The Order of Nature and the Problem of Teleology

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THE ORDER OF NATURE
AND THE
PROBLEM OF TELEOLOGY

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CHAPTER I

REVIVAL OF INTEREST IN TELEOLOGY

The philosopher has always claimed inquiry into the ultimate causes as his peculiar field. He observes phenomena with a view to their interpretation. He asks the eternal "Why?" of things. For a time he may be content with knowing how the objects of his observation operate, or simply that they operate, but he will not be satisfied till he knows "Why?" This wonder, this curiosity to know the reasons for things, and the ability to answer his own inquiries is one of man's most prominent characteristics.

For nearly three centuries men have been amazed at the wonders of science and discovery, and enthralled with the pleasures they afforded. They have delighted in their inventions as children around their Christmas tree, flitting from one toy to another, content to know that everything worked and that all was theirs. A few catch words, evolution, "it just unrolled"; atomism, "it is made up of parts"; mechanism, "it works"; furnished all the explanation to which most people had time to listen. There were other toys to be examined.

During more than two hundred years after Descartes
it was the fashion in non-scholastic circles to overlook or to sneer at any hint of intrinsic purpose in the world. Spinoza and Leibnitz continually opposed the notion of intrinsic finality in the universe, and Hume, denying all causality, wished especially to stamp out all superstitions favoring final cause. The order which had come into the "chaos of the poets" was supposed simply to have evolved, unrolled, according to the laws of nature. But "Whence those laws?" That was an unfair question. And "For what purpose was the evolution?" Only the Dark Age Man could have proposed such a query.

Minds alert to current thought, however, perceive that the curiosity of the world is being gorged with novelties and facts. Men are beginning to seek understanding. True to their human nature they are becoming philosophers and asking, "What does it all mean?" "Whither does it lead?" The answer to these questions leads the inquirer into the subject of final causes.

Since late in the nineteenth century finality has had new defenders in many fields of knowledge. Dilthey's psychology of history, Stern's "personalism," Driesch's vitalism, and Wertheimer's "Gestalt" psychology are all approaches to finality. Many French philosophers, notably Jouffroy, Janet, Renouvier, Boutroux, and Ravaission have
sincerely championed teleology, though not always in the scholastic sense of the term, and have done much in France to overshadow the undeserved popularity of mechanism. Henderson's two books, *Fitness of the Environment* and *Order of Nature* caused some stir in this country when first published. Lloyd Morgan's theory of Emergent Evolution describes a development from matter through the lower forms of life to the supreme goal which is mind. Professor Greenwood's recent book, *Biology and Christian Belief*, also favors a purposive outlook. Moreover, the philosophy of value, at bottom a problem of finality, has in recent years become surprisingly popular.

This new trend in science and philosophy lends more than usual propriety to discussions of the scholastic doctrine of final causes.
CHAPTER II

THE SCHOLASTIC THEORY OF FINAL CAUSES

St. Thomas has written much and well on the subject of final causes. He gives brief, crisp proofs for the objectivity of final causes and the principle of finality. Yet, he and his contemporaries were more inclined than men of our more sceptical age to take the existence of final causes for granted, and to insist chiefly on the teaching of reason and revelation regarding the greatest of all final causes, the final cause of man. Our modern mechanistic school, however, has grown up outside the scholastic traditions, and has failed to appreciate the value of its centuries' store of speculation. As a result students under mechanistic tutelage have been occupied with more fundamental problems of teleology, doubting even whether final causes really exist. The principal intention of this paper will be to point out the propriety of the doctrine of scholastic philosophy on final causes as an explanation of the order of nature and of the determined character of natural phenomena. For sake of clarity, however, we shall begin with a few more general notions.

Final cause is usually defined as "that for the sake of which something is done." 1 In general, final
or purposive activity means action with an end in view; making use, therefore, of apt means to attain an end; acting from a motive with purpose, design, or plan. Psychologically the notion of end arises from our own experience. We take medicine in order to be healed; we work to make a living; we fight a war to preserve our country's liberty. A hundred times a day we go somewhere, or do something in order to obtain or accomplish some desired end. These ends are the motives from which we act. Our free will allows us to choose our motives, to accentuate one or other of many possible motives. This motive or end is always some apprehended good either real or apparent. It must be a good because we never place an action with the intention that it will redound to our own complete disadvantage. It must be apprehended because it is impossible to strive for, or even to desire a good of which we are entirely ignorant. The recognition, therefore, of an object or an action as advantageous or desirable to ourselves is an absolutely necessary condition for it to operate as a cause determining our deliberate acts.

But while recognition of the end is a condition, the end itself is more than a condition. Causes and conditions must be clearly distinguished. A condition is sometimes called in scholastic terminology a removens
prohibens. Within the definition of condition come all things that consist in the removal of obstacles that would prevent an action from taking place, or in the positing of circumstances which would facilitate it. A cause, on the other hand, actually assists in bringing something into being, or in effecting some change, which, of itself, assuming even that all necessary conditions were present, could not have come about.

An illustration will show plainly the difference between the two notions. Gravity is the cause of water running through a canal. But a necessary condition is that the locks be open. Without gravity as a cause, the mere lifting of the gates, the condition, could never effect the flow of water. Applying the comparison to motivated action, a little reflection will reveal to us that the end of our striving is more than a condition. It drives us to action. The ambition to become a doctor makes a young man go through years of gruelling study, almost ruining his own health in order to be able to save that of others. An end, therefore, at least in human affairs, is a cause, not the only cause, but a cause nevertheless, which incites men to do that which without the end they would not and could not do.

Thus, it is quite obvious that persons, when they
act deliberately, do so because of some definite end they have in mind. The real problem of teleology, however, is usually considered to be the question whether non-intellectual nature is influenced by final causes. Scholastic philosophers have always held that final causes are operative here also. St. Thomas writes:

It must be observed that a thing tends to an end, by its action or movement, in two ways: first, as a thing moving itself to the end, -- as man; secondly, as a thing moved by another to the end, as an arrow tends to a determinate end through being moved by the archer, who directs his action to the end. Therefore those things that are possessed of reason, move themselves to an end; because they have dominion over their actions, through their free will which is the faculty of will and reason. But those things that lack reason tend to an end, by natural inclination, as being moved by another and not by themselves; since they do not know the nature of an end as such, and consequently cannot ordain anything to an end, but can be ordained to an end by another. For the entire irrational nature is in comparison to God as an instrument to the principal agent. ... Consequently it is proper to the irrational nature to tend to an end, as directed or led by another, whether it apprehend the end, as do irrational animals, or do not apprehend it, as is the case of those things which are altogether void of knowledge. 3

The phrase to be insisted on here, as is clear from other related passages, is that irrational beings, animals, trees, etc., tend to their ends by natural inclination. The idea is not that they are moved only by an extrinsic cause as a pebble by the foot, but that the extrinsic cause, their Creator, has impressed His own purpose upon natural bodies, so that in tending
according to their natures to their own ends, they also act instrumentally according to the Creator's intention.

A word about the way in which the final cause operates will help to a better understanding of its nature. Final influence can be best studied in those beings where it is most evident, namely in intellectual beings. We have seen that final cause is no mere condition, but a true cause. Its influence, however, must be distinguished from that of efficient cause. Efficient causes produce their effects by physical action as when a horse pulls a wagon. The final cause produces its results on the actions of persons simply by being an attractive object which, however, must be apprehended and desired as a good. "Just as the efficient cause has its influence by acting, so the final cause has its influence by being desired and sought after." Efficient cause actually exists when it is a cause. Final cause qua cause does not yet exist except in the consciousness of the one desiring it. It is an objective reality, not actual, but possible. As soon as it becomes actual it is no longer a cause, but an effect. Hence the distinction between the end intended and the end attained. It is only the end intended which acts causally.

The chief influence of final cause consists in
initiating and directing the operation of the agent or efficient cause.

The end is the cause of the efficient cause, not, however, in so far as it is a being, but in as much as it is a cause. For the efficient cause is such in so far as it acts; but it does not act except for the sake of the end.

The fact that the efficient cause always produces a determined effect is also due to final cause.

Were an agent not to act for a definite effect, all effects would be indifferent to it. Now that which is indifferent to many effects does not produce one rather than another; wherefore from that which is indifferent to either of two effects, no effect results, unless it be determined by something to one of them. Hence it would be impossible for it to act. Therefore every agent tends to some definite effect, which is called its end.

Thus, the fact that an effect is produced is due to the efficient cause. The fact that a determined effect is produced is due to the final cause. Since the intention is prior to the action, final cause is said to be the first of all the causes.

All we have thus far said on the operation of final cause was largely from the metaphysical point of view. It may also be viewed psychologically. The influence of the final cause on the appetite, as we have noted above, results from the mere presence of the idea of the end in the mind as good or beneficial to the one to whom
it is represented. This influence may be looked at in two ways. From the side of the agent the first sign of the influence is a certain complacency or passive yielding towards the good. There follows a positive act of the will towards obtaining it. Finally, there is an active command of the faculties to employ the means necessary for coming into possession of the object. On the side of the final cause the influence consists in attracting the appetite to union with itself.

