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Determinism, Indeterminism and Autodeterminism of the Evolutionary Processes

1. Introduction

Controversies about the deterministic and indeterministic interpretation of the events occurring in nature have a long history. Incidentally deterministic view of the world in its extreme form revealed itself in the mechanism created by classical physics. This mechanism announces that unequivocal natural laws are of universal nature and are unquestiobly obligatory. This view has been questioned. Nevertheless the very principle of events determination is particularly as methodological postulate of biological research. At the same time it must not be forgotten that a considerable part of the processes occurring in nature is subject to probability regularities, that is to casual conditioning which is possible to characterized within statistical framework.

Controversies between determinism and indeterminism prevailed mainly in physics. Only indirectly and occasionally they were reflected can be observed in the research area of biological sciences, where either determinism or indeterminism was favored for some time. The confirmation of this state of affairs may be the formulation of factors and mechanism of the process of biological evolution. Thus Lamarckism formulated a strict causality of he course of the evolution process, creating therefore the opposing trend with respect to Darwinism. On the other hand Darwinism, taking into account a considerable influence of the chance, declared the specifically understood indeterminism. The development of many fields of knowledge in the 20th Century became the ground to give more detailed considerations of this Darwinian formulation, for example within the synthetic evolutionary theory. The development of genetics permitted a discovery of the factors determining features, which

are affected by the natural selection. These features appear as result of mutations which are created randomly in genes. Next the development of populational biology drew the attention on the considerable influence of the population structure on the evolutionary process as well as on the ways of "obtaining" new environment by the population. It was also important that gradually and more lucidly the species were treated as the effect of the so called reproductive isolation. Later, in the 1970 s, a new impulse on the view of evolution processes was conveyed by the results of research on DNA structure. A new branch was created: a molecular biology, the research carried out within the framework of this branch revealed the DNA to be an agent of the genetic information and us evolutionary mechanisms may be perfectly well analyzed at the molecular level. In this aspect it was gradually realized that it is necessary to "distinguish between that, what is called the history evolution from the theory which is emphasizing the mechanisms of mutation and natural selection" (Hempel 1965, P 370).

Moreover, in the very evolutionary theory some aspects are more clearly differentiated (Hull 1974, Dobzhansky 1970). The first refers to the assumption of the organic evolution continuity (Jones 1981, Kloskowski 1986). This assumptions is based on the geological evidence, still being discovered as well as on the attempts of philogenetic reconstruction of evolution which, unfortunately, often is the scene of referring to the speculation. The second aspect applies to the theoretical system of views explaining the evolution processes. The diversity of opinions in the latter aspect of the evolution theory results primarly from the different biological, philosophical, methodological and epistemological assumptions made by different scientists. Moreover many scientists, depending to the field of knowledge they represent, concentrate intentionally on selected mechanisms, features or evolutionary consequences. It would not be an oversimplification to state that, when one says that the evolution is a process of cooperation of genetic variability and the environmental factors. The environmental factors are not so important in the appearance of the mutation process but in the selection of the mutation process itself, that is the selection and approval of favorable mutations with simultaneous elimination of unfavorable. "Evolution does not derive that what is new in it, that what appear in it from nothingness. It acts on the ground of what already exists both in the case when it transforms the old system granting it a new function and in the case when it unites a few systems creating a different and a more complex one. Evolution proceeds like "bricklayer" which slowly transforms its workpiece during many, many millions of years, improving it constantly, deducting here and adding

there, using all opportunities for fitting, transforming and creating" (Jacob 1987, P 56-57). Speaking more precisely the evolution is nothing more than the process of impact natural selection on hereditary changes appearing randomly in certain generations. As a result better adapted mutations are retained, while poorer adapted ones are eliminated from the population. It does not mean that better adapted mutations must be "retained" in any conditions while worse adapted ones must be eliminated. It only means that the mutation has a greater or a smaller chance of survival and a preservation in the population, but there is no certainty. Thus the random phenomena determine thus both the creation of genetic changes and preservation of the changes in the population. However we should remember, what Charles Darwin said selection "quietly and unnoticeably acts always and whenever the opportunity occurs on the improvement of every organic species with respect to its organic and nonorganic life conditions. Such tiny development changes cannot be spotted at all, unless the pace of time leaves its footprint on the thick layer of ages" (Darwin 1955, P 88). It is obvious that the evolution theory is based on collected biological facts: paleontological, biogeographical, genetic, as well as within the scope of systematics, molecular, populatio- nal biology and so on, which may be "arranged" in different manners according to empiriological, methodological or epistemological assumptions. In other words, two mutually dependent elements are essential in the evolution theory: natural data referring evolutionary factors and the method of their arrangement. Thus the second element is important for our analysis because a particular arrangement of evolutionary data shall be treated as their interpretation. In order to adequate analyze such interpretation however, there is a necessity to adequately approach the methatheoretical reflection. Considerations of this kind seem to be appropriate area for obtaining the essential nature of the mechanisms and evolutionary factors. In this aspect it bcomes essential to specify the problems of determinism and indeterminism and compare them as well as relate them to the evolutionary factors, one has also take into account the rules applying to the evolutionary phenomena.

