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Russian Discovery Challenges Existence of 'Absolute Time'

by Jonathan Tennenbaum

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|*Russian scientists discover unexpected regularities in radioactive decay, linked to astronomical cycles*

Two years ago, nearly unnoticed in the West, the Russian biophysicist S.E. Shnoll published a paper in the prominent Russian physics journal *Uspekhi Fisicheskikh Nauk*[1] summing up the results of more than three decades of investigations of anomalous statistical regularities in a wide range of physical, chemical, and biological processes, from radioactive decay to the rates of biochemical reactions.

The evidence points unambiguously to the existence of a *previously unknown relationship* between *fluctuations* in the rates of radioactive and other processes in the laboratory, and major *astronomical cycles,* including the day, month, and year. The implication is, that many phenomena which until now have been regarded as purely *statistical* in character—such as the distribution of fluctuations in the momentary rates of radioactivity measured in a sample—are somehow controlled or at least strongly influenced by an astrophysical factor, which varies in time in the same way at all points on the Earth.

Vladimir Voeikov, a colleague of Shnoll, comments in the Spring 2000 issue of *21st Century:* "Shnoll's work shows that time is heterogeneous. It is not a Newtonian time. Each moment in time is different from another, and this can be seen in any physical process that you study."

Albert Einstein, who rejected claims by Niels Bohr and others that the fundamental microphysical processes are *essentially, irreducibly* random in character, liked to say that "God does not play dice." Einstein and others pointed to the arbitrary nature of Bohr's argument: Just because physicists in Bohr's time could not penetrate beyond the *apparent* randomness of radioactive decay and other microscopic processes, to find a deeper lawfulness and regularity underlying such processes, does not mean that science is doomed to remain in that state of ignorance forever!

By demonstrating the existence of a universal, astronomical factor influencing the fine structure of supposedly random fluctuations, Shnoll et al. have opened up an entirely new field of scientific investigation which is not supposed to exist, according to Bohr.

Prof. Simon Shnoll giving a presentation on his work at Second International

A Simple Experiment

We now give a very brief description of the basic phenomenon discovered by Shnoll and his collaborators. The phenomenon itself is so astonishingly simple, that it is amazing that it has not attracted more attention until now.

The simplest case is the measurement of radioactive decay, where Shnoll has conducted thousands of experiments of the following simple type. We take a radioactive sample, and place it in front of a suitable detector (such as a Geiger counter), which counts the individual acts of radioactive decay of nuclei in the sample by detecting the emitted particles. Assuming the half-life of the radioactive element involved is relatively long, the count-rate of the detector, in counts per second or per minute, will fluctuate around a certain average value, which is related to the number of radioactive atoms in the sample and their half-life.

A.G. Gurwitsch Conference, held in Moscow in September 1999.

This phenomenon of continual fluctuations in the number of counts per unit time, around a relatively fixed average value, is normally accounted for by assuming that the radioactive decay of any given atom is a random event, and the assumption that decay of a given atom occurs *independently* of the other atoms in the sample. Thus, each atom which has not yet decayed up to a certain moment in time, has a certain *probability* of decaying during the next minute—a probability which is fixed for any given isotope by the character of that isotope, and virtually independent of the temperature, chemical environment, and activity of neighboring atoms.

An extraordinary phenomenon emerges, however, when we examine the fluctuations more carefully, with the help of a histogram: We fix a certain period of time (10 seconds, or a minute for example), and record the number of counts during each of a series of consecutive intervals of the given length. This gives us a sequence of whole numbers. We construct a histogram, by plotting the *number of times* a given whole number appears in the sequence, as a function of the number.

Now, from the standpoint of simple statistics we would expect the histogram curve to have a simple bell shape, with a maximum around the number corresponding to the overall average number of counts, and then declining gradually on both sides. Naturally, if the number of measurements is small, the histogram will look more irregular, owing to the effect of random fluctuations; but we would expect that as we increase the total time of measurement, the curve would become closer and closer to the ideal mathematical bell curve.

However, real measurements of radioactivity and many other processes, carried out by Shnoll and others over many years, give a completely different result! The histograms typically show several clearly defined peaks, which do not "smooth out" as we increase the number of measurements, but which actually become more and more pronounced!

In four histograms, each plotting the results of 1,200 consecutive measurements of the radioactivity of a sample of the iron isotope Fe-55, over 36-second intervals, the largest peak corresponds to the average count, of about 31,500 pulses per 36 seconds; but there are a number of other peaks, which we can see emerging more and more clearly as we follow the cumulative results of the first 100, 200, 300, and so on, measurements as "layers" under the main curve (Figure 1).

Change in Shape over Time

The histograms, made from more than two days from four successive 12-hour-long series of measurements, show another typical phenomenon discovered by Shnoll: The shapes of the histograms change over time (Figure 2). Most remarkably, the shapes of histograms for independent measurements taken over the same time period, tend to be very similar.

For example, simultaneous measurement of the reaction rate of ascorbic acid, dichlorophenolindophenol (DCPIP), and beta activity of carbon-14 show histograms of very similar shape.

These and a large number of other experiments carried out by Shnoll and his collaborators over many years, point unambiguously to the existence of a universal factor influencing the shapes of histograms, and which varies in time. Furthermore, the Russian researchers have discovered well-defined periods, over which similar histogram shapes tend to recur (Figure 3).

