A THESIS ON

DIALECTICS AND EXPERIMENTAL BIOLOGY

SUBMITTED TO THE FACULTY OF PHILOSOPHY

LAVAL UNIVERSITY

IN

PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR THE

DOCTORATE IN PHILOSOPHY

QUEBEC

1941

CONTENTS

FIRST PART

SECOND PART

FIRST PART

CHAPTER I

THE PROBLEM OF SCIENTIFIC METHODOLOGY

Experimental biology has such thoroughly convincing justifications, as in medicine, agriculture, and industry, that those men who are the most deeply interested in biology have failed to make a critical analysis of its principles. "Nothing is more striking in this science than the contrast between the brilliant skill, ingenuity, and care bestowed upon observation and experiment, and the almost complete neglect of caution in regard to the definition and use of the concepts in terms of which the results are expressed."(1) It is, nevertheless, this very confused substratum of biology which through Darwinism has laid an exhaustive claim to our whole life. The claim was possible only because of the confusion.

Logically enough, champions of the newer forms of materialism, such as Marxism, pragmatism, logical positivism, have given more thought to the underlying principles of experimental biology than those who claim to pursue knowledge primarily for its own sake, and they have indeed made the greater contributions. The layman is under the impression that these forms of materialism are the only ones favoured by our present knowledge.

More recently there have been most healthy reactions.

---

(1) C.Woodger, Biological Principles, N.Y., 1929, p.3. Cf. Appendix II for a resumé of this work.

We call attention to W.R. Thompson's SCIENCE AND COMMON SENSE. (1) He does not show however just where the method of experimental biology fits into the Aristotelian scheme which he describes. The present thesis is an attempt to set forth in Aristotelian terms the kind of knowledge we acquire in biology.

There is a body of principles upon which all modern biologists agree, such as the primacy of experience, the ever provisional character of definitions and of generalisations, the need to test again and again principles which never stand for the ultimate truth. In other words, experimental biology is not merely a quest for conclusions. It must forever question its very principles. However, the questions 'Is the cell the unit of life?' and 'Are all the generalisations provisional?' are of a different order. The latter is taken from a body of principles which we call methodological. The former is chosen from a body of principles arrived at by experimental investigation and reasoning. And even if we held experimental principles on purely historical grounds as statements of past facts which would be plausible for the future, they would nevertheless be of a different order than those of the methodological kind. For the former relate to the very subject matter of experimental biology, whereas the latter bear on the nature of biological knowledge as such.

---

(1) W.R. Thompson, Science and Common Sense, London, 1937.

Let us suppose that these methodological principles are true. Does it follow that they are to be extended to all fields of knowledge? If the biologist is to know just what he knows, he must have some idea on this problem. Either the kind of knowledge he acquires is the very archetype of science, or it is merely a part of a more general scheme to which it has some definite relation.

But it is especially the catholic biologist who should know the nature of the knowledge he acquires through the experimental method. What would he think of the following statement of Claude Bernard: "The requisite for a scientist who undertakes the investigation of natural phenomena is that he reserve for himself a liberty of mind which rests on philosophical doubt. It is not necessary, however, to be a sceptic; it is necessary to believe in science, that is to say, in determinism, in an absolute, necessary relation underlying the phenomena proper to living beings, as well as to all other beings; but it is necessary at the same time to be thoroughly convinced that we have this relation only in a manner more or less approximative, and that the theories which we possess are far from representing unchangeable truths. When we construct a general theory in our sciences, the sole thing of which we are certain, is that all these theories are, absolutely speaking, false. They are only partial and provisional truths, which are necessary for us, as steps on which we rely in order to advance in our investigation; they represent

simply the actual state of our knowledge, and consequently they must be modified with the growth of science, and so much more often as the sciences are less advanced in their evolution." (1)

For the work of Bernard, the eminent Catholic scientist Louis Pasteur had the highest admiration. He considered it the most illuminating, complete, and profound work ever written on the principles of experimentation. He predicted that its influence in the scientific field would be very great. (2) Does the Catholic biologist realize the implications of Bernard's Introduction? Could he extend this method to all fields? If not, why not? Does he realize the consequences of the generalisation of the hypothetico-deductive method? Does he know where his science fits in with the only philosophy recommended by the Church? Is not the logic of the scientist in open conflict with what is today called traditional logic?

The Catholic biologist has another problem in finding someone to answer these questions correctly. What answers would he receive from the teacher of Scholastic philosophy? Is the latter sufficiently acquainted with the method of experimental biology? Would he not for the most part cramp this method in an attempt to save his own which seems to be

---

(1) C. Bernard, Introduction à l'Etude de la Médecine Expérimentale, (Ballière et Fils), Paris, 1865, p.63.

(2) C. Bernard, Introduction etc., (Delagrave), Paris, 1937; cf. The Introduction by M. Dorolle, p.20.

challenged? Would it occur to him that the answers might lie in those parts of traditional logic which have been completely ignored in our schools?

There is one important fact which we should recognize. The scientists themselves, although as a rule inadequately trained in philosophy, have thrown the greater light on the material to be used in determining the nature of their knowledge. Their contribution, however, remains purely instrumental. We shall take Eddington for an example. In his most important work, which is also the best we know on the nature of physical science, he starts off by stating the subject of his work:

> "Between physics and philosophy there lies a debatable territory which I shall call scientific epistemology. Epistemology is that branch of philosophy which treats of the nature of knowledge. It will not be denied that a significant part of the whole field of knowledge is that which has come to us by the methods of physical science. This part takes the form of a detailed description of a world — the so-called physical universe. I give the name 'scientific epistemology' to the sub-branch of epistemology which deals with the nature of this part of our knowledge, and therefore indirectly with the nature and status of the physical universe to which it formally relates.
>
> There are two matters of definition which it is desirable to make clear at the outset.
>
> Some writers restrict the term 'knowledge' to things of which we are quite certain; others recognise knowledge of varying degrees of uncertainty. This is one of the common ambiguities of speech as to which no one is entitled to dictate, and an author can only state which usage he has himself chosen to follow. If 'to know' means 'to be certain of', the term is of little use to those who wish to be undogmatic. I therefore prefer the broader meaning; and my own usage will recognise uncertain knowledge.

> Anything which would be knowledge if we were assured of its truth, is still accounted as knowledge (uncertain or false knowledge) if we are not assured.
>
> It will not be necessary for us to formulate a general definition of knowledge. Our procedure will be to specify a particular collection of more or less widely accepted knowledge, and then to make an epistemological study of its nature." (1)

But the critical reader encounters in the very beginning of the work a difficulty which will only increase as he reads on. This is so not merely because Eddington does not state what he means by philosophy, but more precisely because he explicitly puts aside a question upon which will depend the very meaning and truth of his far reaching conclusions. He says: "It will not be necessary for us to formulate a general definition of knowledge." But if we are left in confusion about what knowledge is, how can we be clear about scientific knowledge? The avoidance of such fundamental issues leaves the reader in suspense, and increases the already too great confusion on scientific knowledge. If all knowledge were of the type he analyses in this work, we would consider his general idealist philosophy well-grounded. But as it stands, his conclusion is a 'latius hos'. Physical science as he describes it is dialectical. Dialectics as we understand it is a type of knowledge whose generalisation would amount to idealism and ultimately to dialectical materialism; but the generalisation itself would depend in the end upon the definition of knowledge. While we agree with his analysis of

---

(1) A.Eddington, The Philosophy of Physical Science, New York, 1939, pp.1-2.

the nature of physical science, we are in complete disagreement about the principles he should invoke to warrant his generalisation. On the other hand, we can use his analysis to situate this type of knowledge in our general scheme. We can do as much with Claude Bernard's analysis of the experimental method in biology.