Both determinism and indeterminism were and still are variously described by different scientists in the history of science. There is one common point of all those descriptions. Namely different divisions and descriptions of determinism and indeterminism are usually created on the grounds of extra biological sciences, therefore they refer to the nonliving nature phenomena (Dear 1961, Hoering 1969, Jauch 1973, Titze 1963, Weinschenk 1985, Margenau 1967, Scriven 1957). These traditional divisions will be used thereafter and will be related to the statements on

the evolutionary theory. The publications of authors and representatives of the synthetic evolutionary theory, which directly or indirectly approached the issue of the determinism and indeterminism will above all be taken into account. Afterwards a personal view on settling the controversy between determinism and indeterminism will be presented and accurately defined.

2. Features of evolution processes

The nature of evolutionary changes is mainly determined by mutational processes, natural selection and the genetic drift. The natural selection is a major mechanism granting all evolutionary changes a character of "purposeful" adaptations to the environment. The essence of this mechanism, according to Darwin's concept is the varied reproduction effectiveness of certain genotypes in the population. And the mutation processes are spontaneous and permanent changes of hereditary features of the organisms caused by processes occurring in genetic code contained in the DNA (Mayr 1976, Figureau 1986). The genetic drift however is the random oscillation of the gene frequency which takes place in certain, isolated population. The genetic drift may constitute the source of elimination of certain gene from the process of transfer to next populations or the increase of the frequency of its appearance. All that may to a high degree influence the acceleration or slowing down the selection processes (Kampfe, Gunther 1980, Mayr 1978). However, it should immediately be clarified that "the selection process acts on the overwhelming number of taxa of the specoes features in a stabilizing way at any given time, but rejects only very clear deviation while tolerating the minor ones. Not numerous system of features is connected with mechanisms supervising the numbers. Those changes of the genome which are not clearly harmful and which are not connected with the numbers supervisors acting may remain unnoticeable for the selection and thus its oscillation may depend on the random circumstances" (Szarski 1976, P 171).

Leaving aside the problem of cooperation of the aforementioned factors, two essential assumptions, which bind together the further analysis, have to be pointed out. The first emphasizes the fact that the evolution did not have to proceed in a similar maimer in all groups. In some of them it could have proceeded under the direct pressure of the selection as a result of the change of environmental conditions, whereas in the others it could have depended on the random diversification of the groups or its lack (Wright 1940). The second assumptions is the following.

The evolutionary process does not need to be caused only by direct factor or only by the random one. The most probable is the acceptance of the combination of those two factors (Dobzhansky 1970).

Hence it is clearly seen that "the chance takes place in the situation when something unexpected, unforeseen occurs, that is not a consequence of the intentional activity" (Wojciechowski 1976, P 328). Therefore a chance understood in that way has a very extensive scope of "activity" during evolutionary processes.

Random mutations and recombinations constitute the source of the hereditary changes.

Random oscillations of the gene frequency may eliminate a certain gene or increase the frequency of its appearance, moreover they may influence the acceleration, slowdown or setback of the selection process with respect to the certain gene.

The random environmental changes influence the adaptations. In the process of competition by chance the individual may win by chance while being not necessarily the best adapted. In the process of adaptation by chance the features with no adaptive significance may by chance be recorded.

The possibility of such approach to the random incidents does not alter the fact that certain evolutionists emphasize more or less strongly the influence of the remaining evolutionary factors, treating them jointly or exposing only one of them. They strongly emphasize the much paraphrased idea of Keosian (1974) that certain evolutionary factors should not be considered in the aspect of the probability of the appearance of a certain species or the population during the evolution, but rather in the aspect of the probability of the appearance of conditions in which the appearance of the population or species becomes highly probable. The use of such a postulate in the evolutionary process raises the possibility of much more extensive and more generalized understanding of the evolution as well as adequate understanding of the significance of the random incidents. It constitutes the argument to once and for all set apart from the metaphysical interpretation of the influence of the random incidents in the evolution processes. Since within such an approach the chance was treated as a useful factor in filling up the "gaps" in the reasoning or in the indigences of the profound knowledge on evolution processes. Moreover, the aforementioned postulate allows to determine why the mutation, natural selection, genetic drift or isolation occur at all and that is why newly appeared structures become more and more complex (Titze 1983). Every evolutionists as a biologist realizes that purely random appearance of newer and newer organisms, species and populations was limited by:

- the relative stability of in respect of time previous ancestors,
- their mutual interactions.

Thus the process of selection is fairly easy to determine, however there immediately appears the insuperable difficulty in explicit specification of the selected variant of species or population. Since the number of the possible solutions is fairly great, but actual course of the evolutionary process on the rules which "limited the possibility of selection" (Kunicki Goldfinger 1974, P 201). These rules was the operation of the evolutionary factors. Specifying as Dobzhansky (1966, P 64) says: "the natural selection leads to the appearance of organisms which can become adapted to a given environment, but on may be adapted to the same environment in a variety of different ways". Due to those reasons as well as due to the possibility of probable or explicitly causal approach to the random incidents in the evolutionary process we may initially point out: ordinarily random events and probably random ones (Filiyukov 1972). First refer to the set of certain conditions which may or may not occur, yet when they appear one time however, they may not occur again even though the set of those condition is still operating. On the other hand the probably random events are those in which a trend towards repetition is retained. Referring such terms to the evolutionary mechanisms it has to be noted that on the level of individual processes during the mutation, we deal with the probably random events. Whereas on the level of more complex phenomena for example the appearance of the species we should discuss the ordinarily random events. Since no single case is known of the same biological species to appear twice. It seems that in solution of the problem of evolutionary determinism and indeterminism the most adequate will be the following differentiation of the chance. The suggestion here is to treat the chance dually: either as a relative chance or an absolute chance. The first kind of the chance is understood as such an event which has no cause in a given reference system. On the other hand the absolute chance is an event which does not have any cause in all the physical world. The explanation of this division referring to the evolutionary mechanisms is as follows. The mutation is random (a relative chance) because it has a cause beyond the biological system, it has a cause in the chemical or biochemical system. The genetic drift causes the change in the frequency of the gene arising from a low number of the population. The reason for this low number of the population may be for example geological, meteorological disaster or the attack of one population against the other. In this sense the drift is a random phenomenon in the relative aspect. It seems slightly more complicated with the natural selection. It is generally known that certain environmental conditions influence selectively certain