If, however, the final cause cannot have its influence except through an intellectual preconception, how is it that we can say that animal and inanimate natures act for the sake of ends? St. Thomas spoke of irrational natures bearing the same relation to God as an instrument to the principal cause. In other words, we may say that natural bodies attain their own specific perfections by being guided to them by God in a way somewhat similar to that in which an automobile attains its journey's end under the chauffeur's direction. But there is always this difference that natural bodies attain their objectives immediately by the laws and active principles implanted in them by their Creator, whereas the automobile moves only at the instigation of the driver. When we say that the things of nature attain their specific perfections because of innate tendencies placed in them
by God we do not wish to imply that we call upon the na-
ture of God to prove the existence of final causes in the
world. Rather the opposite. The existence of God can
be proved from final causes. If we should attempt to
prove the existence of final causes from the nature of
God, we should apparently be arguing in a circle, though we
should not necessarily do so. We might first establish
the existence of God from other arguments. After that
we could infer from God's rational nature that no object
of His creative power would be purposeless. Perhaps
this would be the only way to prove that there was no
instance of disorder in the world; that all evil serves
some purpose either proximate or remote. To assert that
disorder is impossible, however, is not necessary to our
present thesis. Suffice it to prove that there are some
final causes in irrational nature.

Hence, the argument we propose to the mechanists
is not: God is an intelligent Creator of the universe;
but an intelligent Creator would not create except for
a purpose; therefore, there is purpose, design, finality
in the universe. Our argument is rather: there is an
order manifest in the world; but there can be no order,
plan, or design, without final causes; therefore, there
are final causes in the universe (subject ultimately,
of course, to a directive supra-mundane Intelligence).
It may have already been noted that the existence of a Supreme Intelligence is assumed in this paper. It is, indeed, rather assumed than proved, although the fact of final causes cannot but imply it. When archaeologists discover bits of pottery, weapons, or bone instruments, they always attribute them to beings with intellects, not to monkeys, or much less to chance atomic formations. Why are not mechanists as logical when they find the more marvelous productions of nature? It is probably the fear of theism as a logical conclusion rather than any intrinsic difficulty in the concept of final causes that has led evolutionists and mechanists to deny them.

Our contention is, however, that we can establish the existence of final causes before we establish the Intelligence. In other words, as the minor of the above argument states, order and design necessarily imply purpose or finality. The proof of this proposition will be developed in the course of the paper. Here it is merely stated. The argument is based partly on a perfect analogy between the actions of intelligent and non-intelligent natures, but especially on the fact that, denying finality, there is no intelligent explanation of nature's order. All will admit that irrational natures acting according to definite laws attain to a perfection that is suitable to them. This fact calls for an explanation.
The mechanistic attitude is agnostic. The scholastic philosophy does offer an intelligible if not comprehensive explanation of order and regularity in nature by recognizing in each individual nature an intrinsic principle of development and perfection which ultimately is considered to have been implanted there by the Wisdom and Power of its Creator.

Before closing the general discussion of final causes mention should be made of two divisions which are frequently referred to in treatises on finality in nature. The older scholastics called them _finis operis_ and _finis operantis_. We shall follow an equally common usage by calling them intrinsic and extrinsic final causes. The intrinsic final causes or ends of natural bodies are those which are adapted to their own good and perfection. Extrinsic ends are those which serve rather the good of some other part of the universe. Intrinsic ends of a fruit tree, for example, would be growth, fruition, and propagation. An extrinsic end would be to furnish food for man. To these divisions will correspond absolute and relative order which will be spoken of in the next chapter.
NOTES TO CHAPTER II

1. The end, i.e. that for the sake of which a thing is; e.g. health is the cause of walking. For 'Why does one walk?' we say; 'that one may be healthy'; and in speaking thus we think we have given the cause.


2. Now that to which an agent tends definitely must needs be befitting to that agent; since the latter would not tend to it save on account of some fittingness thereto. But that which is befitting to a thing is good for it. Therefore every agent acts for a good.


4. The term natural body is used in this paper in contradistinction to implements or machinery, for this class of objects bears the stamp of man's intelligence, and they are obviously made and operated for a purpose.

5. "Sicut autem influere causae efficientis est agere, ita influere causae finalis est appeti et desiderari."

St. Thomas, De Veritate (vol. 9, Opera Omnia, Parmae: Typis Petri Fiaccadori, 1859), q. 22, a. 2.

6. Now an end is possessed in two ways; perfectly and imperfectly. Perfectly, when it is possessed not only in intention but also in reality; imperfectly, when it is possessed in intention only.


The end holds the highest place among the causes, and it is from it that all other causes derive their actual causality: since the agent acts not except for the end... and it is due to the agent that the matter is brought to the actuality of the form; wherefore the matter is made actually the matter, and the form is made the form, of this particular thing, through the agent's action, and consequently through the end. The later end also, is the cause of the preceding end being intended as an end: for a thing is not moved towards a proximate end, except for the sake of the last end. Therefore the last end is the first cause of all.

_Ibid._, ch. 17.
CHAPTER III

THE ORDER OF NATURE

Before considering the fact of the order from which we shall argue to the existence of final causes in nature it will be helpful to enucleate the concept of order. According to scholastic authors three things are required to fulfill the notion of order: 1) things to be ordered; 2) certain relations of position or succession; 3) a principle of order. Moreover, in all order two things are implied: 1) an intelligent orderer, and 2) a reason for ordering. If we take the example of an army, the soldiers are the objects to be ordered; their division into companies or battalions would establish the relations of position or succession; the principle of the division or order might be the number of years of experience, the nationality, or the type of artillery which the various groups are accustomed to operate. The orderer implied is the general, and the purpose will depend upon his intentions. We may presume that it is the hope of victory. Order, therefore, may be defined as an exact arrangement of things in their proper positions or relations according to the requirements of the end in view.

To distinguish between the ordered systems set
up by man and the order of nature the former is called artificial order while the latter is styled natural. From the scholastic teleologist's point of view the only difference between artificial and natural order is in the principle. In artificial order the principle is extrinsic to the objects ordered; that is, the objects are indifferent to the norm. In the above example the soldiers are equally capable of being divided according to any one of the three norms. In nature the principle is intrinsic. It is stable and unchanging. This notion of stability, however, is not meant to exclude the possibility of slow evolutionary development. It means merely that at any given time natural agents act in a determined manner and according to laws, which, if they are known, permit predictability of effects within a close margin of accuracy.

To the mechanist, however, the two ulterior implications of order, namely, the orderer and a purpose in the sense of a final cause, are superfluous when there is question of natural order. He conceives nature as a system of bodies endowed with certain forces which under given conditions cannot help producing their effects. He admits efficient causes, and thinks therein is had the full explanation of the activities of nature. The scholastic teleologist also recognizes the forces of
nature, but he sees still more. He sees a tendency in
the forms of nature towards a perfective goal for which,
try as he may, he cannot account by indiscriminate forces.
He is convinced that the various natural bodies are pos-
sessed of an intrinsic principle guiding them without
fail, unless there is some external interference, to a
fixed terminus. He may go so far as to define the na-
ture of a natural body as the substance or essence of
that body in so far as it is subject to an interior
principle of finality. Adequately considered this inter-
3
nal principle represents an impulse impressed by a Supreme
Will upon each being by which it tends in a more or less
regular and predictable manner towards a certain fullness
or maturity which may be considered its own perfection.

In order to bring out the idea of the intrinsic
principle of order in nature, scholastics distinguish
between absolute and relative order. Relative order is
that which exists between the various objects of nature.
Absolute order is that which is entirely within a given
body regardless of its relations to other bodies. Every
mineral, plant, and animal furnishes an example of ab-
solute order. Abundant illustrations of each will be giv-
en presently.

The fact of nature's order no one can deny.
Nietzsche and Schopenhauer may exaggerate the defects of order; Diderot or Buechner may say that it is due to chance; Kant and his disciples may contend that it is a purely mental projection; but not one of them can deny the fact. There is not a single science that does not bear witness to the order of the universe.

The most degraded of savages notice the regularity of the rising sun, and the recurrence of the yearly seasons. Our most accurate time is determined by the precision of the revolutions of the stars as observed by the astronomer's transit. The same law of gravity that holds the stars to their positions or orbits in the heavens binds our planet to the sun, and prevents us from being catapulted into space as we speed along at a rate higher than any modern projectile. The atmosphere that blankets the earth prevents the sun's rays from consuming us by day and the heat from escaping at night. By means of their chlorophyl action plants use up the carbon dioxide exhaled by animals, and release oxygen again into the air thus preserving always the balance of gases necessary for their mutual benefit. Water is evaporated from the ocean by the sun, carried by the wind over the land, and dropped in the form of rain to furnish drink for animals and moisture for plants. The surplus is collected into rivers and carried back to the sea again,
in the meantime furnishing a means of transportation. Nitrogen, a necessity for fertile soil, is precipitated in great quantities from the air by lightning and soaked into the ground by the rain. It is also gathered in surplus quantities on the roots of clovers and other leguminous plants for the use of other crops that need it. Many flowers depend upon bees and other insects for pollination.

The saying that one man's food is another man's poison holds good in nature. Almost every creature in nature seems to be both a help and a hindrance to some other creature. The result is a relative equilibrium. This might be a hard thesis to prove, but may be illustrated by the balanced aquarium. Here the larger fish eat the smaller ones. These in turn eat crayfish and larger insects, while insects eat the protozoa. The protozoa feed upon the green plants, and the latter live by the refuse of the higher animals. Thus the whole of nature seems to be linked together. Animals, plants, and minerals are mutually serviceable. Every part of the world seems to fit in harmoniously with every other part.

The above examples are largely illustrative of extrinsic or relative order. Evidence of purpose is still more striking in the intrinsic construction, ar-
rangement, and activities of individual organisms, and even in inorganic bodies such as crystals, molecules, and atoms.

Think of the innumerable variety of organs and parts that compose the human body; their diverse activities and their marvelous combination into one unified individual; their cooperation to preserve and perfect that individual. The body's architectural complexity, its ease of function, and esthetic coordination are immeasurably more perfect than anything man has ever invented.