Whence this breach between philosophy and what is now called the sciences? We shall make no attempt to give the underlying causes, but we may indicate some historical facts. The first is the absorption of philosophy of nature by metaphysics. We are not merely referring to Wolff and his scholastic followers, but to earlier scholastics such as Fonseca, Vasquez, Suarez, whose notion of chance, movement, and final cause, made philosophy of nature superfluous as a distinct science.

But why should the absorption of philosophy of nature by metaphysics entail a complete breach between philosophy as we understand it and the sciences? By reducing philosophy of nature to metaphysics, we neglect that <u>movement of concretion</u> proper to philosophy of nature, according to which the experimental sciences are but an extension of philosophy of nature. For as Saint Thomas shows in his commentary on Aristotle's book De Sensu et Sensato:

> "Quia habitus alicujus potentiae distinguuntur specie secundum differentiam ejus quod est per se objectum potentiae, necesse est quod habitus scientiarum, quibus intellectus perficitur, etiam distinguantur secundum differentiam separationis a materia; et ideo Philosophus in sexto Metaphysicorum distinguit genera scientiarum secundum diversum modum separationis a materia. Nam ea, quae sunt separata a materia secundum esse et rationem, pertinent ad metaphysicum;

"quae autem sunt separata secundum rationem et non secundum esse, pertinent ad mathematicum; quae autem in sui ratione concernunt materiam sensibilem, pertinent ad naturalem.

Et sicut diversa genera scientiarum distinguuntur secundum hoc quod res sunt diversimode a materia separabiles, ita etiam in singulis scientiis, et praecipue in scientia naturali, distinguuntur partes scientiae secundum diversum separationis et concretionis modum. Et quia universalia sunt magis a materia separata, ideo in scientia naturali ab universalibus ad minus universalia proceditur... Unde et scientiam naturalem incipit tradere ab his quae sunt communissima omnibus naturalibus quae sunt motus et principium motus; et deinde procedit per modum concretionis, sive applicationis principiorum communium, ad quaedam determinata mobilia, quorum quaedam sunt corpora viventia..." (1)

Hence the order of the various parts of philosophy of nature:

"Naturalis philosophia de naturalibus est; naturalia autem sunt quorum principium est natura; natura autem est principium motus et quietus in eo in quo est; de his igitur quae habent in se principium motus, est scientia naturalis... Necessarium fuit quod primo traderetur in scientia naturali unus liber, in quo tractaretur de his quae consequuntur ens mobile in communi... Hic autem est liber Physicorum... cuius subjectum est ens mobile simpliciter... et ideo statim in principio libri de Caelo, qui sequitur ad istum, incipitur a notificatione corporis. Sequuntur autem ad hunc librum alii libri scientiae naturalis, in quibus tractatur de speciebus mobilium; puta in libro de Caelo de mobili secundum motum localem, qui est prima species motus; in libro autem de Generatione, de motu ad formam et primis mobilibus, scilicet elementis, quantum ad transmutationes eorum in communi; quantum vero ad speciales eorum transmutationes, in libro Meteororum, de mobilibus mixtis inanimatis, in libro de Animalibus, de animatis vero, in libro de Anima et consequentibus ad ipsum." (2)

Continuing this movement of concretion in the study of living

---

(1) St. Thomas, In De Sensu et Sensato, Lib.I, lec. 1, No.2-3.

(2) St. Thomas, In Primum Librum Physicorum Aris., Lib. I, lec. 1, No.3-4.

things. Aristotle proceeded as follows:

> "Nam primo quidem consideravit de anima secundum se, quasi in quadam abstractione. Secundo considerationem facit de his quae sunt animae secundum quamquam concretionem, sive applicationem ad corpus, sed in generali. Tertio considerationem facit applicando omnia haec ad singulas species animalium et plantarum, determinando quid sit proprium unicuique speciei. Prima igitur consideratio continetur in libro de Anima. Tertia vero consideratio continetur in libris quos scribit de Animalibus et Plantis. Media vero consideratio continetur in libris, quos scribit de quibusdam, quae pertinent communiter, vel ad omnia animalia, vel ad plura genera eorum, vel etiam ad omnia viventia." (1)

The scholastics then have for centuries been living in a universe segregated from the concretion of matter. But when we do have such a conception of philosophy of nature, it is because we have a false notion of abstraction both in metaphysics and in philosophy of nature. Hegelian idealism, as a substitute for metaphysics and philosophy of nature, is really the logical outcome of this process, where concretion is derived from logical abstraction by means of an abstract dialectical movement. To consider philosophy of nature as a branch of metaphysics, and even in practice to teach metaphysics before philosophy of nature is in fact an idealistic procedure.

Now it is true that some authors have maintained the distinction between philosophy of nature and metaphysics, but of the former they have retained merely the first part made up of generalities on the principles of mobile being. What is treated in Book II of the Physics is generally overlooked, namely the analysis

---

(1) St. Thom., De Sensu et Sensato, loc. cit.

of the definition of nature; of the sciences subalternated to mathematics; of chance and fortune; and of final cause in nature and in demonstration.

As to Book III of Aristotle's Physics, these same authors make no thorough study of the difficult problem of motion. Instead of leading us on to a closer study of natural beings, our philosophy of nature chokes off if it has to speak of more than generalities.

Let us consider the term dialectics, which is sometimes used as a synonym for Logic as such. In fact we have restricted Logic to the Prior and Posterior Analytics. The important section of the Perihermeneias on name and verb has been rather thoroughly neglected. The Dialectics proper of the Topics, and the treatise on Sophistry, have been reduced to a few negligible lines in most text-books. Is it any wonder, then, that we have failed to see that the hypothetico-deductive method applied in modern mathematics and in the experimental sciences is really dialectical; and that as dialectical this method is opposed to the demonstrative method of the Posterior Analytics.

There is a connection between the neglect of concretion in philosophy of nature and the neglect of dialectics in the teaching of logic. For it is as we approach natural beings in what they have from matter, that our discourse becomes of necessity more and more dialectical. Let us consider a concrete case, that of definition in philosophy of nature.

"Aliquando enim datur aliqua definitio, in qua nihil est ex parte corporis, sicut quod ira est appetitus vindictae; aliquando assignatur aliqua definitio, in qua est aliquid ex parte corporis seu materiae, sicut quod ira est accensio sanguinis circa cor. Prima est dialectica. Secunda vero est physica, cum ponuntur in ea aliquid ex parte materiae; et haec pertinet ad naturalem. Ita enim, scilicet: physicus assignat materiam, cum dicit, quod est accensio sanguinis circa cor. Alius vero, scilicet dialecticus, ponit speciem et rationem. Hoc enim, scil. appetitus vindictae, est ratio irae.

Quod autem definitio prima sit insufficiens, manifeste apparet. Nam omnis forma, quae est in materia determinata, nisi in sua definitione ponatur materia, illa definitio est insufficiens; sed haec forma, scil. appetitus vindictae, est forma in materia determinata: unde cum non ponatur in ejus definitione materia, constat quod ipsa definitio est insufficiens. Et hoc necesse est ad definitionem, quod in definitione ponatur hoc, scilicet forma, esse in materia huiusmodi, scil. determinata." (1)

Consequently, definitions by form alone in philosophy of nature are merely dialectical. To be natural, a definition must also comprise the matter, as we have just seen. Now the matter to be defined and whose definition together with the definition of the form will constitute a natural definition, is not matter considered in its indeterminancy, but rather elements, or organized matter; as is clear from the definition of the soul:

"Anima est actus primus corporis physici organici potentia vitam habentis." (De Anima, II, 1, 412a-30.)