To do this, they devised a computer-based algorithm for measuring the relative degree of "closeness" or similarity of histogram shapes, and on this basis carried out a computer analysis of hundreds of histograms taken over a long period. Examining the distribution of time intervals between "similar" histograms, they found strong peaks at 0 hours (that is, histograms made independently at the same time tend to be similar), at approximately 24 hours, at 27.28 days (probably corresponding to the synodic rotation of the Sun), and at three time intervals close to a year: 364.4, 365.2 and 366.6 days.

More recent data, just reported to the author, indicate that the “24-hour” period is actually slightly shorter, and corresponds quite precisely to a sidereal day! The latter would suggest, that at least one astronomical factor influencing histogram shape may originate *outside* the solar system, being associated with the orientation of the measuring station relative to the galaxy, and not only relative to the Sun.

Shnoll concludes: “From the data presented above, it follows that the ‘idea of shape’—the fine structure of distributions of results of measurements of processes of diverse nature—is determined by cosmological factors.” He does not put forward a definite hypothesis concerning the nature of the these factors, but suggests as a possibility the notion of a global “change of space-time structure,” and notes that “a sound analysis of such a hypothesis will possibly require experiments under different gravitational conditions.”

Clearly, these results should be intensively followed up by scientists around the world.

Jonathan Tennenbaum, based in Wiesbaden, Germany, is a member of the scientific advisory board of 21st Century Science & Technology *magazine. He heads the Fusion Energy Foundation in Europe.*

Notes

1. See S.E. Shnoll, V.A. Kolombet, E.V. Pozharskii, T.A. Zenchenko, I.M. Zvereva, and A.A. Konradov, 1998. “Realization of discrete states during fluctuations in macroscopic processes,” in *Uspekhi Fisicheskikh Nauk,* Vol. 41, No. 10, pp. 1025-1035. A new paper is currently in preparation. Shnoll’s group is based at Moscow State University.

When the ‘Scientific Method’ Obstructs Science

Excerpts from the “Conclusion” of Shnoll et al., “Realization of discrete states during fluctuations in macroscopic processes,” in Uspekhi Fisicheskikh Nauk, *Vol. 41, No. 10, pp. 1025-1035.*

Concluding this brief account of studies performed at our laboratory, we would like to anticipate some naturally arising questions. Forty years have passed since our first publication in 1958. Why then have there been no results from other laboratories? We believe that the main reason is that other researchers are too well aware of the “principles of science.” We are talking of the “spread of readings” of measurements. The “spread of readings” is something to be eliminated rather than studied. When physicists or chemists get a scatter of data greater than anticipated on account of inaccuracies of individual stages of investigations, the physicist will reach out for his soldering iron and screwdriver, and the chemist will check the purity of reactants and the quality of distilled water.

Another reason is that the accepted methods of statistical data processing based on the central limit theorems are not suited for analysis of the fine structure of the distributions. The criteria of conformity of hypotheses just “overlook” this fine structure. The distributions are averaged and smoothed. . . . Moreover, the majority of problems do not require knowledge of the fine structure of the distributions.

A third reason is a lack of confidence that this phemomenon is at all possible. The scatter of data is associated with the concept of “error.” We have spent many years looking for possible artifacts. Our main task therefore consisted in proving the “theorem of existence.” This task may be deemed completed. The acceptance of the phenomenon itself—the realization of the discrete spectrum of allowed states, which at any given time is similar for processes of entirely different nature, and which is attributable to to cosmophysical forces—requires some psychological effort. . . .

There are many interesting problems that have to be studied. A number of theorems need to be proved, and new computer techniques developed. Experiments must be performed on satellites and space stations. A network for simultaneous measurements at different geographcial locations ought to be organized. Finally, and most importantly, we need to develop a theory that will explain the nature of this phenomenon. All this is to be done in the future. The task of this paper is accomplished—we have introduced the object of future research.

. . .

Postscript

D.S. Chernavskii, editor of *Physics-Uspekhi*, added a postscript to the article by Shnoll et al., which is excerpted here:

The paper that you have just read is somewhat out of the ordinary. Professor Shnoll is a known biologist, but the paper deals not so much with biology as with pure physics—radioactive decay. Many years of experiments have led to the discovery of several (to be more precise, two) new phenomena.

The purpose of this comment is to discuss why these phenomena may be of interest to physicists, and what role they may play in the development of science. . . .

Two conclusions follow.

> 1. The histograms of S.E. Shnoll et al. contain new information about the nature of a random process which until now has passed unnoticed.
>
> 2. The postulate of measurement in quantum mechanics is at least not complete. Indeed, when we say that "alpha decay occurs at random, so that the probability of detecting . . . etc." we ought to specify what kind of randomness it is, and what chaos it is based upon. Otherwise we are not able to predict a number of phenomena observed. . . .

This proves the importance of the first phenomenon described in the paper. The second phenomenon consists in the periodical change of the fine structure of histograms. It is demonstrated that the fine structures of histograms for quite diverse random processes (physical, chemical, biological, etc.) are similar and vary in sympathy. Moreover, these periodical changes correlate with the changes in our solar system, and possibly in our universe. To evaluate properly this phenomenon we first ought to understand the cause and mechanism of the first phenomenon.

The authors do not suggest any explanation of the phenomena discussed, and make no hypotheses concerning their possible mechanisms, and quite rightly so! The reader must start thinking on his own, which certainly is the main intent of this publication.

21st Century, P.O. Box 16285, Washington, D.C. 20041 Phone: (703) 777-6943 Fax: (703) 771-9214
www.21stcenturysciencetech.com