The human eye is an instrument so delicately adjusted to the function of vision that at least a dozen conditions must be fulfilled before it can see, and, yet, comparatively speaking, how few are blind! First a brain is presupposed, and there must be nerves running between the brain and the eye which are able to bear the impression of light. These nerves terminate in a very special and impressionable tissue called the retina. Various automatic contractions must regulate the focus according to the distance of the object. The quantity of light allowed to enter the eye is regulated by contractions of the iris. The rods and cones at the nerve ends transform the light waves of different lengths into color sensations.
The fact that there are two eyes gives the stereoscopic effect of three dimensions. One eye can see only two dimensions. Nerve coordinations and numerous tiny muscles enable the two eyes to turn together hither and thither and to act normally as one organ. The distinctness and exact similarity of the images on the two retinas presents the appearance of one picture. Tears make the cornea more transparent and remove from it all dust particles. The sunken position of the eye in the forehead insures its protection. And all this lay hidden in the productive power of the primitive cell!

Too much space would be required to go into such detail with all the organs, but a few remarks about some of the more important ones will be in place. How perfectly the stomach and alimentary system is fitted for digestion. The stomach with its juices can dissolve foods and meats of all kinds, but the acids, with rare exceptions, never attack the stomach itself!

No one on examining a pump would deny that it was made by an intelligent person for the purpose of pumping; yet the heart, pushing blood to all parts of the body, and to those parts especially where at a given time it is most needed to feed the body, repair tired muscle, or remove waste, or, finally to be purified in the lungs is a
more self-adjustable pump than man could ever have imagined. Yet some would say that this comes about without a directive cause.

The glands, too, administer remarkable service to the body. There is the pancreas, liver, and salivary glands; that great energiser of the body, the thyroid; the pituitary gland regulating growth and sex characteristics; the adrenals exciting fright and anger for self-defense; and, finally, to pass over many others, the sex glands with the part they play in the origin of life, and, consequently, in the preservation of the species.

From the sex glands together with their corresponding organs comes the material unit of life, and building stone of all organic matter, the primary cell. The fact of reproduction, which looks principally not to the present good of the individual, but to the future good of the species, shows purpose and relation of means to end more plainly than almost anything else. The halving of the ultramicroscopic hair-like chromosomes during the maturation division and their joining with the same number of halves of the mated cell, if not observable, would be almost incredible. And hardly less remarkable is the ontogenetic process. The embryo beginning at the fecundation of the ovum by the sperm by means of division and multiplication
of the cells develops along determined lines and matures into a complete organism. Complication comes from simplicity. New cells are formed which are different from those from which they were divided. This results in the origin of new parts, which are not merely enlargements of already existing parts, but are actually new, and as different from one another as nerves, muscle, skin, and bone. Moreover, supposing no morphogenetic interference has taken place, the new offspring will closely resemble its parents. Thus from the first cell division to the last there is a tendency towards completeness, towards a standard of perfection.

The cell, besides being the unit of reproduction and growth, is also the unit of reparation of lost or injured parts. Some of the lower animals show the power of restitution more than do higher ones. The crayfish can restore its claw or even its eye if the nerve is not destroyed. The newt can restore its legs repeatedly. But all organisms normally have the power of healing their own wounds and of restoring lost skin. It is noteworthy that in all such restitutions "the cells in action always perform that which is necessary in this particular case in order to restore normal organization; and secondly, that the same cells might perform something else if required."
Likewise the cell is the basis of all the organic changes by which living organisms adapt themselves to conditions of environment, to their food, to temperature, to water or air pressure. Characteristic of normal adaptations are the preservation in warm-blooded animals of constant body temperature, and the production of various antitoxins and antibodies to combat anorganic poisons, and especially vegetable and animal bacteria. Generally on the occasion of one attack enough counteractive material is produced to preserve the body from the same danger for a long period in the future.

Something must be said of the myriad instincts of animals by which their activity is constantly directed to procure the good both of the individual and of the species. The reproductive instinct has already been mentioned. Others assist the animal in its search for food and in self-defense. Instinctive actions are not learned from experience, for they are performed too perfectly the first time. They arise from innate knowledge and concomitant desire, or, in simpler cases, from an innate tendency alone. The young swallow builds its first nest as good as that of its mother. Young salmon leave their river home when about eighteen months old and make for the open sea. After three or four years they find their way to the streams from which they came, and often
to the very bed from which they were hatched to lay their eggs and die.

Adult eels of the fresh water streams of the Baltic leave their home in the autumn, passing Denmark and England, then turning southwards cross the Atlantic. They spawn in the depths of the ocean southwest of Bermuda, then, like the salmon, die. The next spring the young eels return across the ocean to their fresh water streams where they live for four or five years before repeating the habits of their ancestors.

Some of the more extraordinary instincts are possessed by ants and honey bees. Shakespeare, holding the latter up to man as an example of obedience and cooperation, poetically summarizes most of their abilities:

Creatures that by a rule in nature teach
The act of order to a peopled kingdom.
They have a king and officers of sorts;
Where some, like magistrates, correct at home,
Others, like merchants, venture trade abroad,
Others, like soldiers, armed in their stings,
Make boot upon the summer's velvet buds,
Which pillage they with merry march bring home
To the tent royal of their emperor:
Who busied in his majesty, surveys
The singing masons building roofs of gold,
The civil citizens kneading up the honey,
The poor mechanic porters crowding in
Their heavy burdens at his narrow gate,
The sad-eyed justice, with his surly hum,
Delivering o'er to executors pale
The lazy yawning drone. 8
Similar to the instincts of animals are the tropisms of plants. The roots of a tree will always grow towards the moisture, so that if the water is on only one side of the tree nearly all the roots will be on that side. Their leaning towards the light is well known. These are two of the many tendencies in plants to grow towards that which will prove most beneficial to them.

Many of the instincts of animals are complemented with mechanisms for protection against their enemies, and for the acquisition of food. Nearly every animal has a natural enemy. Whether it be another animal or plant, or variations, ordinary or extraordinary, of climate or other life conditions they generally have some method of defense or preservation which enables them to withstand their peculiar opposition. It would be tedious to mention more than the mere classes of defense mechanisms. Some animals, e.g., frogs, walking sticks, and katydids are protected by the fact that they are indistinguishable from the leaves and green plants which form their usual habitats. The chameleon, certain fishes, and other animals are able even to change their color to match their surroundings. Some defend themselves with stings, and poisonous glands; others such as the octopus and cuttlefish by ink-throwing glands. Crayfish, crocodiles, turtles, molluscs, sea urchins, caddis flies, and porcupines have a pro-
Equally diversified as the defense adaptations are those which are a help to obtain food. Night feeders such as owls generally have large eyes, while day feeders often rely upon swiftness. The chameleon with its quick tongue can capture unwary insects at a distance of seven inches from its body.

Professor Woodruff almost panegyrizes the wonderful utility and aptitude of the worker bee's legs to the needs of the bee. The quotation is a little long, but the numerous details could hardly be summarized more briefly. It should be remembered that this is only one example out of thousands which could be cited to illustrate harmony between living things and their environment. It seems that it should at least provoke the question whether some third factor did not foresee and perhaps assist in the mutual fitting of the environment with the objects within it.

The worker is a 'bundle of adaptations' for its varied duties. Indeed, when we take away the adaptations there is little left! The primitive insect appendages have become specialized in the worker bee, so that collectively they constitute a battery of tools adapted with great nicety to the uses for which they are employed. This applies to all of the appendages of the insect's body, but we shall neglect those of the head and consider only the specializations of the three pairs of legs....
The worker Bee's prothoracic (front) legs show the following specializations. The femur and tibia are covered with long, branched FEATHERY HAIRS which aid in gathering pollen when the Bee visits flowers: the tibia, near its junction with the tarsus (the foot or hand), bears a group of stiff bristles (POLLEN BRUSH) which is used to brush together the pollen grains that have been dislodged by the hairs of the upper leg-segments. On the opposite side of the leg is a composite structure, the ANTENNA CLEANER, formed by a movable plate-like process (VELUM) of the tibia which fits over a circular notch in the upper end of the tarsus. The notch is provided with a series of bristles which form the teeth of the ANTENNA COMB. The antennae, or 'feelers,' which are important sense organs of the head, are cleaned by being placed in the toothed notch and, after the velum is closed down, drawn between the bristles and the edge of the velum. On the anterior face of the first segment of the tarsus is a series of bristles (EYE BRUSH) which is used to remove pollen and other particles adhering to the hairs on the head about the large compound eyes and interfering with their operation. The terminal segment of the tarsus of each leg is provided with a pair of notched CLAWS, a sticky pad (PULVILLUS) and TACTILE HAIRS. When the Bee is walking up a rough surface, the points of the claws catch and the pulvillus does not touch, but when the surface is smooth, so that the claws do not grip, they are drawn beneath the foot. This change of position applies the pulvillus, and it clings to the smooth surface. Thus the character of the surface automatically determines whether claw or pulvillus shall be used. But there is another adaptation equally remarkable. 'The pulvillus is carried folded in the middle, but opens out when applied to a surface; for it has at its upper part an elastic and curved rod, which straightens as the pulvillus is pressed down. The flattened-out pulvillus thus holds strongly while pulled along the surface by the weight of the Bee, but comes up at once if lifted and rolled off from its opposite sides, just as we should pull a wet postage stamp from an envelope. The Bee, then, is held securely till it attempts to lift the leg, when it is freed at once; and, by this exquisite yet simple plan, it can fix and release each foot at least twenty times per second.' (Cheshire)
The characteristic structures of the middle (MESOTHORACIC) legs of the Bee are a small POLLEN BRUSH and a long spine, or SPUR, which is employed in removing flakes of wax from the WAX POCKETS of the ventral surface of the abdomen.