It seems that it is the definition of this matter of natural beings which the evolution of the experimental sciences has proven to be dialectical. Hence in this field of extreme concretion, our definitions remain afloat both as to form and matter.

---

(1) St. Thom., In Lib. De Anima, (Marietti) Turin, 1926, Lib. I, lec. 2, No. 24-25.

They do not go beyond a dialectical stage. The modern scientist would say the same thing by claiming that he is free. And so, what Saint Thomas taught on suppositions in astronomy seems to have a much wider application than could be suspected in his times.

Dialectics was very much alive when the whole of philosophy was still in a stage of becoming. The definite form which philosophy took on, by reason of certain fundamentals in metaphysics and in the prior part of philosophy of nature, caused dialectics to be entirely overlooked. John of Saint Thomas himself says:

> "In secunda vero parte (artis logicae) agimus de his, quae pertinent ad materiam logicalem seu ad posterioristicam resolutionem, maxime in demonstratione, ad quam praecipue ordinatur logica." (1)
>
> "quae enim pertinent ad partem topicam, quae agit de probabilibus, et quae pertinent ad libros Elenchorum, qui agunt de parte sophistica, constituntur in dialectici, quia non agunt de certa et perfecta resolutione iudicii, et ideo solum libri Priorum et Posteriorum vocantur analytici ab Aristotele..." (2)

Yet in his times, the new interest in nature had compelled the scientists to use dialectics, although these scientists were themselves unaware of it. This has been shown by Duhem. But neither did the latter realize how this dialectic bent on saving the appearances of things (ad salvandas apparentias) was really an application of the fundamentals of Topics.

---

(1) John of S.Thom., Logic, Rome, 1930, Part I, Prologue, p.5.

(2) John of S.Thom., op. cit., Part II, proemium, p.250. (Reiser Edition).

A deeper study of the nature of dialectics is the proper clue to a better understanding of the method of experimental science. The purpose of this thesis is to show that the kind of knowledge acquired in the field of modern biology, by the application of the experimental method, is really dialectical.

CHAPTER II

KANT AND APRIORISM

> "But if it were necessary to choose a leader from among the older philosophers, there can be no doubt that our choice would be Kant. We do not accept the Kantian label; but, as a matter of acknowledgement, it is right to say that Kant anticipated to a remarkable extent the ideas to which we are now being impelled by the modern development of physics." Eddington. (1)

The methodology of experimental science does recognize a fundamental principle usually associated with Kant: A priori knowledge, which Eddington defines as "knowledge which we have of the physical universe prior to actual observation of it", (2) and which had already lead him to repeat Kant in saying: "We have found that where science has progressed the farthest, the mind has but regained from nature that which the mind has put into nature". (3)

Commenting on the Posterior Analytics of Aristotle (4) St. Thomas shows the difference between Metaphysics, Logic, and Dialectics:

> "Sciendum tamen est quod alia ratione dialectica est de communibus et logica et philosophia prima. Philosophia prima enim est de communibus, quia eius consideratio est circa ipsas res communes, scilicet circa omnia quae in rebus sunt habet negotiari ratio,

---

(1) A.Eddington, The Philosophy of the Physical Sciences, N.Y., 1939, pp.188-189.

(2) Eddington, op.cit., p.24.

(3) Eddington, Space, Time and Gravitation, p.201.

(4) St.Thomas, In Post. Anal. Aris., Lib. I, lec. 30.

> logica autem est de operationibus rationis; logica etiam erit de his, quae communia sunt omnibus, idest de intentionibus rationis, quae ad omnes res se habent. Non autem ita, quod logica sit de ipsis rebus communibus, sicut de subiectis. Considerat enim logica, sicut subiecta, syllogismum, enunciationem, praedicatum, aut aliquid huiusmodi. Pars autem logicae, quae demonstrativa est, etsi circa communes intentiones versatur docendo; tamen usus demonstrativae scientiae non est in procedendo ex his communibus intentionibus ad aliquid ostendendum de rebus, quae sunt subiecta aliarum scientiarum. Sed hoc dialectica facit, quia ex communibus intentionibus procedit arguendo dialecticus ad ea quae sunt aliarum scientiarum, sive sint propria sive communia, maxime tamen ad communia. Sicut argumentatur quod odium sit in concupiscibili, in qua est ira, ex hoc quod contraria sunt circa idem. Est ergo dialectica de communibus non solum quia pertractat intentiones communes rationis, quod est commune toti logicae, sed etiam quia circa communia rerum argumentatur. Quaecumque autem scientia argumentatur circa communia rerum, oportet quod argumentatur circa principia communia, quia veritas principiorum communium est manifesta ex cognitione terminorum communium, ut entis et non entis, totius et partis, et similium."

Now to proceed from intentions of the mind to things is obviously to anticipate reality, and to move from mental constructs to things. And in this respect Dialectics differs from both Metaphysics and Demonstrative Logic. In the first Introduction to the Critique of Pure Reason, Kant seems to identify Metaphysics with Dialectics. If such were the case, and since the conclusions of Metaphysics cannot be verified in an experimental manner, Metaphysics would be merely bad dialectics. Overlooking the fact that the second intentions of Logic are based on first intentions, without which the former are nonsense, and having given the second intentions the status of first, he again confuses Logic with Metaphysics.

Kant declares that if Aristotle's Logic has remained unchanged, it is because the mind is therein unconditioned and independent of objects, proceeding entirely *a priori*. The sciences will share the certainty and definiteness of Logic in the measure that the mind can extend this *a priori* procedure to their objects. Kant says:

> "Mathematics and physics are two types of theoretical knowledge which must determine *a priori* their object; the first in an entirely pure fashion, the second at least in part and to the extent that the other source of knowledge, than the reason, permit it to do so.
>
> Mathematics from the most remote times which the human reason can recall, has followed in the company of the Greeks, the sure way of science. But one should not think that it was just as easy for Mathematics as for Logic in which the reason has to attend only to itself, to find, or better, to open for itself this royal road. I believe, rather, that mathematics was feeling its way for a long time, especially with the Egyptians, and that this change was the effect of a revolution due to one man alone, who conceived the happy idea of a trial after which there was no longer any reason for being deceived as to the sure road to follow; and so the certain way of science was opened and traced for all times and for infinite distances. The history of this intellectual revolution a great deal more important than the discovery of the route around Cape of Good Hope, - the history of this man who had the good fortune to discover the route, have not come down to us in detail. Nevertheless, the tradition which Diogenes Laertius, naming at the same time the supposed discoverer of the most simple elements of geometric demonstrations which, following the common opinion, have no need of proof, - this tradition proves that the remembrance of the change effected in the first step of the way newly discovered was due to appear extremely important to the mathematicians, and was saved for that reason from oblivion The first one who demonstrated the isosceles triangle, (who was Thales, or some other person,) struck a great light; for he found that it was not necessary to attach oneself to what he saw in a figure, or even to any simple concept which he had of the figure, but that

he should engender or construct this figure by means of what he would think on this subject and would represent a priori in his concepts, and that in order to know with certitude a thing a priori, he must attribute to that thing only what would derive necessarily from what he had put therein, in consequence of his concept.

"Physics has found more slowly the broad road to science; for it is scarcely more than a century and a half ago that the ingenious attempt of Bacon, Baron of Verulam, in part provoked, (because there was already the trace of it,) and in part stimulated again this discovery, which cannot be explained except by a sudden revolution in the ways of thinking. I wish here to consider physics only in so far as it is founded on empirical principles.

