Lea & Co., 1800.

Christie, James, The History of the English Language, 1790
London: A. S. Lea & Co., 1800.

The History of the English Language, 1790
London: A. S. Lea & Co., 1800.

Clebs, Edward, The History of the English Language, 1790
London: A. S. Lea & Co., 1800.

Copier, James, The History of the English Language, 1790
London: A. S. Lea & Co., 1800.

Donford, James, The History of the English Language, 1790
London: A. S. Lea & Co., 1800.

- _____. The Origins of Greek Philosophical Thought.
Cambridge: The University Press, 1952.
- _____. Plato's Cosmology. New York: Humanities Press,
1952.
- Dampier, Sir William Cecil. A History of Science, and Its
Relation with Philosophy and Religion. Fourth edition.
Cambridge and New York: The University Press, 1949.
- _____. A Shorter History of Science. Cambridge and New
York: The University Press, 1945.
- Darwin, Charles. The Descent of Man and Selection in Rela-
tion to Sex. New York: A. L. Burt & Company, 1874.
- _____. Life and Letters. Edited by Francis Darwin. New
York: D. Appleton and Co., 1896.
- _____. On the Origin of the Species. New York: Philo-
sophical Library, 1951.
- Dewey, John. The Quest for Certainty. New York: Minton,
Balch & Co., 1929.
- Farrington, Benjamin. Greek Science; Its Meaning for Us.
2 vols. New York: Felican Books, 1949.
- Fothergill, Philip G. Historical Aspects of Organic Evolu-
tion. New York: Philosophical Library, 1953.
- Fuller, Benjamin A. G. History of Greek Philosophy. 2 vols.,
Revised edition. New York: Holt, 1945.
- Gomperz, Theodor. Greek Thinkers. Translated by Laurie
Magnus. 4 vols. London: J. Murray, 1901-1912.
- Grote, George. Aristotle. Second edition. London: John
Murray, 1880.
- Haldane, J. B. S. Causes of Evolution. New York: Harper &
Bros., 1932.
- _____. The Philosophical Basis of Biology. London:
Hodder & Stoughton, 1931.

Cambridge University Press
 1952
 Lectures on the Philosophy of Language
 by G. E. Hughes
 New York: The University Press
 Edwin, Ontario
 from to see
 W. York
 in the
 Lacey, John
 Baint
 Partridge, Horatio
 2 vols.
 Forthwell, John
 Palmer, Robert
 revised edition
 Gomers, Thomas
 Nassau
 Gode, George
 Murray, 1892
 Baldwin, J. P.
 1894
 The
 Boston



- Huxley, Julian. Evolution, the Modern Synthesis. New York: Harper & Brothers, 1943.
- Jaeger, Werner. Aristotle; Fundamentals of the History of His Development. Oxford: The Clarendon Press, 1934.
- Jowett, Benjamin, translator. The Dialogues of Plato. 2 vols. New York: Random House, 1950.
- Kapp, Ernest. Greek Foundations of Traditional Logic. New York: Columbia University Press, 1942.
- Loey, W. A. Biology and Its Makers. New York: H. Holt and Company, 1908.
- Lones, Thomas E. Aristotle's Researches in Natural Science. London: West, Newman & Co., 1912.
- McKeon, Richard P. "Aristotle and the Origins of Science in the West," Science and Civilization, Robert C. Stauffer, ed. Madison: University of Wisconsin Press, 1949, pp. 3-29.
- _____, ed. The Basic Works of Aristotle. New York: Random House, 1949.
- Nahm, Milton C. Selections from Early Greek Philosophy. New York: Appleton-Century-Crofts, Inc., 1947.
- Needham, Joseph, and Pagel, Walter. Background to Modern Science. Cambridge: The University Press, 1938.
- Organ, Troy. An Index to Aristotle in English Translation. Princeton: Princeton University Press, 1949.
- Osborn, Henry Fairfield. From the Greeks to Darwin: The Development of the Evolution Idea Through Twenty-four Centuries. Second edition, revised. New York and London: C. Scribner's Sons, 1929.
- Peck, Arthur L., et al., translators. Aristotle's Parts of Animals . . . Movement of Animals . . . Progression of Animals. Cambridge: Harvard University Press, 1945.
- Rackham, Harris, translator. Pliny's Natural History. 3 vols. Cambridge: Harvard University Press, 1939.

Handwritten text, likely bleed-through from the reverse side of the page. The text is extremely faint and mostly illegible due to the quality of the scan and the nature of the bleed-through. Some words are difficult to discern but appear to include names and possibly titles or dates.