The METATHORACIC (back) legs exhibit four remarkable adaptations to the needs of the insect, known as the POLLEN COMBS,PECTEN, AURICLE, and POLLEN BASKET. The pollen combs comprise a series of rows of bristle-like hairs on the inner surface of the first segment of the tarsus: the pecten is a series of spines on the distal end of the tibia which is opposed by a concavity, the auricle, on the proximal end of the tarsal segment; while the pollen basket is formed by a depression on the outer surface of the tibia which is arched over by rows of long curved bristles arising from its edges.

Thus the worker is fully equipped. Flying from flower to flower for nectar, the Bee brushes against the anthers laden with pollen, some of which adheres to the hairs on its body and legs. While still in the field, the pollen combs are first brought into play to comb the pollen from the hairs, while the pectens scrape the pollen from the combs. Then the auricles are manipulated so that the accumulating mass of pollen is pushed up into the bristle-covered pollen baskets. This process is repeated until the baskets are full and then the insect returns to the hive, where the contents of the pollen baskets are removed by the aid of the spurs with which the mesothoracic legs are provided.

Moreover, the structural adaptations of the worker Bee are but one aspect of a reciprocal fitness. Many of the flowers which the Bee visits show remarkable adaptations for the reception of the Bee and for dusting it with pollen, because Bees are effective agents in the transferring of pollen from flower to flower and thus insuring cross-fertilization.

The marvelous aptitude of animals for their environment would be in vain if the environment on its part were not at least to some extent accommodated to it. Henderson elaborates the suitability of the earth and
its elements to receive and foster the living beings that dwell upon it. The peculiar property of water by which it expands at $4^\circ$ centigrade thus preventing the seas from freezing solid and making sea life impossible is but one of the many phenomena treated. There are three elements, hydrogen, carbon, and oxygen whose properties are especially suited to sustain living organisms. Indeed they largely constitute living things. Of the three Henderson writes:

They lead...to the presence of water and carbon dioxide in the atmosphere, and to the meteorological cycle. This cycle regulates the temperature of the globe more perfectly than it could be regulated by any other substances concerned in any similar cycle. It produces an almost constant temperature in the ocean, as well as constancy of composition and of alkalinity. It mobilizes all over the earth great quantities of all the elements; it deposits them in great variety and inexhaustible profusion in the ocean; it comminutes and disperses all kinds of insoluble minerals, thereby diversifying the land; it causes water to penetrate and to remain in nearly all localities; and all of these processes are more perfect or more extensive than they could be if a large number of the different properties of water were not what they are. Thereby the greatest variety and quantity of structural materials is accumulated. Meanwhile the conditions which make for durability of structures are also assured...

These and many other things depend upon properties of hydrogen, carbon, and oxygen. They make up, I cannot doubt, the most remarkable group of causes of the teleological appearance of nature. 10

About carbon also Professor Greenwood has written recently:
It may be justly said that, if one thing more than another stands unique and in majestic aloofness, physically speaking, in the cosmic scheme, it is the element carbon. There does not appear to be a single assignable reason for such remarkable properties as those possessed by carbon (over and above and totally distinct from others) unless it were deliberately provided in a planned scheme that it should in due time play the role it does. Nor is this any more fantastic a claim than when Sullivan says the electron behaves as if it had foreknowledge and could calculate to an amazing extent. Yet for thousands of millions of years, in our own solar system alone, the carbon atom has played its part just like any other atom, rather like silicon in its habits, as it were, until life appeared. The opportunity arose, no element save carbon could supply the foundation for that astounding quality we call life, but it was there, ready to hand when the need came. The story of carbon is more gripping, more breath-taking than any fiction. Yet there are those who refuse to see any significance in this, or any purpose behind it all.

When we descend below the level of living beings and enter the inorganic world, there is no further example of conscious immanent adaptation. Yet the marvelous designs and determined activities of crystals, molecules, and atoms leave our argument from analogy and sufficient reason valid and strong even in the physical world.

Whenever two elements combine to form a compound, they always do so according to definite proportions by weight. Eight ounces of oxygen and one ounce of hydrogen will always combine in this proportion and in no other to form nine ounces of water. Though the law of combination is strange enough, the atomic theory which explains it is still more remarkable. Dalton, taking
a hint from theories of the old atomists of Greece, drew up his atomic theory under the supposition that the elements were made up of atoms, and that compounds were made of more or less stable aggregates of atoms. Furthermore, that all atoms of one element differ from those of another. To form a compound, therefore, a few atoms of one element were supposed to combine with a few atoms of another so as to form an aggregate. This represented the smallest unit of a compound which came to be called a molecule. The Greek mechanists had indeed thought of atoms, but they had never imagined that they combined in definite proportions, nor could they have deduced it logically from their system, for they supposed that all atoms had the same properties, and, denying finality, they could have assigned no reason why the atoms could combine only in exact small proportions.

A further development of the atomic theory came when Avogadro proposed the molecular theory of gases. The simple proportions existing between the component parts of a gas and between each part and the whole volume were explained by supposing that in any gas under constant temperature and pressure there were equal numbers of molecules no matter from how many atoms the molecules were made up. This theory, now held as incontestably correct, added several pieces of information to the former
knowledge of the atomic theory. By it the relative and absolute weight of the atoms could be calculated, the exact number of atoms in a molecule, and, hence, chemical formulae could be determined. From this theory also arose the notion of valences.

Orderly patterns likewise abound in crystals. A cursory comparison of the shapes of a collection of crystals would lead one to believe that there is an almost infinite variety of forms. But in reality the forms of all crystals may be reduced to seven systems depending upon what are called their axes. The first or cubic system has all its axes the same length, and all at right angles to each other. Common table salt is a crystal of this class. Numerous examples could be given of all the other classes, the tetragonal, the orthorhombic, the monoclinic, the triclinic, the trigonal, and the hexagonal. All snow crystals have the general pattern of a hexagon, yet marvel of variety, more than four thousands of them have been photographed, without any two having been found alike. The forms are so intricate and beautiful that they have often been copied as patterns for fine lace.

But the design of the crystal does not consist merely in the symmetry of its visible form. By the
experiments of the two Braggs, von Läue, and others it has been discovered that the exterior form of the crystals is due to the intricate and regular "lattice structure" of the atoms that compose it. The use of the X-ray has shown that the crystal which appears to the eye as solid has in reality the appearance of a three dimensional mesh, the knots being placed at periodic intervals, and with strings joining them.

We have already mentioned that it is possible to determine the number of each kind of atom that composes the molecule. This information is expressed in the chemical formula. But chemists know still more about the molecule. By fairly simple rules they can assign not only the formula of its composition but also the formula or diagram of its structure. It is by structure alone, not by a varying proportion of atoms, that some molecules differ from others. Thus the formula \( \text{C}_2\text{H}_6\text{O} \) signifies two compounds, dimethyl ether and ethyl alcohol. The only difference between them is in their molecular structure which may be represented thus:

\[
\begin{align*}
\text{H} & \qquad \text{H} \\
* & \qquad * \\
\text{H} & \text{C} \text{C} \text{O} \text{C} \text{C} & \text{H} \\
* & \qquad * \\
\text{H} & \qquad \text{H} \\
\text{Alcohol} & \\
\end{align*}
\]

\[
\begin{align*}
\text{H} & \qquad \text{H} \\
* & \qquad * \\
\text{H} & \text{C} \text{C} \text{O} \text{C} \text{C} & \text{H} \\
* & \qquad * \\
\text{H} & \qquad \text{H} \\
\text{Ether.} & 12
\end{align*}
\]
Every chemical compound has its own peculiar structure, and more than three hundred thousands of them are known to chemists. By the structure form of its molecule any substance may be distinguished from any other substance.

The varied forms of crystals and chemical structures are due to orderly arrangements of atoms. The structure of the atom itself is probably more admirable than even that of crystals and molecules, but it is less well known. Roughly, there are two parts to the atom, a nucleus and an outer region of electrons. The nucleus carries a positive electrical charge, and in it is centered most of the weight of the atom. In recent years there has been some evidence that atoms may be composed of as high as six parts. All except the electrons seem to come from the nucleus of the atom, while the latter, ranging from one to ninety-two in number, are situated in orbits around the nucleus.

Though we could wish our knowledge of the atom to be more complete, already enough is known to make us realize that infinitesimal portions of matter contain wonders of symmetry and order comparable perhaps to the vast visible order of the stars and of our solar system.
NOTES TO CHAPTER III


2. Ibid., p. 539.

3. Aristotle's definition of nature: "For nature is the principle and cause of motion and rest to those things, and those things only, in which she inheres primarily, as distinct from incidentally."

Aristotle, Physics, tr. by Wiggsteed and Cornford, Loeb Library (New York: Putnam and Sons, 1929), II, 1.