When Galileo rolled balls down an inclined plane with an acceleration determined and chosen by himself, when Torricelli attributed to the air a weight which he computed as equal to the weight of a known column of water, or when later Stahl transformed metals into lime, and the latter in turn into a metal, by separating and adding certain elements, then there was a new light for all physicists. They understood that reason discovers only what it produces itself according to its own designs; it must take the lead with principles which determine its judgements according to constant laws, and force nature to respond to its questions, instead of leaving itself be conducted by nature as on a string; for otherwise our observations made at random and without any plan traced beforehand would never lead to a necessary law, which the reason nevertheless looks for and demands. The reason must present itself before nature holding in one hand its principles which alone are able to give the concordant phenomena the authority of law, and in the otherhand it must hold the experiment such as it has planned according to the same principles. Reason demands to be informed not as a school boy who binds himself to speak only what pleases the teacher, but as a judge on his bench, who constrains the witnesses to answer the questions put to them. Physics, therefore, is indebted to the happy revolution which has occurred to its method by this simple idea, that it must hunt for (and not imagine) in nature, conformably to the ideas which the reason itself brings to it, what reason ought to learn of nature, of which it can never learn anything simply by itself. It is thus that Physics enters for

the first time upon the sure road of science, after groping along for so many centuries." (1)

Clearly this procedure falls under the heading of what Aristotle calls dialectics. But in the latter conception, knowledge acquired through the application of dialectics remains either vague when certain, as in the example given by St. Thomas; or merely probable when attempting precision. It remains a "pis aller". And while we might call it a powerful substitute for ignorance, it is by its very nature provisional. It is indeed knowledge by anticipation; vague knowledge is an anticipation of precise knowledge, and opinion is an anticipation of certainty; and verisimilitude of truth. But the latter remains the measure and the first principle. A hypothesis is good, not because the mind posits it, but rather because it may be tested by experience, or because experience confirms it. The a priori of Aristotelian dialectics is therefore the very contrary of Kant's.

It should be noted however that since Kant did adhere to Newtonian physics as to something definite whose principles would remain unchanged, he failed to recognize the ever provisional character of the kind of knowledge that he fostered. The history of the experimental sciences shows them to be dialectical in the Aristotelian sense, rather than in the Kantian.

Nevertheless, the substance of Kant's specific position has been maintained by contemporary authors both idealists and

---

(1) E. Kant, Critique of Pure Reason, preface to the second edition.

materialists, who see in the provisional character of scientific principles a deeper emancipation of man. Vagueness and uncertainty are declared signs of the freedom of our mind, and of the highest form of wisdom. I shall give a few examples of this attitude.

The first I take from F.C.S. Schiller:

> 'The mental attitude which entertains hypotheses on the other hand, and can take 'fact' as hypothetical and possibly unreal, means an intellectual revolt against mere givenness. It has become critical in appearances, and has partially freed itself from the oppression of brute fact. It meets reality with an active response, and does not merely submit to whatever comes along. It feels free to anticipate reality by its guesses, to question it, to experiment, to distrust and doubt appearances, to rearrange the world at least in thought, to play with it, and with itself. For hypothesis is a sort of game with reality, akin to fancy, make-believe, fiction, and poetry. In the hypothetical attitude 'facts' have ceased to be accepted on face value, to be just fact, and become capable of being symbols, whose suggestions are more important than their bare existence. Whatever they may be in reality, they are no longer fixed in the mind, but afloat; not being fixed ideas they can be moved about and played with. But, like games in general, this play has a serious function. By loosening the connexion between what the real is (or seems) and what we think about it, it enables us to think it other, and better, than it is; and so, guided by our hypotheses and 'ideals' (which are postulates), we can set to work to make it other, and better, than it was.' (1)

The second example is taken from Abel Rey who writes on the evolution of thought. Having described the various stages from primitive times, he finally comes to the sixth stage in which

---

(1) F.C.S. Schiller, HYPOTHESIS, Studies in the History and Method of Science, Oxford, 1921, Vol. II, pp. 429-431.

the mind is absolutely free even of first principles.

> "The present era announces a new liberation, as profound perhaps as the two previous ones. It aims at these immutables, these mathematico-physical absolutes. There is no longer a tool that serves the intellect, except the intellect itself in its inventive omnipotence. The universalisation of the hypothetico-deductive method, in its broadest signification, is the logical illustration of it. An order forever temporary and relative. It dilates accordingly to correspond to the relations discovered by intuitions ever more rich and profound. It renews itself by changing, whenever necessary, even its very foundations. Logic, a collection of rational formulas, appears no longer as an architectural conception constructed once and for all into an unchangeable unity resting on an eternal foundation. Thought must constantly be ready to build on new foundations, or to modify the arrangement of the edifice, and consequently, to complete, to adjust, and to renew its tools.(1)

Tobias Dantzig maintains a similar position:

> "The abandonment of the naive realism of the classical period of science entails the abandonment of the absolute; and when I say the abandonment of the absolute, I mean not only space, time, and matter, but absolute certainty and - I may as well say it - absolute truth too. What remains is but a universe of discourse, a playground for the human mind.
>
> That the physical sciences have at all survived this drastic revision is entirely due to the flexible mental apparatus with which the mathematician has supplied them: for mathematics is sublimely indifferent whether the forms in which it deals represent significant statements or are but empty shells which can contain everything or nothing. In some such shell modern physics has found a refuge.

---

(1) Abel Rey, L'OUTILLAGE MENTAL, Encyclopédie française, Paris, 1937, pp.1'20.10 - 1'20.11.

> The physical sciences have avoided a catastrophe by a series of sacrifices. They have recognized that the rational permanent frame in which they have sought to confine the universe is an elusive squirming web; they waived the right to deal in significant statements; they have pledged to confine themselves to formal relationships between entities which derive their existence from mathematical equations, and mathematical instruments, graduated and calibrated to conform with these equations. The scientist has resigned his mission to unravel the chaotic universe of man's sense-impressions; he is now engaged in an intellectual game which is being played with hypothetical scales, clocks, and quanta in the shadowland of number, form, and change."(1)

Finally we have the position of two dialectical materialists, both noted biologists; namely, Marcel Prenant and J.B.S. Haldane. Basing biology and the experimental sciences on dialectical materialism, they hold, although for other reasons than claimed by Kant, that the sciences have no absolute principles, that nothing is certain. Prenant says:

> 'In the fact of universal change resides the dialectical character of marxist materialism. 'Dialectical materialism, says Lenine, insists on the approximative, relative character of every scientific proposition concerning the structure of matter and its properties; it insists on the absence in nature of any absolute lines of demarcation; on the passage of moving matter from one state to another which appears to us as sometimes incompatible with the first.' In 1877 Engels cited from universal dialectics some very diverse examples: the evolution of the nebula of Laplace, that of the surface of the globe, that of living species, the liquifaction of gas, the transformation of energy, and many others. We should add today, among the most characteristic, the evolution of radioactive elements, the transmutation of simple chemical bodies, and perhaps even, to the limits of modern physics, the reciprocal change of energy into matter, and of matter into energy. All these categorical distinctions

(1) T. Dantzig. Aspects of Science, N.Y. 1937, pp.277-280.

vanish one after the other, the general formula of 'rational materialism' simplifies itself more and more. As Engels says, 'the science of nature has actually come to the point where it can no longer escape dialectical synthesis: there exists one matter in movement.' (1)

J.B.S. Haldane differs very little from Prenant, and therefore need not be quoted at any length.