BOARD

Handwritten text at the bottom of the page, possibly a signature or a date, which is also very faint and difficult to read.

- Radl, Emanuel. The History of Biological Theories. London: Oxford University Press, 1930.
- Reichenbach, Hans. The Rise of Scientific Philosophy. Berkeley: University of California Press, 1951.
- Ross, William David, ed. The Works of Aristotle. 12 vols. Oxford: Clarendon Press, 1908-1952.
- Royce, Josiah. Herbert Spencer, An Estimate and Review. New York: Fox, Duffield & Company, 1904.
- Sarton, George. A Guide to the History of Science. Waltham, Massachusetts: Chronica Botanica Co., 1952.
- _____. A History of Science; Ancient Science Through the Golden Age of Greece. Cambridge: Harvard University Press, 1952.
- _____. The Life of Science; Essays in the History of Civilization. New York: H. Schuman, 1948.
- Sears, Paul Bigelow. Charles Darwin; the Naturalist as a Culture Force. New York: Scribner's, 1950.
- Simpson, George. The Meaning of Evolution; A Study of the History of Life and of Its Significance for Man. New Haven: Yale University Press, 1949.
- Singer, Charles Joseph. Short History of Biology. Oxford: The Clarendon Press, 1931.
- Smith, Homer W. From Fish to Philosopher. Boston: Little, & Co., 1953.
- Taylor, A. E. Evolution in the Light of Modern Knowledge. London: The Macmillan Company, 1925.
- Temkin, Owsei, "Metaphors of Human Biology." Science and Civilization, Robert D. Stauffer, ed. Madison: University of Wisconsin Press, 1949.
- Toynbee, Arnold J. Greek Civilization and Character; The Self-Revelation of Ancient Greek Society. Second edition. Boston: Beacon Press, 1950.

1841, New York, 1841
Oxford, England, 1841

1842, New York, 1842
Oxford, England, 1842

1843, New York, 1843
Oxford, England, 1843

1844, New York, 1844
Oxford, England, 1844

1845, New York, 1845
Oxford, England, 1845

1846, New York, 1846
Oxford, England, 1846

1847, New York, 1847
Oxford, England, 1847

1848, New York, 1848
Oxford, England, 1848

1849, New York, 1849
Oxford, England, 1849

1850, New York, 1850
Oxford, England, 1850

1851, New York, 1851
Oxford, England, 1851

1852, New York, 1852
Oxford, England, 1852

1853, New York, 1853
Oxford, England, 1853

1854, New York, 1854
Oxford, England, 1854

1855, New York, 1855
Oxford, England, 1855

1856, New York, 1856
Oxford, England, 1856

1857, New York, 1857
Oxford, England, 1857

- _____, translator. Greek Historical Thought From Homer to the Age of Heraclitus. New York: New American Library, 1952.
- Turner, Ralph. The Ancient Cities. Vol. I: The Foundations of Civilization. New York: McGraw-Hill Book Company, Inc., 1941.
- Weber, Alfred. History of Philosophy, Frank Thilly, translator. New York: C. Scribner's Sons, 1896.
- Wightman, William P. D. The Growth of Scientific Ideas. Edinburgh: Oliver and Boyd, 1950.
- Windelband, Dr. W. A History of Philosophy With Special Reference to the Formation and Developments of its Problems and Conceptions. Second edition, revised and enlarged. New York and London: Macmillan Co., 1893.

Articles

- Alexander, H. G. "Concerning a Postulate of Fitness," Philosophy and Phenomenological Research, XIV (March, 1954), 309-318.
- Balme, D. M. "Greek Science and Mechanism," Classical Quarterly, XXXIII (July, 1939), 129-138.
- Bloch, H. A. "Theophrastus, Nemoi, and Aristotle," Harvard Studies in Classical Philology Supplement, I (1940), 355-376.
- Boas, George, "Aristotle's Presuppositions About Change," American Journal of Philology, LXVIII (October, 1947), 404-413.
- _____. "A Basic Conflict in Aristotle's Philosophy," American Journal of Philology, LXIV (April, 1943), 172-194.
- _____. "Presuppositions of Aristotle's Metaphysics," American Journal of Philology, LV (January, 1934), 36-48.
- _____. "Presuppositions of Aristotle's Physics," American Journal of Philology, LVII (January, 1936), 24-32.

to the ... of ...

... of ...

... of ...

... of ...

... of ...

... of ...

... of ...

... of ...

... of ...

... of ...

... of ...

... of ...

... of ...