phenotypes, this activity is causal, for example an individual with higher tolerance for the temperature changes will survive higher temperature oscillation than an individual with a lower range of tolerance. Nevertheless the natural selection also possesses the random "component" because the best adapted individual does not always survive (it can be statistically calculated). Naturally in the natural selection the causal relation is of much greater importance than the chance. However also here the relative chance must be pointed out. The isolation is also random. The reasons for this evolutionary factor are also beyond the reference system that is beyond the species, for example geographical conditions, random displacements and so on. As it is be clearly seen within the evolution process the chance may be discussed in the relative aspect. The absolute chance cannot be discussed. The chance itself is exposed as an event without a cause which can however constitute the cause.

3. Determinism versus indeterminism dispute

Elsasser (1981) in the research which took many years attempted to set up the formal biological theory related to the quantum mechanics. He came to the conclusion that the biological theory discusses the biologically necessary conditions and not the sufficient conditions. Conditions which are at the same time sufficient and necessary refers to physics. The previously presented considerations fully support these suggestions. However, in earching for an appropriate biologically indispensable evolutionary conditions one comes to the conclusion that both the chance as well as the aforementioned factors and mechanisms are the source of the evolutionary changes. Moreover reference to the random events does not deny the so called continuity of the evolutionary processes. In such generalization it is necessary to understand what lies at their basis. The point is then to explain the evolution creativity that is "the creation of novelties" (Dobzhansky 1967, Elliott 1966, Gaussen 1951) by referring, among others, to the chance. In solving this problem one may try to put up the question about the wieght of an ancient dispute on the determinism versus indeterminism. At the same time two suggestions will be taken into account:

One may "not declare for the determinism or indeterminism thesis and nevertheless favored an idea which, in consequence, leads to the rejection or to the acknowledgment of the chance" (Sztejnbarg 1934, P 170).

The chance is an event occurring simultaneously with the other event "with which it is not causally tied" (Dennert — not dated, P 41).

Such an outline of the problem forces one to the realize that well known evolutionary factors such as mutation, recombination, natural selection, drift are the determinants of the dependance of phenomena on various antecedents in the evolutionary process. Moreover it is necessary to determine clearly what is understood by determinism and indeterminism.

3.1. Basic specification and the nature of the dispute

Amsterdamski (1958, P 86) on the ontological plain specifies the general determinism and the univocal one. The general determinism is a view, according to which "all biological processes are carried out in such a way that the state of the system isolated in the moment to, characterized by an appropriate set of parameters, depends by virtue of certain rules on the state of this system in the moment ti. On the other hand the univocal determinism constitutes the particular case of the general determinism, since besides all the conditions determining the general determinism, it specifies such a state of the system, which in certain moment ti univocally points out its location in the moment to.

This type of classification of the evolutionary processes may be found in the works of Simpson (1964) who distinguishes the general determinism from the univocal determinism. The general determinism is, in the opinion of Simpson, a view which assumes the occurrence of the dependencies among particular evolutionary processes without the necessity of referring to the predeterminism of the future states. It is to be emphasized however, that what is discussed here is the not renewed, not repeated determinism, which is unpredictable and unforeseeable. The foundation of such descriptions is laid by the fact that the evolution is partly deterministic, and partly indeterministic, for example the mutation triggers of the appearance and adaptation to environment one of many mutants and it is impossible to point out precisely which of mutants will adapt. Generally speaking a certain event (one of many possible) determines the appearance of another event which cannot be precisely predicted. Trying to describe the "functioning" of the determinism, Simpson draws the attention to its historical and nonmechanistic aspect. Thus the base is the historical determinant where the evolution may occur, for example certain populational structure or certain environmental situation. On the other hand the nonmechanistic dimension of the evolutionary processes finds expression in the effects of the activity of the evolutionary mechanisms within the "base" and these are the random elements of the evolution: the genetical variability in particular. Although the interde-