"So far we may say that Marxism anticipates pragmatism, although it differs from pragmatism in almost all other respects, notably in its consistent emphasis on the changing world, and above all in its belief that absolute truth, if never reached, can be continually approached."(2)

Now it is not difficult to see the point which all these authors exploit. For we should admit that if we could not recur to hypothesis and anticipation, our mind would remain bound and enslaved. The mind's power to question is a condition of its freedom from ignorance and uncertainty. (3) And dialectic is by

---

(1) M.Prenant, Biologie et Marxisme, Paris 1937, p.77

(2) J.B.S. Haldane, The Marxist Philosophy and the Sciences, London, 1939, p.24

(3) Note the explanation of this condition by Aristotle: "For those who wish to get clear of difficulties it is advantageous to discuss the difficulties well; for the subsequent free play of thought implies the solution of the previous difficulties, and it is not possible to untie a knot of which one does not know. But the difficulty of our thinking points to a 'knot' in the object; for in so far as our thought is in difficulties, it is in like case with those who are bound; for in either case it is impossible to go forward. Hence one should have surveyed all the difficulties beforehand, both for the purpose we have stated, and because people who inquire without first stating the difficulties are like those who do not know where they have to go; besides, a man does not otherwise know even whether he has at any given time found what he is looking for or not; for the end is not clear, to such a man, while to him who has first discussed the difficulties it is clear. Further, he who has heard all the contending arguments, as if they were the parties to a case, must be in a better position for judging." Aristotle, Metaphysics, Bk. III, c.1, 995a 25- 995b 5.

its very nature interrogative, not only of conclusions, but of its very principles. (1) Tentative dialectic is essentially critical; it is a critique based not on scientific knowledge, nor on a clear formulation of principles, but rather on what Descartes called "le bon sens", on that of which everyone is deemed to have enough. (2)

---

(1) "Sciendum tamen est quod interrogatio aliter est in scientiis demonstrativis et aliter est in dialectica. In dialectica enim non solum interrogatur de conclusione, sed etiam de praemissis; de quibus demonstrator non interrogat, sed ea sumit quasi per se nota, vel per talia principia probata; sed interrogat tantum de conclusione. Sed cum eam demonstraverit, utitur ea, ut propositione, ad aliam conclusionem demonstrandam." St. Thom. In Post. Anal. I, lec. 21, n.3; cf. also In Post. Anal. I, lec. 5, n.4.

(2) "Dialectic is at the same time a mode of examination as well. For neither is the art of examination an accomplishment of the same kind as geometry, but one which a man may possess, even though he has not knowledge. For it is possible even for one without knowledge to hold an examination of one who is with knowledge, if also the latter grants him points taken not from things that he knows or from the special principles of the subject under discussion, but from all that range of consequences attaching to the subject which a man may indeed know without knowing the theory of the subject, but which if he does not know, he is bound to be ignorant of the theory. So then clearly the art of examining does not consist in knowledge of any definite subject. For this reason, too, it deals with everything; for every 'theory' of anything employs also certain common principles. Hence everybody, including even amateurs, makes use in a way of dialectic and the practice of examining; for all undertake to some extent a rough trial of those who profess to know things. What serves them here is the general principles; for they know these of themselves just as well as the scientist, even if in what they say they seem to the latter to go wildly astray from them. All, then are engaged in refutation; for they take a hand as amateurs in the same task with which dialectic is concerned professionally; and he is a dialectician who examines by the help of a theory of reasoning." Aristotle, De Sophisticis Elenchis, chap. XI, 172a 20-35.

Relative to ignorance, hypothesis and anticipation are a kind of emancipation, contributing thereby to free our mind. But the emancipation through hypothesis and tentative anticipation has no finality in itself. In them the mind remains enchained, unless we claim that at no time do we fall back into this state by refusing to move on toward truth. The end we have in view is something better than hypothesis, though we may never reach it.

However, the authors we have just quoted have obviously rejected any definiteness. The dialectical movement has fallen back upon itself, and the freedom to construct hasbbecome a joy based on uncertainty as on its first principle.

There is another point which these authors have exploited to the full. Experimental knowledge, since as such it implies mere givenness, does remain an imperfect kind of knowledge. The very plurality of first principles and of media implies imperfection. This applies both to first principles in the Aristotelian sense, and to what we call today the facts of experience, such as that of the elephant's trunk. It is necessary for us to free ourselves from mere givenness in so far as this is possible. To know why the elephant has a trunk would be better than to know only that he has one. And any tendency toward the why through hypothesis is a healthy movement toward upsetting mere givenness. But the why of the trunk should remain the limit of the hypothesis. But the revolt against all mere givenness is a revolt against the finite mind.

The literature which has grown around the dialectical nature of experimental science is such a fierce and ludicrous exploitation in favour of anti-Aristotelian and anti-Christian dogmas, that our recognition of the simple truths about the experimental sciences, as they are practised today, leaves us uneasy. This is because of the bad company in which we seem to move. Is not the concession of <u>apriorism</u> a concession to Kant, to dialectical idealism or materialism, to relativism and pragmatism? The situation is the more embarrassing that even among our own Scholastic philosophers Aristotelian dialectic is generally deemed a thing of the past.

CHAPTER XII

J. VON UEXKULL AND PHENOMINALISM

1.

An attempt to bring out the implications of Kant's critique for biology was made by an enthusiastic follower, J. Von Uexkull, in THEORETICAL BIOLOGY. (1) In the introduction he says:

> "No attempt to discover the reality behind the world of appearance, i.e. by neglecting the subject, has ever come to anything, because the subject plays the decisive role in constructing the world of appearance, and on the far side of that world there is no world at all.
>
> All reality is subjective appearance. This must constitute the great, fundamental admission even of biology. It is utterly vain to go seeking through the world for causes that are independent of the subject; we always come up against objects, which owe their construction to the subject.
>
> When we admit that objects are appearances that owe their construction to a subject, we tread on firm and ancient ground, especially prepared by Kant to bear the edifice of the whole natural science. Kant set the subject, man, over against objects, and discovered the fundamental principles according to which objects are built up by our mind." (2)

While this position is unacceptable in its generality, it actually describes a type of knowledge well recognized long before Kant.

What do we mean by appearance? Appearance is a relative

---

(1) J. von Uexkull, Theoretical Biology, N.Y., 1926.

(2) J. von Uexkull, op. cit., Introduction, p.xv.

notion embracing three terms: that which is said to be the appearance; appearance is predicated of something; and that of which it is said to be the appearance. Thus (a) clouds are said to be (b) an appearance of (c) rain. Hence, that which is called an appearance is considered a sign of something else. More specifically it is an instrumental sign, a sign which makes itself known before it makes known that of which it is a sign.

Now an instrumental sign may have either a contingent or a necessary connexion with that which it signifies. Either connexion may be such on the part of things our knowledge would be true in both cases if we know them as such. Again, the connexion may seem necessary or contingent: in this case the sign is only an appearance of the signified. ~~In so far as it is only an appearance of the signified.~~ In so far as it is an appearance of truth, an appearance is verisimilitude, or probability.

