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Statistics and the Principle of Conservation in Biology

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Abstract

In the paper there is given a proposition of fundamental axiom of biological sciences. This is the principle of conservation of biological energy. Author is arguing on behalf of that statement.

1 General Principles – Foundations of Measurement

XX century science was based on three principles. First of them says that exist infinite sets. It is purely mathematical axiom of existence. It can be verified only indirectly – trough applications. That axiom generates numbers and continuity. The second axiom is the principle of Cartesian coordinates. Every state of the nature can be described by sequence of numbers. It simply means that we can measure everything. The third axiom has essentially different character. It is unique general law of science. It says that everything is in the state of equilibrium. From that last axiom follow all physical principles of conservation. Now we are giving a proposition of fundamental axiom of biological science. This is the principle of conservation of biological energy. There are two questions. How biological energy should be measured? The second question concerns empirical verification of this principle. Could statistics help to solve them?

2 Statistical Measurement – a Sample

Statistic is a theory of scientific experiments – experiments understood in a specific sense. The theory is based on the averaging. Main theorem states that – under condition that the number of measurements increases – the average of independent measurements approximates the measured value. A statistical sample is a measurement. Since every measurement is homomorphism of a natural scale, a sample is also homomorphism. A sample is epimorphism of a probabilistic space, which is a model of a general population, onto a probabilistic space of results. Results are usually vectors. In general, a scale is a mathematical structure. The most important scales include a set without a structure, a set with a preference relation, an operation and a determined element. Depending on the structure which defines the scale, various groups of homomorphisms, which are measurements, can be distinguished.

The structure of a population is determined by given set of attributes – qualities. It means, in formal terms, that in a probabilistic space (B, m) there is an ordered family of events $(A_1, \ldots, A_n)$ such that $A_1 + \ldots + A_n$ is a certain event – the set of elementary events. Sample A is identified with a probabilistic space (B, v) where event A is an element of algebra B such that $m(A) > 0$, whereas v is conditional probability: $v(C) = m(AC) / m(A)$ for any event C from algebra B. The sample structure is consistent with the population structure if vector $(m(A_1), \ldots, m(A_n))$ and $(v(A_1), \ldots, v(A_n))$ are linearly dependent. Certainly, not every population contains samples whose structures are consistent with the given structure of the population. Asymptotic consistency can always be achieved in probabilistic spaces of samples with repetitions. It is assumed that in a given population there is a determined preference – a reflexive and transitive relation. It is quality. The relation is statistically measured by a monotonic sample representation into a set of real numbers.

If, for instance, a population contains m elements and a sample contains k elements, the population structure is a vector of natural numbers $(m_1, \ldots, m_n)$ such that $1 \leq m_1 \leq m$, whereas the sample structure is a vector of natural numbers $(k_1, \ldots, k_n)$ such that $0 \leq k_1 \leq k$, where $i = 1, \ldots, n$. There are always relatively prime natural numbers p and q such that $kp = mq$. Having calculated p and q we obtain a linear system of Diophantine equations:

$$k_1 p = m_1 q, \ldots, k_n p = m_n q.$$

If this system is consistent – under predetermined conditions – there is a sample whose structure is consistent with the population. Samples whose structures are consistent with the population structure are rather rare.

3 Biological law of conservation

Although we live we do not know what life is. Just as we do not know what death is although ultimately we all die. We also do not know what is a beginning of a new life, whether it is creation of new life or simply a new form – metamorphosis – of a perennially existing element. The notion of life can be defined only in a descriptive, axiomatic way. It means enlisting properties characterising the organisms commonly perceived as living, but without any narrowing of its kind. Physics is ruled by the principle of the conservation of energy. Whatever life is, we can undoubtedly say that it is a certain kind of energy. Therefore if the basis of physics is the principle of conservation of energy, one could certainly apply the analogical reasoning to biology. It would be the principle of conservation of life as a particular being or the principle of the conservation of life energy. According to this principle, one should assume the quantity of life energy in the universe to be constant. Therefore life cannot be destroyed, however at the same time it is impossible to increase the global life stock. If one takes a *bion* as a symbolic unit of life, which in present research is defined in a purely intuitive way, then function transforming time factor into the number of life units – existing in the universe at that time – is *constant*.

Thus life is everlasting and eternal, only its form changes. One of its characteristics is its cyclical renewal. Hence there arises a fundamental question – how to verify this fundamental biological principle? How to ascertain whether the existing portion of life energy is constant in the universe? What kind of survey or experiment could be used to negate or confirm the principle declared above? In the present day understanding of scientific problems such a task eludes science. However it is impossible to practise, e.g. biocybernetics, eliminating questions referring to such fundamental principles. Also medical sciences can profitable from establishing a strong basis – the law of the conservation of life. The difficult issue of cancer research presents itself in a new light if one accepts such a working hypothesis as the indestructibility of life. Modern physics is based on principles of conservation. If these are the laws of physics, as general laws of science they also should have a biological interpretation.