pendence of the evolutionary phenomena in its physical and chemical dimension shows a deterministic character, the evolutionary laws do not have to be reduced to the physical laws. Thus — according to Simpson — it would be an oversimplification to interpret the evolutionary processes within indeterminism of the physical laws and chemical phenomena. When discussing the univocal determinism however, within its framework the univocal interdependence of the phenomena that is stressed. A particular event is followed by another one, always the same and precisely determined event. According to Simpson (1964) the best examples are Lamarckian concepts, (the so called antichance concepts), Berg's nomogenesis (evolution is determined by law) orthogenesis (orthogenetic evolution is supposed to proceed underviatingly in single directionregard- less of environment, organic activity, or such factors as natural selection) vitalism or finalism. Still different understanding of determinism appears in the context of causalism (Largeault 1981, Friedman 1980, Hesslow 1981, Frank 1932). Amsterdamski (1964) points to the univocal an nonunivocal causalism (Taylor 1973). Causalism of the second kind can be defined as follows: all nature phenomena influence one another in such a way that any system existing in the moment to defined by certain parameters marks out univocally or probabilistically the state of a system in the moment to. Therefore while defining the univocal causality the condition qualified by the feature "probabilistic" is to be excluded. Thus it is easy to point out that the version of nonunivocal causalism is a broader formulation, this kind of causalism indicates mainly the nonunivocal influence between certain physical structures. Such a formulation is close to the explanation of the evolution processes within the framework of the synthetic evolutionary theory. If however the chance was excluded from the evolution, then one could only refer to the univocal causalism. One has to consider closer these issues and justify them. Causalism is understood here in such a way that "all separate events are the result of other individual events, that is they are univocally genetically determined by some other events which constitute heir causes" (Hempoliński 1989, P 254).

Causalism understood in such a way, according to Fischer (1934, P 106), assumes the form of natural causal relationship which governs all nature phenomena including the evolution. This natural causal relationship may have the deterministic and the indeterministic dimension. Within the deterministic causal relationship one searches for the reasons ad finitum based on extrapolations from experience. As a consequence, causal relationship understood in such a way does not allow to predict the future on the grounds of the observation of the past because in "the history of the world there is neither cause nor result included but only a

previously determined pattern of events which for some reasons, not explained by the deterministic theory, is perceived by the man as arranged in time" (Fischer 1934). The pattern of those events possesses, according to Fischer, a probabilistic dimension. It may be determined in the following way: it may be possible to predict, on the grounds of observation, that certain physical system would react appropriately (adequately to expectations), according to the similar rule the number of weddings in London this year may be predicted. These predictions are based on the calculation of the average of those events in the past. But as the cold beaker delays the chemical reactions, the emotional apathy affects millions of people, their average behavior will be determined by the environment and not by the determinism of the aggregation of the aforementioned phenomena (Fischer 1934). The shortcomings of the deterministic causal relationship become more apparent when one takes into account the results of genetic research of the fruit fly mutation process. It is evident from the research that the relationship: mutation — evolutionary changes is not of the deterministic nature because in some cases small and rare mutations appearing suddenly in the naturally unfavorable mutations lead to the favorable modifications of species and populations. Thus Fischer concludes that the reasons for evolutionary changes are not processes which determine that the favorable mutations will be effective, whereas harmful ones, often stronger and more numerous will turn out to be ineffective as the causes of evolutionary changes. Due to those reasons Fischer is of opinion that the indeterministic casual relationship is appropriate for evolutionary processes, in such understanding of the causal relationship the notions of cause and causality acquire crucial significance. The point is that the natural law determines the probability of future events. Certain events determine probable events which cannot be predicted explicitly on the grounds of extrapolation of the observation of past events. The cause is creative. It is beside the question in what way some events trigger off others yet the point is "to place in time and space the creative casual relationship" (Fischer 1934). In order to understand the evolutionary process it is necessary to locate its causes. In this perspective the evolution appears as a creative process and individual mechanisms are treated according to their nature. Hence for example the mutation becomes a requirement enabling the course of the evolutionary processes and it does not become a reason of the direction of the evolutionary changes. Similarly, the remaining evolutionary factors may be interpreted.

Therefore while discussing determinism within the evolutionary theory what is meant is the general determinism as well as equivocal

causalism. Thus according to Bunge (1961, P 446-447, 1968, P 25) "the chance which at first sight seems to deny the determination is subject to its own laws while the random events emerge from conditions which precede them". According to his opinion it can be illustrated by falling on heads tails of a tossed coin. This event has not appeared from nowhere and it is subject to certain regularities. The problem however is with the univocal determination of the result of that toss. A series of tosses is determined by (Mazierski 1961):

- characteristic peculiarities of the coin,
- conditions.

The former conditions are invariable, while the latter ones are variable. The toss of a coin would be a nondetermined process if the tails appeared sometimes and some objects not related with preceding conditions appeared at other times (Bunge 1968). As a result of tosses the appearance of the heads or the tails could (according to statistical laws) be predicted. Nevertheless the determination of all the invariable and variable conditions is impossible, thus the results of the tosses will be random, although it cannot be excluded that "the result of one event is ultimately determined" (Mazierski 1961, P 22). What is taken into account here is the so called statistical determinism different from the mechanical one. The former lies in establishing the statistical regularities of some phenomena. The latter kind of determinism treats all phenomena equally necessary, equally important. When it is emphasized that all phenomena are subject to regularities, then the chance becomes the expression of our ignorance, that is the event whose causes are unknown. It is fairly easy to spot that in the jungle of presented definitions and differentiations between determinism and indeterminism the key factor is the following theory: the determination of events occurs or does not occur. That is why within this theory one can undertake to solve the dispute over determinism and indeterminism of the evolutionary processes.