The following text is from Saint Albert the Great:

> "Probabilia autem (ex quibus fit syllogismus dialecticus) sunt verisimilia. Dupliciter autem verisimilia: aut enim in se sunt verisimilia, eo quod ipsa habitudo praedicati ad subjectum verisimilis est, eo quod nec praedicatum est in subjecto per se, nec subjectum in praedicato per se, nec utrumque in utroque, nec praedicatum necessariam et essentialem inhaerentiam habet cum subjecto, sed verisimile est in signis non in causis necessariis acceptum. Aut quia necessariam habet inhaerentiam, sed non accipitur nisi per signum: et hoc est probabile secundum modum acceptionis, quamvis in se sit necessarium: sicut solem esse majorem terra

(ex quod ubique unius quantitatis apparet) probabiliter acceptum est. Solem autem esse majorem terra per quantitatem dimetri acceptum est necessarium et non probabile, secundum quod probabile et necessarium opponuntur. Probabile autem sic dictum verisimile est, quod per suaipsius veritatis figuram videtur omnibus aut pluribus aut sapientibus, et his sapientibus videtur omnibus aut pluribus aut maxime notis et probabilibus: ita quod sapientibus et his vel omnibus sapientibus vel pluribus vel maxime notis vel probabilibus, totum pro uno membro ponatur.

Signa vero verisimilitudinis, aut occurrunt statim in superficie et in exterioribus rei quae accipit -sensitiva potentia comparans sensata ad invicem; et si talia sunt signa, probabile est quod videtur omnibus, sicut nivem esse albam per hoc quod nix est parvae partes perspicui in parva conjuncti, in cuius partibus undique lux diffunditur; hoc enim signum sensui est medium. Si autem signa indicium facientia de verisimilitudine sunt non in superficie, sed aliqualiter profundata, non ad necessaria, sed nec in superficie extrinseca manentia: tunc est id quod videtur pluribus; quia sensui aliquid miscent rationis, sicut quod stella in cauda minoris ursae sit polus, eo quod non deprehenditur eius singularis motus: hoc enim rationis judicium sensui est permixtum. Si autem signum verisimilitudinis profundatur in essentialium et convertibilium causas quae sunt convertibilia sicut causae: tunc est quod videtur sapientibus, sicut est, quod luna moveatur in epicicle: quia profundius et altius transit per umbram terrae: hoc enim non est causa sed signum."(1)

Obviously, if biology as Uexkull understands it is merely about signs and appearances, then it is dialectical.

By subject Uexkull means the knower. Therefore to say that we always come up against objects, which owe their construction to be knower, is to say that what we consider to be together on the part of things, is really together because the knower has

---

(1) St. Albert the Great, Lib. I, Topicorum, Tract. I, caput. 2.

put them so. This putting together however is relative to something else, in which what we tentatively put together is really so or not.

Let us consider the intuitive or experimental proposition "snow is white". That snow is white is known through sense experience. This is true, not because we see a necessary connexion between "snow" and "white", but merely because experience presents us with such an object. We did not put the snow and the whiteness together; for that is what is given in sense experience. Now we may go on to study the kind of connexion between these two terms. The senses reveal only a contingent connexion: although we find the two together, this does not mean that they are necessarily together. (1) But how does white belong to snow? Per se, or per accidens? As genus, property, or accident? This is the connexion to be proved. The proof will be either demonstrative or dialectical. Whatever

---

(1) "Unde constat, quod non est idem propositio per se nota quod intuitiva sive per experientiam sensuum nota, quia quod sensu cognoscitur, non cognoscitur ut propositio, sed ut simplex obiectum apprehensum, neque ex sola explicatione terminorum innotescit, sed quia experientia externa attingitur. Et sic nivem esse albam, licet in sensu sit per experientiam notum, in intellectu tamen non est propositio nota ex terminis per se connexis, sed potius materia contingenti." John of St. Thomas, Logic, P.II, q. 24, art. 4, (Reiser edition, p.767).

dialectic puts together will be formally put together by the knower, and this tentatively referred to the thing in itself. And this knowledge is phenomenal, in so far as, relative to what it is now referred to, the very starting point was merely appearance or phenomenon.

It should be noted therefore that the experiential proposition "snow is white" may be understood in two ways: either as signifying an experiential truth; or as the sign of some connexion to be further determined. In this last respect it is a phenomenon; it is the appearance of some kind of connexion. The connexion we shall hence forth establish, if it does not reach the true connexion, (that is the one which is on the part of the thing in itself,) will itself retain the state of mere appearance: the knowledge will remain phenomenal and dialectical.

The argument might be pressed by stating that snow itself is phenomenal. Let us consider a definition: "Snow is water vapour in the air crystalized into geometrical forms". Now what is water? What is air? What is it to become a crystal? Further definitions will lead us back to similar questions, and other experiences. But this does not make the water we drink phenomenal, and our senses do reveal its difference from beer. Nevertheless any definition we shall give will lead us into dialectical discourse. Relative to this discourse, the snow or the water are phenomenal. What is signified by the name snow

may be known well enough to be distinguished from bricks, and to be shovelled, but it is not necessarily known well enough to serve as a proper term in a demonstrative discourse.(1)

2.

In the preface to the same book Uexkull states:

> "Natural Science falls into two parts, doctrine and research. The doctrine consists of dogmatic assertions, which contain a definite statement concerning Nature. The form these assertions take often suggests that they are based on the authority of Nature herself.
>
> This is a mistake, for Nature imparts no doctrines: she merely exhibits changes in her phenomena. We may so employ these changes that they appear as answers to our questions. If we are to get a right understanding of the position of science vis-à-vis of Nature, we must transform each of the statements into a question, and account to ourselves for the changes in natural phenomena which men of science have used as evidence for their answer." (2)

---

(1) "Dicendum quod nomen dicitur ab aliquo imponi dupliciter: aut ex parte imponentis nomen, aut ex parte rei cui imponitur. Ex parte autem rei nomen dicitur ab illo imponi per quod completur ratio rei quam nomen significat; et haec est differentia specifica rei; et hoc est quod principaliter significatur per nomen. Sed quia differentiae essentiales sunt nobis ignotae, quandoque utimur accidentibus vel effectibus loco earum, ut VIII Metaph (VII, comm. 10) dicitur; et secundum hoc nominamus rem; et sic illud quod loco differentiae essentialis sumitur, est a quo imponitur nomen ex parte imponentis, sicut <u>lapis</u> imponitur ex effectu, qui est laedere pedem; et hoc non oportet principaliter significatum per nomen, sed illud loco cuius hoc imponitur. Similiter dico, quod nomen verbi a verberatione vel a boatu dicitur ex parte imponentis, non ex parte rei." St. Thomas, De Veritate, q. 4, a.1, ad 8.

(2) von Uexkull, op. cit., preface, p.ix.

The author presumably means that the propositions of biology are dialectical, and never adequate expressions of nature. But a dialectical proposition is interrogative, not absolutely, but of the probable. (1)

> "The difference between a problem and a proposition is a difference in the turn of the phrase. For if it be put in this way,' 'An animal that walks on two feet' is the definition of man, is it not?' or 'Animal' is the genus of man, Is it not?' the result is a proposition; but if thus, 'is "An Animal that walks on two feet" a definition of man or no?' (or 'Is "animal" his genus or no?') the result is a problem. Similarly too in other cases. Naturally, then, problems and propositions are equal in number: for out of every proposition you will make a problem if you change the turn of the phrase."
> (Aristotle, Topics, I, c.4, 101b 25-40.)

A dialectical proposition however may take on the appearance of a definite assertion, in so far as it is assumed or posited. But this assumption or position has not made it true.(2)

---

(1) Aristotle, Topics, I, c.10; Albert the Great, op. cit., Lib.I, Trac.III, c.1, where he says: "Sed dialectica propositio est interrogatio consensus in probabile, nec consensus requireretur si probari non deberet: manifeste autem falsum probari non potest, et manifeste verum non indiget probari, sed ad alterius alicuius assumitur probationem.