7. Habits traced by Johannes Schmidt of Copenhagen; Loc. cit.


CHAPTER IV

FINAILITY AND ORDER

The previous chapter by accumulation of examples of order aimed to present the material which must be accounted for by any philosopher, indeed, by any thinking man, who wishes to treat himself to more than a superficial explanation of one of our earliest concepts, the order of nature. "The existence of order," says Bergson, "is a mystery to be exposed, or, at least, a problem to be stated." The question of teleology is one of the most fundamental problems of metaphysics. Man has always recognized that it closely touched his interests. History proves that it is almost impossible not to take some attitude upon apparent purposiveness in the world. To suppose it is impossible to decide whether the universe is purposive is just as definite an attitude as any other. The most important problem for man, obviously, is to decide whether he himself has any purpose. The discussion of teleology in lower nature may indirectly throw some light on that problem. As a rule there are no gaps in nature. If final causes can be proved to exist in irrational nature, it will be easier to demonstrate that man should direct himself according to certain norms and towards certain goals. Man is not alien
to nature after all. He is king of it.

All the philosophers who have tried to answer the question, "Is non-intelligent nature governed by final causes?" may be divided roughly into two classes: teleologists and mechanists. Not all teleologists are scholastics, however, nor do all philosophers who claim to be teleologists thereby proclaim the influence of final causes. Henderson, despite his defense of the purposive appearance of nature, must be assigned to this latter class. He states:

Concerning the philosophical aspects of this question I have clearly established in the history of thought that when this problem arises the only safety is to be found in retreat and in employing the vaguest possible term which can be imagined, from which all implication of design or purpose has been completely eliminated. By common consent that term has come to be recognized as teleology. Thus we say that adaptation is teleological, but do not say that it is the result of design or purpose. 2

Whether or not common consent has removed all notion of purpose from the term 'teleological,' it must be borne in mind that whenever a scholastic uses the terms 'teleology,' 'finality,' or 'purposive universe,' he invariably implies the existence and operation of final causes.

Bergson falls short of the scholastic demands by defending a finality that is entirely immanent thereby
denying an ultimate directive Intelligence. Still, we may say "any view that regards the universe as realizing ends or values is a form of teleology."

The opposing camp is made up of all materialists, of course; and, largely, of scientific mechanists and mechanistic evolutionists. These, instead of admitting that the world tends or is directed toward an end, say rather that every present phenomenon is fully accounted for by a preceding fact or a series of preceding facts. No matter what the method of evolution may have been, ultimately it was merely a redistribution of matter, force, and motion or energy. They admit efficient causes but deny final causes. Results are had but no finality. Mechanism in this modern form owes its origin to Descartes. Denying substantial forms he made the essence of corporeal substance consist in extension. From this it followed that a body has no intrinsic principle of change and activity, and is only capable of receiving local motion from some extrinsic source. Such a theory is obviously opposed to intrinsic finality. Natural bodies become mere machines. An internal principle of self-perfection is denied. This "scientific" attitude with the added notion of evolution, to both of which he agrees, is colorfully summed up by William James in his Varieties of Religious Experience:
She (science)catalogues her elements and records her laws indifferent as to what purpose may be shown forth by them, and constructs her theories quite careless of their bearing on human anxieties and fates. Though the scientist may individually nourish a religion, and be a theist in his irresponsible hours, the days are over when it could be said that for Science herself the heavens declare the glory of God and the firmament showeth his handiwork. Our solar system, with its harmonies, is seen now as but one passing case of a certain sort of moving equilibrium in the heavens, realized by a local accident in an appalling wilderness of worlds where no life can exist. In a span of time which as a cosmic interval will count but as an hour, it will have ceased to be. The Darwinian notion of chance production, and subsequent destruction, speedy or deferred, applies to the largest as well as to the smallest facts. It is impossible, in the present temper of the scientific imagination, to find in the drifting of the cosmic atoms, whether they work on the universal or on the particular scale, anything but a kind of aimless weather, doing and undoing, achieving no proper history, and leaving no result. Nature has no one distinguishable ultimate tendency with which it is possible to feel a sympathy. In the vast rhythm of her processes, as the scientific mind now follows them, she appears to cancel herself.

Still, there are not many mechanists who will deny the fact of nature's order. Many of them are as enthusiastic about it as are teleologists. Indeed, if all idea of purpose were removed from nature, they would be the first to admit its order. It is they who have formulated most of the laws of nature. Teleologists have often enough capitalized upon their findings to strengthen their own position. No, the disagreement is not about order. Where the two schools part ways is in accounting
The difficulty of settling the problem rises chiefly from two sources: 1) the real and apparent truth of mechanism, and 2) from the difficulties that beset the teleological position.

In so far as mechanism concerns itself with discovery and examination of physical causes no fault is to be found with it. To insist merely upon final causes to the exclusion of the efficient would seriously hinder scientific progress. To know the purpose of the stars would doubtless do some astronomers good, but would not advance astronomy very far. Moreover, there is no one who will deny that the visible world is to some extent a mechanism. Astronomers can tell the date of an eclipse at any time in the future or past history of the world. This could not be predicted except by mechanical laws based on physical causes. To mechanists is due most of the credit for the progress of modern science. I say to mechanists, however, not to mechanism. The reason for this distinction is that most mechanists have been scientists, and as scientists they have done splendid work. They have perfected the experimental method and the mathematical sciences, and have applied them with as-
tonishing results. The pursuit of the exact sciences, however, is not the only characteristic of mechanism. Mechanism is also a system of philosophy. It does not remain in science and material things, its field of specialization, but reaches up into philosophy, where problems are decided by reason and not by experiment. In this thin air, mechanism suffocates. Its renown in science lends a specious glow to its false philosophy. In this masquerade the unpracticed eye mistakes mechanistic philosophy for the truth. Thus when the mechanist claims to measure matters of mind, will, and morality with meter stick and formula, he really convicts himself of childishness, but his prestige in his own field makes it hard to defend common sense views against him.

Teleology, on the other hand, labors under difficulties peculiar to itself. First of all, it has the disadvantage of having come first. Theories that have come down to us from primitive ages are often classed by the uncritical as necessarily superstitious. Secondly, finality is said to operate only through an intellect, and yet we set out to establish finality in nature as far as possible without reference to a Supreme Intellect. Thirdly, because there are many instances of apparently unordered activity; the dust, for example, that is scat-
tered by the wind; the formation of the clouds; avalanches, waterfalls, volcanoes; and in the realm of living things, monsters. A mechanist may say, "drop a stone from your hand. Impelled by a physical force it tumbles to the ground. Where is the purpose? Where is there a final cause? I see an efficient cause and nothing more." Of course one might answer that the person who dropped it had a purpose. But let us say that the stone after lodging for centuries on the side of a mountain, broke loose one morning and went crashing down the precipices. Where was the purpose? Rain and erosion had weakened its support. The force of gravity overbalanced the equilibrium, and it fell. But purposely?

Should we, then, abandon attempts to prove finality in the inorganic world and limit ourselves to the plant and animal kingdoms? If we desert the inorganic we admit defeat in the widest sector of the field. If there is no finality in the inorganic world, if it is governed merely by efficient causes, it will be an easy matter to extend the argument to organic nature and even to man.

The Mechanist will say: 'It is the same Nature working mechanically in all the kingdoms of the world; which sleeps in the mineral, slumbers in the plant, dreams in the animal, and awakes in man. The insect moves because it has powers of locomotion, the bird flies because it has wings, men and brutes see because they have eyes, and reproduce their kind and perpet-
uate their species because they have organs of gen-
eration.' It will not suffice for us to challenge
him with the retort: 'What precisely do you mean
by Nature?' Our task will be to prove that the bird
has wings in order to fly, that men and brutes have
eyes in order to see, and sexual organs in order
to reproduce their kind. Is this task easier than
that of proving the existence of final causes in
the inorganic world, the world of stones, water, sun,
moon, and stars? A victory in the lower kingdom
will make easy a triumph in the higher. 5

We have said when speaking of the avalanche that it
seemed to proceed without purpose. If we are told that
there is disorder in the world, therefore, no finality,
we have a greater right to say that there is a far greater
amount of order in the world than disorder, therefore,
there is a greater reason for admitting purpose, the
foundation of order. For our argument we lean especially
upon the conspiracy of causes that go to make up the
intrinsic order of nature. Many examples were described
in the previous chapter.

There we saw the geometrical structures of the
atoms, molecules, and crystals. If atoms merely come
together, and form molecules and crystals,
and not also to form them, why the exact numbers for each
substance? Why the symmetrical formations? How the unity
and stability of the molecule? How does one cell divide
and multiply till it becomes a full grown organism, and
why does the organism always quit growing after a certain
period of development? And, again, how can we say that when an organism is wounded the cells merely multiply but not in order to heal the wound? Why should the bee's legs be so delicately and so finely adjusted if it were not in order to carry pollen?

In other words, we offer to the mechanist cases where apparently, there has been a conspiracy of causes to produce a definite, determined effect. If he would admit a real conspiracy he would not differ from us. But if he contends that the conspiracy of causes is only apparent, he must fall back on one of two explanations. He may say that those physical, that is, efficient causes cooperate by mere chance, or he may say--and this is his best argument--that the apparent pooling of causes is no more than a case of physical forces added to physical forces, from which only physical forces may be expected to result. It is this force, according to him, that produces the apparently purposed effect.

In the beginning we may challenge the universal statement that physical forces added to physical forces give only a sum total of physical forces. Is it not possible that prescinding from the forces in question, the very combination of causes is a phenomenon that requires the intervention of a final cause? Certainly it is a phenom-
enon which demands explanation. To say that physical forces acting without direction always proceed in a regular, determined, and direct manner towards a definite goal borders on absurdity.