3.2. Attempts to solve the dispute

It is not oversimplification if on the basis of former analysis one states that at first the synthetic evolution theory is involved in the dispute between determinism and indeterminism. The point is to determine the possibility of appearance of certain regularities on the basis of which individual evolutionary phenomena are subordinated and determined by the preceding events. As it has already been mentioned indeterminism may appear in two versions: radical or moderate (Lalande 1976). As far as

the moderate indeterminism is concerned one may on the one hand point to determining of the phenomena in one sphere of reality, on the other hand one may negate this determining in the other system of phenomena. In this aspect the dispute between determinism and indeterminism may be reduced — as it seems — to the answer for two issues: is every event determined by the preceding events by virtue of natures laws and are the natures laws of probabilistic or strictly deterministic nature. The attempts to answer these questions are undertaken within certain evolutionary theory. These attempts cannot be treated as final solution of the dispute between determinism and indeterminism because the evolution:

1. depends on the natural necessities as well as on the random events (both factors are viewed in the same plane);
2. is subject to the deterministic and probabilistic laws.

Although within indeterminism the appearance between phenomena is not denied nevertheless, the nature of these regularities is not clearly defined, on the other hand referring only to probabilism is not fully adequate to defining the significance of the random events during evolution. Similar objections are explicitly expressed by Louis George Stebbins who claims that "the approval of the Darwinian concept of diecting by the natural selection does not include the suppositions that mutations are utterly random. Eventually all genes which mutate, posses certain chemical configuration which may change in various but not limitelessly manifold ways" (Stebbins 1957, P 1).

Moreover the evolutionists support the view that evolution as a creative process. "Evolution is creative because it introduces novelties which did not exist in past. Genotypes of each person, each fly and each differ from each other. Genotype, the genetic equipment of each of us being absolutely unique, it has never appeared in any other person and is lowly probable that it may exist with any other person in future. Furthermore, these genetic novelties are not created at random. The natural selection creates novelties which are biologically coherent. They are capable of survival and adapted to their environments. The evolution process on Earth does not posses the deterministic aspect as this is a process which result is unpredictable in view of our genetic and ecologic knowledge (Dobzhansky 1966, P 68). By the phrase "creative" one understands here that certain events being results from other events can be estimated only within calculus of probability. "The chance establishes disorder, while selection order. The former is not directional, the latter is directional, both the chance and the selection are statistical phenomena and therefore they not only coexist but it may even be said that cooperate harmoniously" (Mayr 1974, P 178). That is why the regularities of the

evolutionary processes can be observed, although not all of them. Bearing in mind such a formulation referring to indeterminism (a view contrary to determinism) cannot be considered incorrect, since indeterminism denies the existence of univocal dependence among events. However considering the evolution from the point of view of indeterminism is unilateral because within the evolution one also deals with the existence of univocal dependence of phenomena, the point is that the evolutionary factors are deterministic evolutionary conditions which are affected by many environmental factors, the results of that influence are rendered probabilistically. Similar problems are met while referring to causalism. According to that rule one can say that the evolutionary process is the result of some other phenomena, speaking precisely the event *a* is the cause of the event *b* in given conditions W (Hanson 1955, Ruddick 1968, Sosa 1980, Vendler 1967). One may analyze causalism understood in such a way. It is clearly visible — from the logical and philosophical point of view we may obtain some of its basic measurements (Fales 1953, Simon 1952, Weinberger 1980). They are:

- The reality of the relation of the cause to the effect (Hartmann 1948, Montefiore 1958, Gram 1970, Dieksl980). The theses of the evolutionary theory point to the evolution processes as well as the real relation taking place between them. Hence it is neither abstract, logical, nor epistemological relation. Moreover the theory presents the real causes and effects which may be reduced to genetico populational, ecological, physiological.
- The continuity of relation between cause and effect (Lande 1968, Hillinger 1968). This aspect of the pronciple of causalism can be question neither by the great significance acquired by the chance during the evolution by the so called destabilized equilibrium nor by the neutral mutations, these factors may be treated as more or less "positively disturbing" the process of evolution yet not as excluding the process of one way, irrevocable changes occurring in time, creating novelties as well as more and more complex than highly organized individuals.
- The necessitating nature of the relation between cause and effect. Jan Łukasiewicz explicitly determines conditions essential to maintain that relation. Namely he is of opinion that "in every causal relationship we assume the existence of a necessary relation binding the cause and effect. It is obviously only an assumption because necessary relations are not observed in nature, in order to justify this assumption it is necessary to prove that its consequences are in accordance with facts and allow us to predict new facts" (Łukasiewicz 1961).
- The predictability of future events. Edward Mayr points out that the predictability of the evolutionary events is of statistical nature. The very

effectiveness of predictions is directly proportional to the dimension of the phenomena (Mayr 1961, Boyd 1972, 0 Connor 1957).

- The dynamism of the relation of cause and result (Spohn 1983). This condition of causalism is dependent entirely on indicating the place and weight of the chance during the evolutionary process. Most generally speaking this condition is the initiator and in a way the creative force of the evolutionary process.