In diffiniendo ergo propositionem dialecticam secundum potissimum suum statum dicimus, quod propositio dialectica est interrogatio probabilis, ita quod probabilis sit genitivi casus, hoc est, interrogatio de probabili, quod est materia propositionis dialecticae. In probabili enim (quia ponitur in judicio eius cui proponitur, utrum sic videatur vel non) oportet quaerere respondentis judicium et consensum, antequam procedere possit opponens. Sic ergo dialectica propositio interrogatio est probabilis. Et hac ratione etiam Boetius in diffinitione syllogismi dicit, quod est oratio in qua quibusdam positis et concessis, respiciens ad propositiones syllogismi dicit, quod est oratio in qua quibusdam positis et concessis, respiciens ad propositiones syllogismi dialectici. Cuius causa est, quod probabile de se non habet sufficientem causam consequentiae vel inferentiae, et causam inferentiae sufficientem accepit a concessione respondentis. Haec igitur est tota diffinitio propositionis dialecticae."

(2) Aris., Topics, I, c.14.

we assume them for the purpose of reasoning from them and testing them.

In so far as biology starts from phenomena of the kind described above, we must bear in mind that while our statements may appear highly plausible and confirmed by all the material at our disposal for the present time, they nevertheless remain open to question and are problematic.

And it is true that dialectical propositions and problems somehow contain the answer, as in the examples given from Aristotle. For the questions, What is man? or What is a cow? are not dialectical, though the answer may remain dialectical.

Uexkull rightly continues:

> "Investigation cannot proceed otherwise than by making a supposition (hypothesis) in its question, a supposition in which the answer (thesis) is already implicit. The ultimate recognition of the answer and the setting up of a doctrine follow as soon as the investigator has discovered in Nature what he considers a sufficient number of phenomena that he can interpret as positive or negative on the lines of this hypothesis.
>
> The sole authority for a doctrine is not Nature, but the investigator, who has himself answered his own question. (1)

While the thesis or position adds something to the dialectical proposition or problem, (2) it does take the nega-

---

(1) von Uexkull, op. cit., preface p.ix.

(2) "Positio autem adjuncta est problemati, et est quasi accidentale principium syllogismi dialectici. Problema enim est principium quod est circa conclusiones dialecticas, de quo neutro modo opinamur. Positio autem est de quo opinamur contrarie.." (Albert the Great, Top. I, Tract. III, c.3).

tive or the affirmative of what is contained in the question, though not as a definite assertion. The position or thesis itself remains open to question.

It does not follow however that the investigator is the sole authority for a doctrine. For while the dialectical proposition and doctrine, considered as such, are constructs of the knower without an adequate counterpart in nature, nature remains the measure to which the biologist attempts to conform himself. For instance, if experience favours one part of the proposition without making the proposition true, nature has something to do with the answer. What is to be answered in the affirmative or in the negative depends upon the question of the investigator; but that the answer is disjunctively affirmative or negative depends not on the question but on nature.

Uexkull goes on to say:

> 'A man may have assimilated the conclusions of natural science in the form of doctrine, and may know how to employ them in speculation, according to the rules of logic; but he still knows nothing whatsoever concerning Nature - or at any rate, infinitely less than does any peasant or gardener who is in daily intercourse with her.' (1)

This statement brings out what we have already said about experience and phenomena. The peasant does not cultivate phenomenal carrots. But in a way the biologist does. We eat the former,

---

(1) von Uexkull, op. cit. preface p.ix.

not the latter. What the author says about doctrine is true of dialectical doctrine. The rules of logic would then mean those of formal logic and of that part of material logic which we call dialectic, or dialectica docens.(1) But it seems exaggerated to say that he then still knows nothing concerning nature. We would say that he still has no science of nature.

> "Peasants and gardeners, however, are not students of Nature, unless they happen to have acquired the art of interrogation. This art forms the gateway to all knowledge in natural science. In biology it is associated with quite especial difficulties, and so it should occupy the central position in the whole doctrine." (2)

---

(1) "Licet autem dicatur, quod Philosophia est scientia, non autem dialectica et sophistica, non tamen per hoc removetur quin dialectica et sophistica sint scientiae. Dialectica enim potest considerari secundum quod est docens, et secundum quod est utens. Secundum quidem quod est docens, habet considerationem de istis intentionibus, instituens modum quo per eas procedi possit ad conclusiones in singulis scientiis probabiliter ostendendas; et hoc demonstrative facit, et secundum hoc est scientia. Utens vero est secundum quod modo adjuncto utitur ad concludendum aliquid probabiliter in singulis scientiis; et sic recedit a modo scientiae. Et similiter dicendum est de sophistica; quia prout est docens tradit per necessarias et demonstrativas rationes modum arguendi apparenter. Secundum vero quod est utens deficit a processus verae argumentationis.

Sed in parte logicae quae dicitur demonstrativa, solus doctrina pertinet ad logicam, usus vero ad philosophiam et ad alia particulares scientias quae sunt de rebus naturae. Et hoc ideo, quia usus demonstrativae consistit in utendo principiis rerum, de quibus fit demonstratio, quae ad scientias reales pertinet, non utendo intentionibus logicis. Et sic apparet, quod quaedam partes logicae habent ipsam scientiam et doctrinam et usum, sicut dialectica tentativa et sophistica; quaedam autem doctrinam et non usum, sicut demonstrativa." (St. Thomas, In Meta. Aris., Lib. IV, lec. 4, n.576-577.)

(2) von Uexkull, op. cit., preface p.x.

The art of interrogation is again dialectic. (1) But the art the author here refers to is more specifically the art of interrogating nature, and nature is then considered in a way as the one who knows, her answer being what we can collect from experience. Not that all questioning of nature is as such dialectical, but it certainly is when the problems are of the kind mentioned above.

> "In the present book I have endeavoured to frame the theoretical considerations concerning biology, in such a way that there can no longer be any doubt that, in their very nature, biological doctrines always remain unsolved problems."(2)

We must agree with the author that biological doctrines starting from phenomena, already mixtures of reason and sense, and therefore impure in a fashion, can never go beyond the problematic state. All their conclusions are dialectical propositions and therefore problems.

> "In nature everything is certain; in science everything is problematical. Science can fulfil its purpose only if it be built up like a scaffolding against the wall of a house. Its purpose is to ensure the workman a firm support everywhere, so that he may get to any point without losing a general survey of the whole. Accordingly, it is of the first importance that the structure of the scaffolding be built in such a way as to afford this comprehensive view; and it must never be forgotten that the scaffolding does not itself pertain to Nature, but is always something extraneous."(3)

What Uexkull here means by nature and certainty is not clear. We hold a degree of objective uncertainty in nature,

---

(1) Aristotle, De Sophisticis Elenchis, chap. 11, 172a 10,172b 1.

(2) von Uexkull, op. cit., preface, p.x.

(3) von Uexkull, op. et loco cit.

as we shall explain later. Nature itself has its problems. What the author calls science is really dialectics of nature. And this does remain problematical. And of these two the opposition holds. Dialectics of nature is like a scaffolding against a house. And although the scaffolding is not the house, the former has some relation to the house. The shape of the scaffolding gives some knowledge of the shape of the house. The purpose of the scaffolding is not the mere extrinsic imitation of the house. It is built to reach the house the better. The comparison might lead to confusion, for by means of a scaffolding we actually reach the house. But dialectics does not actually reach nature.