To illustrate the two points of view, the teleological and the mechanistic, let us consider the operation of a gas engine. The mechanist in describing it would tell you that the gas spray compressed by the rising stroke of the piston is ignited at the highest point of tension with the result that the piston is forced downward thereby revolving the drive shaft which transmits the power to a pulley or gears. With this he would imagine he had accounted summarily for the running of the engine. If pressed further with why-questions about the construction of the machine, he would go back further and further, but always enumerating efficient causes. His account would omit the causality of the mind that conceived it. That is, he would neglect the fact that the manufacturer had a definite purpose in mind when he built the engine, or, else, he would attribute that to mechanical causes too, and so on ad infinitum.

The scholastic would also enumerate the efficient causes, but he would not forget that no manufacturer could construct an engine, whether gas, steam, or diesel,
unless he had one of these types of engine in mind as an end-in-view when he set to work. Here is seen the causal influence of the end intended. Something is produced by the help of the end which without it could not have been produced at all. Efficient causes can account for the quantitative properties and functions of the engine, but they do not design it. Design is a further effect and must be attributed to a further cause. That cause we call the final cause.

Applying the analogy to nature we come to the same conclusion. The harmonious and consistent convergence of non-intelligent nature towards the realization of good and beautiful effects, the manner in which they adopt suitable means to attain their own perfection necessitates the intervention of final causes. No other explanation is satisfactory. Nature is so constant that evolutionists postulate extremely long periods for a transformation. Moreover, animal and plant species, and chemical formations persist in spite of innumerable obstacles and opposing forces. Such persistence, such precision, order, and determination is a result over and above the drive of physical efficient causes. It loudly demands some justification for existence. Final cause fulfils all the requirements, for its function is precisely to guide, limit and determine. Final cause, therefore, is the
key to nature's order and the designer of her manifold patterns.

The possible explanation of order and determined activities and effects is the still more absurd recourse to chance. A deus ex machina explanation of a phenomenon is nearly always an admission of ignorance. The plausibility of the chance account of order and, indeed, of the existence of the whole universe is based on the fact that some things in the world do happen by chance. The inference is supposed to be: "Therefore everything happens by chance." A few words, therefore, on the possibility of explaining intrinsic order by chance will not be out of place.

Chance arises from the coincidence of two or more causes acting independently of each other, or from the coincidence of effects which have been independently produced. The eruption of Vesuvius was caused by an explosion in the earth which happened according to natural laws. The city of Pompeii was placed near Vesuvius purposely. But its being buried under Vesuvius' lava was accidental. Thus, evidently, the scholastic thesis on finality does not say that nothing happens by chance, but, rather, that not everything happens by chance. It is not possible that everything should happen by chance.
cause the accidental presupposes the intentional. All
cause is accidental. Chances it the result of an acciden-
taneous concurrence of two causes, and is, therefore, an
fact which is beside the intent or natural tendencies
the acting causes.

There are at least three phenomena which chance can-


1) Persistence. Even if it were possible
the order of nature could have resulted from a fortu-
ous collocation of chemicalical matter, the same principle
not account for the continuance of order. Our intel-
aturally distinguishes between events that happen
ly and unexpectedly, and those which happen regularly.
Some morning a tile falls near me as I pass a certain
iling, I will suppose that it was an accident and think
le of it. But if it begins to happen regularly every
ning, even if I were a mecanic mechanist I should soon suspect
licious intention. 2) Unity of effect from multiply-
y of causes. The human eyeye is a good example of this.
all all the parts that must cooperate. The muscles,
s, iris, pupil, cornea, sclerotic coat, the rods and cones,
des numerous other factors which must unite to pro-
the one effect of seeing. Such unity of effort on
part of the causes towards a definite effect cries
for for a sufficient reason. Whence comes it unless
from the end? 3) Multiplicity from unity. It unreasonable to say that the manifold perfections of a hardy oak spring by chance from the simplicity of a tiny acorn, or that it is only by luck that the human personality develops from a single cell.

To endeavor to explain predictable effects by hit or miss causes, or to affirm that physical causes systematically and persistently converge towards a definite goal without a directive influence is equivalent to saying that

there are effects without causes, that the greater comes from the less, the higher from the lower; that the accidental is prior to the essential, that the essential is but a name—a denial of the principle of identity—that, in consequence, the real is not intelligible. 8

It seems, therefore, justifiable to conclude that neither chance, nor mechanical forces undirected by a final cause can explain events that happen always or nearly always, nor phenomena that take place in a regular, definite, and determined manner.
NOTES TO CHAPTER IV

1. "L'existence de l'ordre serait donc un mystère à éclaircir, en tout cas un problème à poser."


6. This is true only of secondary, i.e., finite causes. If we consider the whole plan of the universe as conceived in the mind of God there can be nothing that happens without His permission and foreknowledge. Thus St. Thomas writes:

   Something may fall outside of the order of any particular active cause, but not outside the order of the universal cause, under which all particular causes are included. If any particular cause fails of its effect, this is because of the hindrance of some other particular cause, which is included in the order of the universal cause....Hence that which seems to depart from the Divine Will in one order, returns into it in another order....


8. Ibid., p. 356.
CHAPTER V

FIVE OBJECTIONS ANSWERED

The value of some of the arguments for and against teleology will be more clearly brought out by a systematic consideration of some of the principle objections against them. The statement of the last three objections is taken from Brightman's An Introduction to Philosophy, but their solutions, as well as those of the first two, are constructed along the principles enunciated in the previous part of this paper. Although the objections are not referred to any particular author it should be noted that taken together they represent the opinions of most of the opposing authors already discussed.

I. A Misunderstanding. Most objections to sound theories arise from a misunderstanding of the theory. The problem of final causes is sometimes stated in this picturesque formula, "Does the bird fly because it has wings, or does it have wings in order to fly?" This formula, if taken as disjunctive, represents a type of thinking which has characterized modern thought since the time of Descartes. It is the inability to avoid extremes. English philosophers preached, "All is matter." German philosophers shouted back, "There is nothing but thought."
If both sides had listened to their audiences they would have heard the right answer. To the German philosophers the people would have said, "Dust thou art, and to dust returnest;" and for the instruction of the English would have emphatically added, "Was not spoken of the soul." This is the common sense answer and it is the answer of scholastic philosophy. When the extremist inquires into the causes of the world he will ask, "Are there only final causes in the universe, or are there only efficient causes?" He always feels that by the admission of one of two opposites the other is necessarily excluded even when the opposites may not be at all contradictory. But if we place our original problem, whether birds fly because they have wings, or have wings in order to fly, before the oracle of common sense, the response will be brief but sure, "Not either, but both."

Certainly, the bird would never fly if its wings were not mechanical structures of a kind that would be sufficient to help it overcome the pull of gravity and the resistance of the air. But it would also seem that no matter how it came to have wings, whether by evolution or by immediate creation, it has them also in order to fly. Else why should it have wings at all? This is no more strange than my using an automobile to ride to work every morning. The machine, indeed, is mechanical,
but I have bought it and I use it for a purpose. Thus, there is no difficulty in admitting both final and efficient causes. Indeed, the trouble has always come when one or the other was denied. They cannot work separately. Except in the case of God, the First Cause, Who is not influenced by any cause outside Himself, the final and efficient causes are always found together. "The causality of the idea, or final causality is not adequately distinct from efficient causality. The former does not operate apart from the latter. It completes it, adding to it a direction."

II. The Logical Objection. In assigning causal efficacy to ends, one of the difficulties which arise immediately is how the end which in some cases does not yet exist, and in no case exists in so far as it is a cause, can be the cause of something that will exist in the future. Professor Hobhouse puts the difficulty in the question "Does the non-existent cause the existent?" To illustrate he proposes the case of a dinner which, considered as an end, would be the cause of a series of actions necessary to convey one from his office to his home. He then asks, but what of the "dinner which does not come off?"

If a mechanist offered this difficulty we could
parry by saying that the past by which he attempts to explain the present is just as non-existent as the future. However, if we try to offer a more rational explanation, our first observation will be that evidently there is no difference whatever as far as causality is concerned whether the meal was served or not as long as the person concerned thought it would be awaiting him. This much is a fact that we all know from experience. It is sufficient if the end exists in the mind. Here we have the answer to our problem in so far as one can be given. It is not a case of non-being causing being, but it is the case of a possible being apprehended as good inducing the efficient cause to produce or obtain it, or, at least, to try to bring it into actuality or possession. The erroneous conception produces the necessary actions to attain the end until the error is rectified. The execution or acquisition of the end in case of error may remain incomplete. The difficulty is less severe if we remember the nature of the appetite which corresponds to the final cause. From the very first moment of our existence we are inclined towards the good. Thus, we are, as it were, already off dead center in the direction of the end, which is convertible with good, before it is conceived in the mind. This also helps us to see the causal nature of an objective. Perhaps it less than one might have imagin-
ed. It determines, directs, diverts the appetite which by nature already tends towards good in general.

The above remarks have been an endeavor to explain briefly the manner in which the non-existent (not the non-real) influences the agent which will bring it to actuality. Perhaps a more satisfactory answer would be desirable, but the difficulty loses much of its force the moment we recognize the certainty of the fact. Even the fact cannot be admitted by a pure materialist, but it is evident to anyone who admits mind. The mind can look to the future and plan just as easily as it can look to the past and remember.

Once the problem is solved for intelligent beings there is no difficulty for natural bodies, for although their principle of direction is innate in them, ultimately they are determined to their end by another who has mind.

III. The Anthropomorphic Objection. The anthropomorphic objection runs as follows: "the whole idea of purpose or end is derived from human psychology, and only human conceit would make bold to read the cosmic process in terms analogous to human experience." Before we can discuss this difficulty intelligent-
ly we must come - we to some agreement on a definition of anthropomorphism as. Baldwin's Dictionary gives the following: Anthropomorphism is "the assumption of human beings that their own characteris tics are present in beings or facts widely ory different from them selves, more particularly in gods or in the forces of nature." The word has most frequently been used in the history of religion to denote a tendency in early peoples, especially the ancient Greeks, to attribute human bodies, passions, needs, faults, and characteristics to their gods. The word is also used to signify the attributing of these same characteristics to members of the animal, plant, or mineral world.