The analyses presented above as well as doubts appearing in this connection clearly point out that it is impossible determine the nature of the evolutionary process within classical dispute between indeterminism and determinism. There are at least two reasons. The first is of objective nature and refers to the very nature of the evolutionary process itself. These processes due to their complexity as well as to their dependence on the random events in fact cannot be formulated exclusively in terms of statistical or univocal determinants. Hence the difference between the deterministic and indeterministic interpretation lies in understanding the realtivity of evolutionary determinants. This problem is connected with the second reason for questioning the effectiveness of referring to the dispute between determinism and indeterminism with respect to the issue mentioned above. The reason is of methodological nature. It turns out that the aforementioned dispute is not the most appropriate perspective to render the evolutionary processes, even in mutual relations are investigated yet the process is not described as a certain phenomenal whole. Due to these reasons I suggest to view the evolution through a new different perspective. Within this new view one can try to reconcile what was so explicitly expressed by Simpson the evolutionary processes are "subject to both order and disorder and to randomness and directive tendency". In this way one approaches autodeterminism.

4. Autodeterminism as the new empiriological perspective of rendering determinants of evolutionary processes

At this basis of biological and philosophical evolutionary research lies the appropriate definition and establishment of the activity of various determinants vital to the course of this process. In order to do it adequately as far as the methodology is concerned one should carry out the research according to a certain research perspective. As the previous attempt to interpret the nature of the evolutionary processes made on the basis of the dispute between determinism and indeterminism has not brought satisfactory solutions, one may try to change the research perspective.

What is suggested here is the reference to autodeterminism. This view is treated as a continuation of the research carried out in light of the dispute between determinism and indeterminism. According to that view the evolutionary processes are simultaneously univocally and probabilistically determined by other phenomena. The key to understand this approach is the acceptance of conjunction "and" binding two mutually exclusive features described within the general determinism as univocal and probabilistic. Such a "conjunction version" of the understanding of general determinism seems to accurately express and explain the nature of the biological evolution formulated within the evolution theory. Thus determinism and the chance constitutes the nature of the evolutionary processes. One can take a closer look at the evolutionary processes in the aspect of this new perspective.

4.1. Univocal and probabilistic arrangement

In works of the representants of the synthetic evolutionary theory, particularly those of mathematical attitude (Fischer, Haldane, Wright, Dobzhansky, Kimura), various mechanisms, of a different level of complexity have been taken into account creating different stochastics models. Hence, it is not a surprise that particular approaches of the evolutionary processes and mechanisms explicitly or implicitly include many simplifying assumptions it is particularly noticeable in changing and presenting simplifying descriptions of chosen evolutionary processes mechanism. While reading such works one has an impression that individual researches "choose" and "expose only certain factors and mechanisms of the evolution, those which they considered the most important. However, it is an erroneous assertion because:

- the discovery of particular, known today factors took place gradually and in time.
- many factors and mechanisms of the evolution were simply unknown of certain time.

By the way of example, on the basis of molecular research the existence of the, so called, neutral mutations were discovered which had been unknown to the scientists in the thirties and fourties. Nevertheless, one has to note that simplifying ways of descriptions and models were created to explain both the particular mechanisms of the functioning of the evolutionary factors, and the very course of evolution as the integral process. It seems, that at the basis of realization of such assignements lies one vital assumption. It is not the point to prove that the evolution is

stochastic but rather, to answer the question how the stochastic it is (Beatty 1984, Grene 1961, Lewontin 1976, Holz 1983). As a consequence, the simplifying ways of descritpiton and models to a higher or lower degree depart from from the reality. Neverteless, even with consideravle "aberrations" such a description or model has its function and application, it can help to calculate and understand something. If one accepts this assumption one can fairly easily understand the creation of a model, "ideal" population, which is easy to describe. Such a population is a matter of interest in works applying mathematical formulas written by the representants of the synthetic evolutionary theory. Comparably, the attempt was made to justify the fact that evolution is based on the process of changes which take place in genes and in frequency of genes and genotypes of population. Hence, Dobzhansky (1937) refering to the results achieved by Dubinin and Romaschoffski in 1932 assumed that in the model population in a certain locus there exist 50% of *A type genes* and 50% of *a* type genes. In effect, in the same locus, the distribution of genotypes in this model population will be as follows: 25% *AA type,* 50% *Aa* type and 25% *aa* type. This kind of "mathematical" point of view allowed making the analyses of the phenomenon of mutation taking into consideration natural ppulations of the species Drosophila. Further, the results of this research confirmed the law of Hardy and Weinberg, according to which, despite the consecutive replacement of nascent and dying generations, the frequency of appeamace of particular alleles will not undergo change the following conditions are filled:

- particular alleles are not traeted with favor,
- mutations do not appear,
- the population is unrestrictedly numeorus,
- the place occupied by the population will be free from individuals from neighbouring populations (Szarskil976).

One has to make a reservation that the aforementioned conditions can be fulfilled only in the model situation. However, in reality the very nature of the mutational process and drift mechanism can shake the accepted conditions. One has to remember that the probability of appearance of some variation in a given individual does not become greater only because this variation favours the survival and reproduction of this individual. It is just the chance that will decide whetherr a given organism carries the change favouring survival and reproduction (Beatty 1984, Rogers 1981). Most interesting is also the attempt of Dobzhansky (1937) to explain the mechanism of genetic drift. The author refers to the chance model of drawing balls from a box, he treated balls as alleles. In fact, this model shows that the frequency of gene and genotype in the

population oscillates hear a certain value. Nevertheless the avlue of this frequency is not the point, but rather, it is important to present, by the way of exmple, of blind drawing of balls from the box, the random character of the mechanism called the drift. It is assumed that every ball has the same chance to be drawn in a given try. Consistently, the very drawing procedure is random when:

- there is the same probability for every ball to be drawn as the first,
- every ball, excluding balls already drawn, has the same chance of being drawn as the next element of the try (Beatty 1984).