To say that dialectics is extraneous to nature is to speak formally, for:

> "Dialecticus procedit ad ea consideranda ex intentionibus rationis, quae sunt extraneae a natura rerum. Et ideo dicitur quod dialectica est tentativa, quia tentare proprium est ex principiis extraneis procedere." (1)

---

(1) "Differunt autem adinvicem. Philosophus quidem a dialectico secundum potestatem. Nam majoris virtutis est consideratio philosophi quam consideratio dialectici. Philosophus enim de praedictis communibus procedit demonstrative. Et ideo eius est habere scientiam de praedictis, et est cognoscitivus eorum per certitudinem. Nam certa cognitio sive scientia est effectus demonstrationis. Dialecticus autem circa omnia praedicta procedit ex probabilibus; unde non facit scientiam, sed quandam opinionem. Et hoc ideo est, quia ens est duplex: ens scil. rationis et ens naturae. Ens autem rationis dicitur proprie de illis intentionibus, quas ratio adinvenit in rebus consideratis; sicut intentio generis, speciei et similium, quae quidem non inveniuntur in rerum natura, sed considerationem rationis

(next page)

As examples of such intentions of reason St. Thomas had just mentioned the intention of genus and the intention of species, as distinct from natural genus and species. The logical notions are in themselves clear enough and definite. We need these intentions for classification in biology, not only for the classification of the various kinds of plants and animals, but no less for their parts. But the classification has nothing definite. While it has some foundation in nature known through experience, we would not dream of substituting our classification by means of logical intentions for that of nature itself. The very use of these intentions is governed by principles which are ever provisional. Uexkull himself shows that genus and species as used by biology are what we call logical intentions.(1) Singer's pages on the same subject although confused, bring out the same point. (2)

---

consequuntur. Et huiusmodi, scilicet ens rationis, est proprie subjectum logicae. Huiusmodi autem intentiones intelligibiles, entibus naturae aequiparantur, eo quod omnia entia naturae sub considerationem rationis cadunt. Et ideo subjectum logicae ad omnia se extendit, de quibus ens naturae praedicatur. Unde concludit, quod subjectum logicae aequiparatur subjecto philosophiae, quod est ens naturae. Philosophus igitur ex principiis ipsius procedit ad probandum ea quae sunt considerandum circa huiusmodi communia accidentia entis. Dialecticus autem procedit ad ea considerandum ex intentionibus rationis, quae sunt extranea a natura rerum. Et ideo dicitur, quod dialectica est tentativa, quia tentare proprium est ex principiis extraneis procedere." (St. Thomas, In Meta. Aris., Lib. IV, lec. 4, n. 574.)

(1) von Uexkull, op. cit., c. VII, pp.236–269.

(2) C. Singer, The Story of Living Things, N.Y., pp.175 ff.

Uexkull goes on to say that "from time to time it will always be necessary to renew the scaffolding". (1) The experimental sciences are forever in search of first principles, of primary elements. This research makes them definitely dialectical. (2) What are the primary elements of the physical world? What are the primary elements of living things? The experimental science of a given period has a provisional answer to these questions. But it does remain provisional. The discovery of more fundamental elements change the whole system.

We shall not venture to say that the present biologists consider to be the lowest forms of living beings, or the first elements of living beings as living beings. One thing is certain however. Some would venture to say that such or such is definitely the lowest, or is definitely first. But so far as such and such are considered first elements, we have the attributs of first principle added to what we actually do not know to be first on the part of things. The result of this combination is in this respect a construct of the mind.

The rest of Uexkull's THEORETICAL BIOLOGY is an attempt to renew the scaffolding of biology which should take account of "conformity with plan" as the basis of life. It is beyond the scope of this dissertation to analyse this concept.

---

(1) Aristotle, Topics, I, c.2, 101a 35.

CHAPTER IV

MARXISM AND PRAGMATISM

The philosophies of Marxism and pragmatism have in common an instrumentalist conception of knowledge. In their opinion, human knowledge, but for its greater complexity, is fundamentally the same as that which we attribute to brute animals: "leo non delectatur in aspectu cervi vel caprae...sed delectatur in spe habendi cibum". (1) Their knowledge is essentially ordered to something else.

We should admit, however, that if all our knowledge were of a dialectical nature, that since dialectic, whether docens or utens, remains merely useful and instrumental, (2) the position common to marxists and pragmatists would follow logically, unless vagueness and uncertainty were ends in themselves.

But what is that to which this kind of knowledge can nevertheless be ordered successfully? Although dialectical knowledge of nature is either vague or merely probable, the distance between knowledge and nature can be breached by action. Pronant quotes the second thesis of Marx on Feuerbach:

> "The question of knowing whether human thought can attain objective truth is not a theoretical question, but a practical one. It is in praxis

---

(1) Aristotle, Ethica, III, c. xii, 1118a 15; St.Thomas, lec.19.

(2) Aristotle, Topica, I, c.2.

that man must demonstrate the truth, that is to say, the reality, the power, the precision of his thought."(1)

There is then no precision in thought itself; it will be called precise and true in fashion, only if its leads to practical results. We should recognize that however vague physical and biological doctrine may be, they do permit us to make highly efficient machines and to cure diseases. Even a bad shot can hit a target, provided the target is big enough. And if the target is small, buckshot will do the trick. For the purpose of action such seems to be the relation between dialectical knowledge and nature.

Neither Dewey nor the marxists attribute the vagueness and uncertainty of knowledge to some fundamental inadequacy of our mind to grasp all that is really <u>there</u>. Such a conception, they say, would suppose an inherent invariable order in nature which we strive to grasp ever more adequately; or it would suppose reason to seek necessity, and universality, without having at the same time the powers to accomplish this ideal. This would lead to perpetual frustration. Dewey says:

> "The doctrine that nature is inherently rational was a costly one. It entailed the idea that reason in man is an outside spectator of a rationality already complete in itself. It deprived reason in man of an active and creative office; its business was sim-

---

(1) Textes Choisis sur Marxisme, Québec, 1940, p.7.

> ply to copy, to re-present symbolically, to view a given rational structure. Ability to make a transcript of this structure in mathematical formulae gives great delight to those who have the required ability. But it does nothing; it makes no difference in nature. In effect, it limits thought in man to retraversing in cognition a pattern fixed and complete in itself. The doctrine was both an effect of the traditional separation between knowledge and action and a factor in perpetuating it. It relegated practical making and doing to a secondary and relatively irrational realm.
>
> Its paralysing effect on human action is seen in the part it played in the eighteenth and nineteenth centuries in the theory of "natural laws" in human affairs, in social matters. These natural laws were supposed to be inherently fixed; a science of social phenomena and relations was equivalent to discovery of them. Once discovered, nothing remained for man but to conform to them; they were to rule his conduct as physical laws govern physical phenomena. They were the sole standard of conduct in economic affairs; the laws of economics are the "natural" laws of all political action; other so-called laws are artificial, man-made contrivances in contrast with the normative regulations of nature itself.
>
> Laissez-faire was the logical conclusion. For organised society to attempt to regulate the course of economic affairs, to bring them into service of humanly conceived ends, was a harmful interference."(1)

In this conception, theoretical uncertainty loses its very meaning:

> "It is a strict truism that no one would care about any exclusively theoretical uncertainty of certainty. For by definition in being exclusively theoretical it is one which makes no difference." (2)

And again we should admit that this would be the case if all knowledge were dialectical.

---

(1) John Dewey, The Quest For Certainty, London, 1930. pp. 202-203.

(2) John Dewey, op. cit. p.40.

It will not be necessary to analyse in detail Prenant's efforts to show that Marxism is not only in line with current conceptions of the nature of experimental biology, but that it is confirmed by them. His position, like that of pragmatism, follows simply enough from the generalisation of dialectic and the recognition of its instrumental nature.[1]