- _____. "Some Presuppositions of Aristotle's Psychology," American Journal of Philology, LVIII (July, 1937), 275-281.
- Case, T. "Development of Aristotle," Mind, XXXIV (January, 1925), 80-86.
- Cherniss, Harold, "The Philosophical Economy of the Theory of Ideas," American Journal of Philology, LVII (October, 1936), 445-456.
- Cornford, Francis Macdonald. "Anaxagoras' Theory of Matter," Classical Quarterly, XXIV (1930), 15.
- Field, G. C. "Aristotle's Account of the Origin of the Theory of Ideas," Classical Quarterly, XVII (July, 1923), 113-124.
- Frank, E. "Fundamental Opposition of Plato and Aristotle," American Journal of Philology, LXI (January, 1940), 34-53; (April, 1940), 165-185.
- Huxley, Julian. Book Review of Life of the Past by George Gaylord Simpson, Scientific American (August, 1953), 88-90.
- Jaeger, Werner. "Aristotle's Verses in Praise of Plato," Classical Quarterly, XXI (January, 1927), 13-17.
- Koyré, Alexander. "Galileo and Plato," Journal of the History of Ideas, IV (October, 1943), 400-428.
- McKeon, Richard. "Aristotle's Conception of the Development and the Nature of Scientific Method," Journal of the History of Ideas, VIII (January, 1947), 3-45.
- _____. "Communication and Community as Philosophy," Ethics, LXIII (April, 1953), 190-206.
- Petronijević, Branislav. "The Historic Development of the Evolutionary Idea," in Smithsonian Institution. Annual Report of the Board of Regents for the Year Ending June 30, 1921, 325-334.
- Flochmann, George Kimball, "D'Arcy Thompson: His Conception of the Living Body," Philosophy of Science, XX (April, 1953), 62-67.

1927

1928

1929

1930

1931

1932

1933

1934

1935

1936

1937

1938

1939

1940

1941

- _____. "Nature and the Living Thing in Aristotle's Biology," Journal of the History of Ideas, XIV (April, 1953), 167-190.
- Rogers, A. K. "Note on Socrates and Aristotle," Mind, XXXIV (October, 1925), 471-475.
- Shorey, P. "Aristotle on Coming To Be and Passing Away," Classical Philology, XVII (October, 1922), 334-352.
- _____. "Note on the Evolution of Aristotle," Classical Philology, XXII (October, 1927), 420-423.
- Solmsen, Freidrich. "Aristotle's Syllogism and Its Platonic Background," The Philosophical Review, LX (October, 1951), 563-572.
- _____. "Tissues and the Soul," The Philosophical Review LIX (October, 1950), 435-469.
- Torrey, Harry Beal, and Felin, Frances, "Was Aristotle an Evolutionist?" The Quarterly Review of Biology, XII (March, 1937), 1-18.
- Vlastos, Gregory, "The Physical Theory of Anaxagoras," The Philosophical Review, LIX (January, 1950), 31-57.
- _____. "Slavery in Plato's Thought," The Philosophical Review, L (May, 1941), 289-304.
- Wiener, Philip Paul, "The Tradition Behind Galileo's Methodology," Osiris, I (1936), 733-746.
- Williams, Gardner, "Naturalistic Metaphysics and the Two Evolutions of Man," Philosophy and Phenomenological Research, XIV (December, 1953), 221-227.
- Williams, M. V. "Aristotle, the Heir of Platonism," London Quarterly Review, CLIII (April, 1930), 226-242.

Unpublished Manuscripts

- McKeon, Richard P. "The Philosophy of Aristotle."
- Flochmann, George Kimball. "Herbert Spencer: The Concepts and Methods of His Biology."

MILERS BALLE
ESERASE
COTTON COUNTRY

IMPORTANT!

Special care should be taken to prevent loss or damage of this volume. If lost or damaged, it must be paid for at the current rate of typing.

Date Due	
JUL 3 1959 JUL 8 RECD	APR 24 RECD JUN 3 - 1962
SEP 17 1960	MAY 20 RECD JUN - 9 1962
SEP 15 RECD	MAY 31 RECD MAY 24 1963
MAY 27 1961	MAY 27 RECD Sept 15, 1963
MAY - 6 RECD	SEP 17 RECD HF
NOV 10 1961	JUN 2 1964 JUN 3 RECD
NOV 7 - RECD	JUL 31 1964
JAN 15 1962	JUL 17 RECD
JAN 19 RECD	DEC - 4 1964
MAR 10 1962	NOV - 7 RECD

198

PRINTED IN U.S.A.