Yet another example of simplified treatment of the evolutionary mechanism may be the opinion of King and Jukes (1969, P 788) on the selectively neutral mutation, these authors note the following: "natural selection is rather the editor then the comopser of the genetic transfer. One thing that the editor cannot do is to remove the changes which are impossible to notice". Selectively presented facts allow to assume that the evolution appeared, as it were, at the point of contact between directional *and random process. Extremely difficult is the intension ofmodelpresen-*tation of the cooperation between these processes. The attempts, which have been made by the representants of the synthetic theory of evolution, point to the necessity of setting in order variable and constant factors of the evolution, and to the standardization of "micro" parameters of the assumed model of the investigated phenomenon and "macro" parameters of this model (Iwasa 1988, Chela Flores 1985). However, this assignment goes beyond this work.

Hence, one can note that it is possible to calculate mathematically the coopration of various evolutionary factors determining the course of changes within the population of species. Nevertheless, not only such precise assumptions have impact on the calculations but also their interpretation. Hence, in motivating the opinion, the interpretation of the genetic drift activity was slightly different in the works of pioneers of the synthetic evolutionary theory then in works of their followers. It is easy to notice, while reading these works that either the number of favorable events was decreased this strategy as applied according to the significance which a given author attached to the genetic drift, mutations and recombination, and to the natural selection in the course of evolution. Also, the way of rendering other evolutionary factors is important, factors which seemingly have only secondary significance for the course of the evolutionary process. Such factors as environment, isolation, size of the population or species, speed of changes and their cooperation are capable of changing the course of evolution, and, in some sense, they are univocal phenomena. However, the very way of their "entrance" into the strictly

defined sequence of the evolutionary process can be rendered within higher or lower probability. It seems proper here, to undertake the analysis of the aforementioned assertions in fight of the following notions: the impossible event (it cannot take place), the inevitable event (it must take place in given circumstances), the chance event (may but does not have to take place), among them rare events (the probability near zero) are taken into account. For this purpose the notion of the single event (it must appear but it is non recurrent) will be applied. There are the stochastic events, hose probability is unknown up to the moment of experiment, or up to the time of drawing implications from the appropriate model. The representants of the synthetic theory of evolution treat the very evolutionary process, to a higher or lower degree as the chance event. They remember that even if the probability of the event is slight, its appearance is not improbable, the genetic or environmental conditions may aqccelerate, retard or even restrain the selectional process what is more, one cannot exclude the appearance of a population of the uncommon set of genes and genotypes displaying the adaptable and reproductive abilities. It is necessary to note straight away that this singularity does not mean the same as slight probability it is generally known that the notion "singularity" and "slightly probable" are difficult to interpret. Nevertheless, the single event may take place, but it is non recurrent (see the analysis of Simpson), whereas the slightly probable event is the event of probability near zero. If one ticks 25 out of 49 numbers in pools, and one guessses six expected right, then one is dealing not with the single event, but with the event which is slightly probable (rare). Hence, to maintain that a mutation appearing in a given generation was eliminated during the following generations (Fischer), or that species remain unchanged for a relatively long period of time (Eldredge, Gould), or that the process of the appearance of nucleotides takes place rather, as a result of accidental consolidation of neutral mutants, then an outcome of natural selection (Kimura) one should not stress the singularity, but the fact, that one of the elementary events of the evolutionary process took place. In other words, the phenomenon of slight probability may take place, whereas the phenomenon of great probability need not take place. It cannot be treated as an nevitable event. The important issue, for a reasonable reference to the stochastics of the autodeterminism, in order to interpret correctly the evolutionary process, is to notice that the researches of the thirties and the forties tacitly accept the assertion that particular phenomena are equally possible. Whereas the theories discussed in point tree clearly point to the fact that the choice of a given amino acid depends on the mechanism of combining and elimination of

different types of antagonisms existing in the molecular structure of the appearing chain, hence, not all amino acids have to readily combine together in the same, efficient manner (Schuster 1981). So, for such researchers as Kimura, Eldredge, Gould given elementary events are not similarly possible. However, the change in rendering the possibilities of the occurence of elementary events makes one realize that the evolutionary processes are determined by other phenomena univocally and probabilistically.

4.2. The chance and the necessity

Taking into account the title of the book by Monod "Le hassard et la necessite", the chance and the necessity can be treated as a certain complementary integrity whose acceptance guarantees the understanding of the aforementioned evolutionary processes as well as the influence of the random events on its course. What is emphasized here is that the representatives of the synthetic theory reject two extreme standpoints. The former says that the chance was the only ground for evolution. Whereas the latter states that referring to the evolutonary factors such as: mutation, recombination, selection, isolation and so on is a sufficient reason for understanding the evolutonary processes. No doubt however, those evolutionists attempt to determine the evolution processes as a specific natural necessity within which the chance events are indispensable. What is discussed are thee natural necessities (Wicken 1981) which consist of: historical, physical and logical necessity. It is said, within the historical necessity, that the evolution is the documentation of changes occurring in the genetic bank. The physical or empirical necessity is expressed in the following assertion: when there are certain initial genetic and environmental conditions, in a given time *t sit,* then in time *t tit* necessary changes in the genes frequency will take place. On the other hand the logical necessity constitutes, to some extent, a theoretical condition of the physical and historical necessity. In the moderate version the logical necessity resolves itself into the formula: whatever has happened during evolution, it was indispensable, although it could have happened in another way round. It has to be emphasized here that not everything that is the empirical at the same time the logical necessity. Hence well founded assertion that natural necessities understood in such a way, are for evolutionists besides the chance, the two complementary "components" of the evolutionary process. Two basic objections are to be taken into account.