The portion of life in space does not change, and does not fluctuate in parallel with the numbers of births and deaths. Organisms, or even whole species die, others are born, but there is still – in a global sense – the same amount of life. Naturally it is only a hypothesis, but such a hypothesis could prove fertile and useful. Perhaps on its basis it will be possible to deduce a theory on the formation of cancer cells. Perhaps cancer is a kind of protection of the organism against death? A dying organism, in a effort to prolong its existence, affects its cells in such a way that their increased development gets out of control. It often happens that a medicine becomes the reason for death. People of exceptional vitality who are also characterised by great biological potential may be the very ones who more frequently suffer from cancer.

4 Arguments and Analogies

We assume that the portion of life dispersed in the universe is constant. Experiment is the soil of science theory is its soul. How to verify this fundamental rule of biology? I think that it would be as difficult as verifying the laws of physics. It is impossible to create an autonomous system, biologically independent from its environment and totally isolated. There can only be partially isolated systems that are separated only in theory. Even planet Earth is only a minute particle in space. Our inference can only be indirect. Could statistics be useful in measurement of biological energy? More rabbits – less grass, and so on. Death always leads to a new life. There is no birth without death: if death disappeared so would birth. Is it an conclusion of the principle of conservation of life? It is not clear. But is certainly an argument in accordance with such a principle. One can quote here numerous examples of this kind taken from the animal and plant kingdoms. Such cases can undoubtedly be explained even without our hypothesis. This is true, however we can combine all these cases in one theory, and this is its main advantage. One could even go as far as to say that these cases are the empirical form of verification of this law.

In classical physics, velocities are added up as vectors, according to the principle of parallelogram. In relativist physics a resultant velocity v is given in another formula

$$v = \frac{c^2}{c^2 + v_1 v_2}\left(v_1 + v_2\right)$$

where c is the speed of light in a vacuum, and v_1, v_2 – are given velocities. From this formula it results that no real velocity v can exceed the speed of light. In an analogical way we can sum life energy. Within a small area, locally, the principle of conservation of the life may also not apply. Local biocoenosis are not isolated systems.

5 Life is a quality

Obviously life can change and, as we know, it changes its form. There is no biopoesis – creation of life, there is only biometamorphosis. How to measure life energy? Every measurement is a preference. Also life itself is a preference, a reflexive and transitive relation. This last sentence can be treated as one of the axioms defining the concept of life. It means that the world of living organisms is ordered. Sports competitions have something of the measurement of life energy. The person who wins in sport or at work is the more lively one. Vitality can also be shown through reproductive powers – offspring, or the speed of renewal of the population. Could an act of conception be identified with the sum of life energy of a male and female? The most careful natural selection and choice do not ever classically sum up the parents' life potential. One cannot generate individuals cumulating within themselves more and more life energy as it can only be drawn from other organisms. Therefore if we multiply organisms cumulating increasing amount of life force then their number must decrease. The amounts of life force and the number of individuals of certain vital potency are inversely proportional quantities; their product is constant.

Also longevity is a certain sign of vitality. The age of an individual can be taken as a measure of the organism's life energy. Where is this energy located? I should not think that it is located in kilograms of a body's mass. It is a kind of a clock. A biological stimulator, the spring of this clock, is wound for a definite period of time. After that the clock must stop as the spring slackens. But one can consider such a state as winding in the opposite direction. The minimum energy of one, kinetic energy, is at the same time a maximum of potential energy. Therefore there is a constant change of energy just as in a pendulum. These periodical repetitions are the birth of some organisms and the death of others.

Real beings can be treated as convex linear combinations of simple beings, ideal ones: life force (bios), matter (chaos) and form (morphe). Organisms are convex combinations of those indepedent beings – which can be thought as some kind of units. Therefore every real being would be an ordered (in alphabetical order: bios, chaos, morphe) triple (p_1, p_2, p_3) non negative numbers such that $p_1 + p_2 + p_3 = 1$. In order to describe in that way an organism, one has to give these three numbers, which are its baricentric coordinates. Chaos is matter, therefore we can attempt to weigh it; form is a kind of symmetry, and as such it can be described through a group of transformations. The issue measuring life force remains open. However it should be possible.

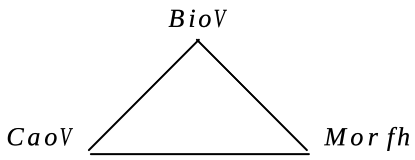

Fig. 1 Aristotle's Triangle

6 Conclusion

Those general thoughts are undoubtedly beyond mathematical strictness, but they belong to a broadly interpreted science. Without general principles science does not exist. This is the main message, in my opinion, witch we should send to people who will live in this century.

Literature

A. Smoluk (1999). *On the Principle of Conservation in Biology*. Ekonomia Matematyczna [Mathematical Economics] 3, pp. 17-24.