We must carefully distinguish this use of the word from the doctrine line of analogy. It is impossible for us to speak of the Infinite Being, for example, except in terms derived from human experience. We say that He is Being, that He has intellect, will, life, personality, because we can prove from reason that these are essential qualities of a necessary being. It is true that we draw these notions first from our own experience. But when we apply them to God we do not mean that He possesses them in the same sense or degree in which we possess them. We speak analogously, not anthropomorphically. We predicate a
human property to a being that is not human, not, indeed, in a univocal sense, but understanding that there will be at least a partial similarity, but possibly a far greater dissimilarity.

Let us now turn our attention to finality. When teleologists are accused of anthropomorphism the objection may be understood in two senses: first, it may be an imputation of real anthropomorphism. Whenever there is evidence for this error the accusation is just. But if it is taken in a broader sense by which it would mean that because we first get the notion of purpose from human experience it is illicit to apply it to a being of any other nature, in other words, if it wishes to make anthropomorphism synonymous with analogy, it misunderstands the nature of human thought, and underestimates its value.

We could hardly get outside of ourselves without the use of analogy. The Humane Society would not be so solicitous for the care of dumb animals if it did not think they feel pain in a way similar to that in which men suffer. But they can know this only through analogy. We can know that other men think the same way that we do only by the perfect analogy we see existing between their words and actions and our own.

Hence, although the argument from sufficient
reason is the strongest argument for finality in nature, the analogical argument is valid. Scientists continually make use of the principle that like causes produce like effects. The principle is just as valid if turned around: "Like effects have like causes." The teleologist sees the order and adaptation in nature. "But order," he argues, "or at least continuous and persistent order is always the result of purpose. Therefore, there is purpose in the world."

IV. The Dysteleological Objection.

There are facts that seem to point to a purpose. There are as many more facts that seem to point to an indifferent or malevolent universe. To select the teleological facts while ignoring the dysteleological is to deceive oneself. 'Teleology is an illusion.'

This is a broad objection opposing the whole problem of evil to the arguments for finality in the world. This is truly the most serious objection to a metaphysics of finality. It is not that any other system, whether of monism, mechanism, or pantheism can explain it better, or even as well, but after all has been said that can be said, there still remains the fact of evil in the world, and its ultimate "why" is a mystery. It is evident that the world is not the best possible, absolutely speaking, as Leibnitz supposed. But God has created the world for
reasons of His own, and we can be certain that He created at least relatively the finest possible world, i.e., the one best suited to accomplish His own inscrutable designs. Since it is not given us to fathom the intentions of the Infinite Wisdom in creating the universe, naturally there will be certain factors in it the purpose of which we will not be able to understand. But ignorance of purpose is not a denial of purpose. Certainly we have found uses for things which in the past were considered purposeless. However, we must still account for things that are certainly evil. The answer here must be limited to physical evils, but correct general notions of evil will also be applicable to moral deordinations.

The nature of evil can be brought out more clearly by contrasting it with essential or ontological goodness. Good is that which is suitable or desirable to any nature. Good in this sense is coextensive with being, for there is no being for which at least existence is not suitable or desirable. Good, too, is closely connected with end, for that is good for a being which perfects it, i.e., which helps it attain its end. We continually think of good in this relationship. What do we mean when we say that a rifle is good or that a bird dog is good except that they be good for the end for which they are intended? Every end is in some sense good, and every good could be
considered under the aspect of end. Thus

the two formulae, 'The good is that which beings desire, or towards which they naturally tend,' and 'The good is that which is adapted to the ends which beings have in their existence,' really come to the same thing; the former statement resolving itself into the latter as more fundamental. 

In the concrete good is identical with any real being, for there is no being which cannot be conceived as the term either of its own appetite or as the term of some other being's appetite.

If everything is ontologically good, it follows that there can be no being which is evil. And this is the scholastic teaching in spite of its admission of evil in the world. As good is to be identified with being, so evil is identical with non-being, not, however, with absolute nothing, but with "absence of the good which is natural and due to a thing." Just as we never see color alone but only colored objects, so evil as such or as a positive reality separate from a subject of inherence simply does not exist. Disease, blindness, war, death are always with us. They are never alone, however, but always in some subject.

With these preliminary notions about the nature of evil, the reconciliation of teleology with physical evil in the world may be treated with dispatch.
1) Evil, as we have seen, is always seated in a subject, therefore, in a good. This is sufficient to answer those who imagine a totally malevolent universe.

2) Many things that are apparently useless or even harmful may serve unknown purposes. Some of the endocrine glands, for example, were long thought to be mere vestiges, but are now known to have useful functions.

3) There are many cases where the evil is so relative that the good occasioned by the evil is obviously equal or greater than the damage done. Man and certain animals must inflict death on other animals and on plants to provide themselves with food. Death to one is life to the other. Besides, what overcrowding we should soon have if no animals on earth ever died?

4) The metaphysical reason why evil does not contradict teleology is that nothing ever tends towards evil as an end (unless under the appearance of a good). Evil is related to teleology in almost the same way as chance. It always results accidentally, or at least secondarily to the primary tendency. Whatever evil or flaw there may be in any effect is the result of defect in the principle of action. Hence, St. Augustine says that "evil has not an efficient cause but only a deficient one."
Thus, if a monster is born it is due to a defect in the primary cells or in the genital organs of the parent or to some similar disorder, and not to a natural tendency in the embryo towards imperfection. Such a diseased embryo still tends towards its end and natural perfection. It tends, however, only in so far as it is an operative principle, and not in so far as it is defective. Thus, when an agent fails to attain its end, it is not a sign of a false tendency towards defect or destruction. It is because of failure to act completely, or because its action was thwarted by some counteractivity. This failure to reach the end is evil. But the evil is not the object of the natural tendency. It is due, rather, to circumstances.

Still, it may be urged, explain it how you will, evil remains. This is true, and the teleological worldview is not so radically optimistic as to deny it. But the fact of evil will remain no matter what system of philosophy one adopts. It is that system which can best explain evil and all the other difficulties that should be accepted. The scholastic teleologist is convinced that his system labors under the fewest inherent difficulties.

V. The Evolutionary Objection.
The theory of evolution has rejected the 'special creation' theory. Evolution has also explained the adaptations to environment by the theory of natural selection. Hence present adaptations are not the work of a creator who made organisms as they are, fully equipped for the battle of life, but they are the result of a sifting-process, which involves the apparently aimless birth and destruction of countless maladjusted or poorly equipped organisms.

In another direction evolution seemed to undermine belief in a world-purpose. Traditional philosophy and theology had usually regarded the purpose or purposes embodied in the universe as eternal and unchanging. The theory of evolution has laid rude hands upon this ark. It sees in change and growth and the emergence of genuine novelties the most characteristic features of our world. If evolution be true, the reality that embodies itself in the world-process cannot be eternally static.

The first of the above objections may be resolved into two parts: 1) the rejection of the "special creation" theory in favor of the evolution of species. 2) The affirmation that evolution of species involves the aimless birth and destruction of countless maladjusted organisms.

It will not be possible here to consider these theories historically, nor exhaustively in any sense. But let us for a moment turn on each one the light of a little logic in order to see how they affect the arguments which, we maintain, prove the objectivity of final causes in nature.

First of all, the "special creation" theory must be carefully distinguished from the absolute or direct
creation of the matter of the world with its laws and order. Matter could not of its own power have arisen from non-matter. This philosophical postulate is beyond the realm of scientific evolution. In regard to the evolution of the species we should distinguish between the origin of the first species and the origin of those species which have supposedly developed from preexisting ones. For with respect to the first species there is the problem of how life came from non-life. Science has proved that all past and present theories of spontaneous generation have been myths. Philosophy also calls our attention to the fact that no being can give to another what it itself does not in some way possess. To state the contrary would be to hold that entity could come from non-entity. Matter might have developed some simple organization which would be a favorable receptacle for life. But at some time there had to come a flash of life. The only explanation of this first vital flash which coincides with the principles of logic and the findings of science is a creative act. It would not necessarily be creation in the strict sense, as in the creation of matter, for that matter would already be at hand. It could be what is sometimes called secondary creation or Divine Administration. Thus, strictly speaking, the question of evolution and finality is
restricted to the appearance of new variations of primitive species for whose existence we have assigned a sufficient reason.

The foregoing remarks have been laid down as a foundation without which evolution can have no intelligible meaning. When we look upon evolution as the systematic growth and development of the universe which took its inception from the Creator, it matters little to scholastic teleology whether we say that each species was separately created or whether the new was somehow generated by the old. It came ultimately from the Creator, and, logically, if there is development, it should be according to His intention. In this light, evolution is not only not opposed to teleology, but furnishes another argument in its favor.

Now to the second point of the objection which may be stated thus: 'In the process of evolution thousands of unfit plants and animals perish aimlessly. Only the fit survive.' Let us ask, What if none of them did die? Would finality have a sounder basis? Or, would they not destroy man whom they are intended to serve? In the supposition that no plants or animals would die, men and animals would have to live on water and the minerals of the earth as plants do, and plants would so multiply
as to smother and crowd out men and animals, and, indeed, they would soon exhaust the fertility of the soil, which in the present system is partially replenished by the corruption of dead matter, and be doomed to starve. Our conclusion is that unless some die all will die. Death is necessary that life may continue. Therefore, while death is the frustration of the immediate end of the individual, it is not a frustration of the principle of finality, as was explained in answer to the dysteleological objection. Death serves rather a larger and more ultimate end.