"Regulatory relations arising from the second thermodynamic rule as well as its specific applications to open systems not being in the state of equilibrium may be interpreted only statistically.

The amount of possible states is so enormous that it is impossible to be completed within the spatial and temporal borders of our universe" (Eigen, Winkler Oswatitsch 1981, P 170).

Nevertheless it is possible to determine certain regularities of these regulatory relations which may be expressed by exactly defined evolutionary mechanisms. At the same time it must be stressed that either there occurred the transition of the random to the necessary constituting "the process of accumulating the discoveries the way of selection among many solutions" (Zavadskiy, Zerdev 1971) or there occured the comboned activity of the chance and the necessity where the chance determined on the other hand the choice of the activity (Gilles, De Gennes 1977). Thus the chance was of great importance. The process of selection supervised and controlled the influence of the results of mutations and recombinations and drift, while the chance defined "specific, historical and chronological sequence of events" (Eigen, Winkler Oswatitsch 1981). Hence mutations, recombinations and drift as the random events introduced disorder to the evolutionary process, while the selection made the "choice" of one course of events because generally being anti random it tended to arrange the relations of certain systems with the environment (Dobzhansky 1963). So the chance defined the course of the evolution. Such a relation occurring between the necessity and the chance leads to an indirect absolutization of the chance as the novelty initiator. While taking into account the biological formulas including the molecular ones referring to functional and structural dimesnsion of the organism, population or species as well as to the knowledge about the history of the evolution (Simpson 1959), one draws the following conclusion that the necessity and the chance are respectively a statical and dynamical element in the evolution. As a consequence the continuity of the evolution as a process of transition to more complex or for some reasons highly developed states will remain intact (Fuchs Kittowski 1969, Franz, Thomas 1981, Zukov Vereznikov, Chochlacev, Volkov 1976). The necessity and the chance may be interpreted in a different way in the aspect of certain regularities of the phenomena (Filipenko 1966, Weiss 1969). The regular phenomena are those which in given conditions appear with irreversible necessity, whereas the random ones are those which are not directly involved in a certain regularity chain but instead they may initiate an entirely different chain. Then the chance may be interpreted either as a certain regularity of appearing phenomena or as completely unexpected event.

The latter interpretation is a source of numerous disputes because the evolutionary processes may never be completely verified or directly observed. There is an attempt to solve these difficulties by formalization of the evolutionary processes — which is expressed by the calculations of the probability of the appearance of a certain mutation or recombination as well as by the extent of the drift influence — which is based on two thesis:

The chance and the necessity are the internal elements of selforganization (Filiyukov 1900).

Or the chance and the necessity are two aspects of the same evolution (Jablokov not dated 1976).

Hence the creation — within the evolution — of a new depends on the antecendent consisting of the random and the necessary "element" (Luc- nik 1980). In other words the evolution was formed both by the necessity and the random events. Those two "elements" should not be antagonized, "contradicting the weight of the necessity and the chance in the evolution is as false as it is wrong to contradict the weight of adaptation to the environment and the importance of organisms structure while explaining the structure itself' (Szarski 1976). Moreover, when one refers to the considerations in Point 1, one may assume that the chance should be treated as the specific necessity of the evolutionary processes.

5. Summary

At the base of evolutionary determinism and indeterminism lies accurate as far as empiricism goes definition of the sequence of events taking place during evolution. Therefore the interpretation of this sequence of events, from the logical point of view, allows to reconcile determinism and randomness. In consequence the evolutionary process seems to be an interdependence of determinism and randomness, both determinism and randomness are to a higher or lower degree exposed at all stages of the biological evolution. Moreover these very evolutionary mechanisms are random by virtue of their nature.

The attempt to interpret the evolutionary phenomena within determinism and indeterminism turns out to be unsuccessful. Different kinds of determinisms specified in this work: general, univocal, equivocal, causal, extreme or moderate indeterminism only "tackle" selected aspects of the evolution. These formulations are thus one sided and therefore the have been rejected as inadequate. The main reason for such a standpoint are the results of the empiriological analyses, that in the evolution exist

both univocal and probabilistic conditions in the very structure of individual evolutionary mechanisms and factors. Moreover the determinism versus indeterminism dispute itself is a result of the alternative approach to the biological phenomena. The evolution itself cannot be rendered within a dispute understood in such a way. The evolution however points to the existence of a different point of view on the world of nature, therefore the necessity of changing the research perspective. It was suggested to refer to autodeterminism as a new empiriological perspective of the evolutionary research. Autodeterminism is understood as the following:

1. The view according to which the evolution is set in order univocally and probabilistically.

2. The methodological rule which imposes the necessity of taking into account the chance in the evolutionary process as well as the necessity of conjuctive treatment of the evolutionary regularities interpreted as the necessity and the chance.

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