Darwin's theory of selection on which the objection is based cannot alone account for a theory of race-evolution. To try to explain present species by pointing out that they are the survivors of countless numbers that have perished, is almost like saying that there are two hundred leaves on a certain tree because all the others have fallen off. Thus, those who would uphold that part of the Darwinian theory which tries to account for the survival of the fit by the fall of the weak, have yet to account for the 'arrival of the fit.' If there were no design in the world the fact that by far the greater majority arrive fit would be an insoluble problem.

If Darwinism be accepted in the loose sense of
evolution in general, we might agree with Darwin's son when he writes:

One of the greatest services rendered by my father to the study of natural history is the revival of teleology. The evolutionist studies the purpose or meaning of organs with the zeal of the older teleology, but with far wider and more coherent purpose. He has the invigorating knowledge that he is gaining, not isolated conceptions of the economy of the present, but a coherent view of both past and present. And even where he fails to discover the use of any part, he may, by a knowledge of its structure, unravel the history of the past vicissitudes in the life of the species. In this way a vigor and unity is given to the study of the form of organized beings, which before it lacked.

But Darwinism in the stricter and truer sense of the word according to which the evolution of species is due entirely to chance variations is not compatible with scholastic teleology.

Yet, while scholasticism cannot accept Darwinism, it finds in evolution itself no contradiction of its doctrine of teleology, but a broadening and enobling of the concept. There is a principle in scholastic philosophy which says that 'it is not permissible to postulate an act of the Creator to explain a phenomenon which may be accounted for by natural causes.' Whatever, therefore, can be explained by evolution must not be attributed to the direct action of the Creator. There is greater elaboration of design in an evolutionary system than in a
To plan out a universe of finite entities, differing in essence and in grades of perfection, is doubtless a work of superhuman wisdom; but to include in the design the further idea, of conferring on these entities a complex variety of forces, qualities, active and passive, faculties by virtue of which nature could ever grow out of itself and develop from lower to higher forms of existence, and should multiply along definite lines of being; to conceive a world whose constituents would ceaselessly energize on one another, yet without confusion and in an admirable order; to allow to the creature its own proper causality, and yet, even in spite of the manifold action of free will in a countless multiplicity of immortal intelligences, to elaborate a perfect unity; surely this is an incalculably higher manifestation of wisdom. It serves to manifest the DoUier of the Creator; for every cause is proportioned to the effect. But the completion of a design such as has been described, is a more noble effect than if every production of natural operation were the result of immediate creation.

Similar quotations could be multiplied, but those given will suffice to show that defenders of teleology find nothing incompatible between final causes and a reasonable theory of evolution.

Little need be said in answer to the second objection. When it speaks of the "purpose or purposes embodied in the universe", it refers to the ultimate physical, subsistent end of the universe, that which is popularly called God.

How any thoughtful person who knows anything about what the concept of God must contain, could say that
He is a product of evolution is incomprehensible. To evolve means to unroll. Now you can't have unrolling merely. You must have something unrolling. And this something must have a cause which itself is not caused. Otherwise matter would have to be the cause of its own existence. It would have to exist before it existed which is absurd. The conclusion is the same not only for matter, but for anything finite. Therefore, the Uncaused Cause must be a being that is infinitely perfect. But what is infinitely perfect cannot change, for in the concept of change is included the notion of acquiring or losing some perfection. But in a being which is infinitely perfect there can be neither liability of loss nor possibility of gain. Therefore, the notion that God is being brought forth in the labors of a world-process is chimerical.

Evolution, therefore, far from weakening the evidence for teleology, augments and corroborates it. An efficient cause rather gains than loses prestige by working through secondary agents. Our concept of God is nobler if we suppose that He created the world with laws and powers for development than if we imagine that He had constantly to intervene in order to create a new variety or species or to extinguish an old one.
NOTES TO CHAPTER V


9. "Evil is not an essence."

10. Et similiter malum uno modo potest intelligi id quod est subjectum mali; alio modo potest intelligi ipsum malum; et hoc non est aliquid, sed est ipsa privatio aliquid particularis boni.

11. For a sovereign evil must needs exclude the association of all good; just as the sovereign good is that which is wholly disconnected from all evil. Now there cannot be an evil entirely apart from good. Therefore nothing is supremely evil.

12. Causas porro defectionum istarum, cum efficiences non sint, ut dixi, sed deficientes, velle invenire tale est, ac si quisquam velit videre tenebras vel audire silentium, quod tamen utrumque nobis notum est, neque illud nisi per oculos, neque hoc nisi per aures, non sane in specie, sed in speciei privatione.

St. Augustine, De Civitate Dei (B Dombart, editor; 2 vols.; Lipsiae: In Aedibus E.G. Teubneri, 1877), XII, 7.

13. Defect in effect and action results from defect in the principle of action: thus a monstrosity results from a defect in the seed, and limping from a curvature of the leg. Now an agent acts according as it suffers from defective power. And according as it acts, it intends the end. Wherefore it intends an end corresponding to its power. Hence whatever follows corresponding to the defective power, will be beside the agent's intention. And this is evil. Therefore evil occurs beside the intention.

St. Thomas, op. cit., Bk. III, ch. 4.


15. That these primitive pairs, then should have been evolved out of the potentiality of the matter without parentage,--in other words, that the matter (of itself utterly incapable for the task) should have been proximately disposed for such evolution,--belongs to a special divine Administration.


18. This principle was foreshadowed by St. Thomas (v.g., S.C.G., III, 77) and by Suarez, and is clearly enunciated by later scholastics:

Hescio cur ulli increadibile inopinatumque videri possit, si res elementares, quas Deus in prima rerum
creatione effecerit, viribus a natura sibi inditis active cooperari potuisse dicamus ad mundi efformationem, simodo ponatur Deum ad hoc primitus iis dedisse convenientem motum localem, convenientem distributionem in spatio, convenientesque dispositiones ceteras.


20. Whatever becomes anew must take its origin from some cause of its becoming, since nothing evolves itself from potentiality to act, or from non-being to being.

CHAPTER VI

THE OLD VERSUS THE NEW TELÉOLOGY

Some of the recent Introductions to Philosophy devote a section to what they call the "new teleology." Exponents of the modern theory of Emergent Evolution such as Lloyd Morgan are among those who defend this view. Their theory upholds an immanent teleology akin to that of Bergson whose theory has already been mentioned. According to this theory no mind is required to conceive the principles of nature's order. From the viewpoint of being the world is an organism in which the parts are ordered to the whole and the whole to the parts. Its activity is a kind of creative evolution, a process of self-realization and achievement. This realization presumably would consist in "life, individuality, mind, consciousness, social organization, freedom, morality," but whether nature will ever come to the end of its tendency creative evolution generally does not say. This theory is no more satisfactory than the absolutist teleology with its postulate of an immanent, all-absorbing mind, constituting nature, working in it and ordering it through evolutionary laws. Both are pantheistic.

Superior, we believe, to either of these theories
is that of those medieval (and modern) philosophers who, beginning with the order evident in nature, sought its explanation by tracing series of causes to their origin. Doing this they found that in order to have a beginning at all, there must be some being of a nature essentially superior to the series in question, a being whose existence did not have to be accounted for by some previous being, but one who should have existence as necessary and essential to it, and be in every way self-sufficient. A cause was needed because the order could not have caused itself. It had to be intelligent because the very nature of order presupposed foresight and planning for a definite effect. Order without an orderer was not order at all but chance and chaos. This orderer they called God. Those who proposed this argument for the ultimate explanation of universal order were the scholastics. Their theory is sometimes referred to as the "old teleology." Those who so name it seem to think of it as a predecided theological dogma which the argument must be made to fit, and not a rational justification of fact. And, yet, what is so odd about the scholastic teleological system? It would seem to be based on solid grounds and to proceed without logical blunder. It has all the advantages of the "newer teleology," and many more. Both admit the inmanence of the final tendency. Both may agree that the influence
is a "pull" rather than a "push", an attraction, not a goad. But scholastics add that God is the author of both the ends and the tendencies. Say what you will is intermediate; He is the first beginning and the last end. Herein the scholastic doctrine is more complete and ultimate. Of what value is a tendency towards an immediate goal or end? Of what value is an immediate goal even when attained? Even if we supposed the material universe to be homocentric, and that all the ends of all the beings in the world were fulfilled in becoming for man an object either of use or delight or contemplation; of what value would it all be if man also did not have a goal, an eternal, infinitely satisfying object of all his desires and loves, and through man all things else? In the scholastic system this object is given. It is God. All things were created by Him because of His desire to communicate His goodness to others. All things tend towards Him, man immediately, and through man the lesser creatures. Not by absorption in God, however, but by love and contemplation of Him man will find his happiness. When man has attained his goal the material world shall have served its purpose and will be needed no longer. But while it exists we can still say "the heavens show forth the glory of God." This in brief is the complement which the older teleology offers to the new.
NOTES TO CHAPTER VI


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The thesis, "The Order of Nature and the Problem of Teleology", written by James Stuart Tong, S.J., has been accepted by the Graduate School with reference to form, and by the readers whose names appear below, with reference to content. It is, therefore, accepted in partial fulfillment of the requirements for the degree of Master of Arts.

Rev. Reginald R. Lefebvre, S.J., Ph.D. May 8, 1939