21st Century Science & Technology (ISSN 0895-6820) is published 4 times a year by 21st Century Science Associates, 60 Sycolin Road, Suite 203, Leesburg, Va. 20175. Tel. (703) 777-6943.

Address all correspondence to **21st Century**, P.O. Box 16285, Washington, D.C. 20041.

21st Century is dedicated to the promotion of unending scientific progress, all directed to serve the proper common aims of mankind.

Opinions expressed in articles are not necessarily those of 21st Century Science Associates or the scientific advisory board.

We are not responsible for unsolicited manuscripts.

www.21stcenturysciencetech.com
Electronic subscriptions are $35 for 4 issues, $60 for 8 issues, and $80 for 12 issues. Back issues (1988-2005) are $10 each ($20 foreign). Electronic issues from 2006 on are $10 each.
Payments must be in U.S. currency.

EDITORIAL

Reclaiming the 'Scientific Method'

by Jason Ross

While "scientific method" is a term we hear used all the time, and a much-trumpeted "scientific consensus" is cited as reason to move ahead with stunning reductions in carbon dioxide emissions to halt "climate change," a historical understanding of the development of science is scarcely to be found anywhere in the scientific community, let alone in the general population. We're told that the history of science belongs in the history department, and that education should focus on the most recent breakthroughs, rather than older discoveries that have been superseded. The problem is that along with the specific "back of the book" conclusions taught in today's classrooms, the concept of "scientific method" taught–that conclusions should be drawn from the results of experiments in which a hypothesized outcome is tested–leaves out the most crucial part of science! How are hypotheses formed? Which methods of thinking are fruitful at developing fundamentally new hypotheses, and which are not? Take for example, the founder of modern science, Johannes Kepler. How did he think?

Johannes Kepler

The astronomer Johannes Kepler overthrew the very concept of science. In his day, astronomical science was based on "saving appearances," meaning coming up with some sort of mathematical and geometrical model that matched observations. Whether or not the geometry the model was based on was *true*, was beside the point. Kepler insisted that the mind of man could understand the intentions of the Creator, the *reason* things were so, rather than otherwise. His physical theory of gravitation was shocking to his contemporaries, since it lay outside the entire domain of possible hypotheses (in their view).

If Kepler had simply presented his physical astronomy and associated laws of planetary motion, his discovery would have been divided in two by the astronomers of his time, into: 1) a mathematical means to compute planetary positions, which they would accept, and 2) a hypothesis of a physical cosmography, which they would feel free to reject or completely ignore, while using his mathematical apparatus. That is, astronomers would have completely ignored the kernel of Kepler's breakthrough, and treated his concepts as *additions* to science, rather than as requiring that all of science be rethought!

Thus, he was put in a position akin to that of the playwright: he had to communicate something to his audience in a way that would lead them to an understanding of his discovery, without leaving any opportunities to evade the full consequences of his new concept. Kepler required his audience to develop a new type of hypothesis-formation. The full consequences were not limited to the science of astronomy itself, but extended to the very nature of the physical universe, and how human minds could come to understand it.

To force this point, Kepler first demonstrated with absolute certainty that the problem could not be solved by geometry and mathematics alone. Using his *vicarious hypothesis*, Kepler made the best possible model based on mathematics, and showed that it could not work.[1] Here, an earlier example in his work, the *New Astronomy*, can begin to show the chasm that separated Kepler from his predecessors.

Helio-Centrism?

This example is the *mean sun*, an imaginary astronomical position near the actual Sun. This fictitious point was introduced by Ptolemy, whose thinking remained bounded within the possibilities of mathematical causes and effects, to coordinate the epicycles that he added to the orbits of the planets. Since, contrary to Ptolemy, our Earth does move, its changing position adds an extra element of *perceived* motion to the planets. Ptolemy kept the Earth still, and therefore had to add its motion to the other planets. He did this by incorporating circular epicycles into their orbits. Although the motion of these epicycles was coordinated with the Sun, which was known since the 2nd century BC not to appear to have a circular orbit, but an off-center one, Ptolemy wanted to use simple circles, and therefore introduced a (fake) perfectly circular solar orbit—the orbit of the *mean sun*.[2]

What was a mathematical shortcut for Ptolemy became an article of faith for those who came later. Nicolaus Copernicus, renowned as the man who set the Earth in motion around the Sun, did not place the Sun at the center of the cosmos. Instead, he used the same mean sun as had Ptolemy, which became, in Copernicus's system, the *center of the Earth's orbit*. Why would all the planets move around a point so near the Sun, rather than the Sun itself? How would they be affected by an imaginary point associated with just one of the many planets? Even Tycho Brahe, Kepler's sometime-employer, who had the planets circle the Sun which itself circled the Earth, also used the mean sun, rather than the real one.

Kepler insistently used the real Sun, as part of his absolute commitment to the truth. He wanted a real understanding, rather than a mathematical model that was "close enough." Since the Sun was the *reason* for the planets moving as they did, Kepler could not possibly replace it with a mathematical point. In Kepler's hypothesis, the planets went faster when nearer the Sun, not an imaginary point! Based on this physical foundation, he went on to discover the motions of each planet individually, as well as the cause for the relative distances and eccentricities of the planets, in his still-controversial work, the *Harmonice Mundi*.

End of the Road?

Kepler was committed to discovering causes for phenomena, rather than mathematical descriptions. This approach has been all but abandoned in modern science, particularly since the Copenhagen interpretation of quantum mechanics, which asserts that quantum phenomena cannot be known individually. Only when an experiment is repeated many times, can quantum mechanics indicate the statistics of what the outcomes will likely be. Causation in individual events no longer exists. Does this simply mean that the science is incomplete? Will quantum processes in life or the human brain, which expresses free will, allow more progress to be made?

No, its practitioners think we're at the end of the road. The Copenhagen interpretation has taken us back to pre-Keplerian thinking, where models to "save appearances" are considered all that is possible. Niels Bohr, the main proponent of this outlook, proclaimed his view of the new scientific method: "There is no quantum world. There is only an abstract quantum mechanical description. It is wrong to think that the task of physics is to find out how Nature *is*. Physics concerns what we can *say* about Nature."

Kepler would not agree with this! But, do we need a modern Kepler? Has the development of science brought us to the end of the road for methods of hypothesizing? How does the cultural and political environment affect the scientist? Two revolutions in scientific thought occurred a century ago: Einstein's relativity, and Planck's discovery of the quantum. Both discoveries required a reconceptualization of literally *everything*—nothing in physics was untouched, even if the changes were usually too small to be observed. These discoveries were not *additions* to knowledge in the usual sense of the word.

Einstein and Planck recognized the challenges to the concept of causation that their quantum revolution brought about. In the epilogue to Planck's *Where is Science Going*? the two thinkers express their thoughts. Planck:

"Where the discrepancy comes in today is not between nature and the concept of causality, but rather between the picture which we have made of nature and the realities in nature itself. Our picture is not in perfect accord with our observational results; and, as I have pointed out over and over again, it is the advancing business of science to bring about a finer accord here. I am convinced that the bringing about of that accord must take place, not in the re-

1. For more on the vicarious hypothesis, see *Metaphor, an Intermezzo* at http://larouchepac.com/metaphor-intermezzo.

2. See this author's guide to the *New Astronomy* at: science.larouchepac.com.

jection of causality, but in a greater enlargement of the formula and a refinement of it, so as to meet modern discoveries."

And Einstein:

"Our present rough way of applying the causal principle is quite superficial. We are like a child who judges a poem by the rhyme and knows nothing of the rhythmic pattern. Or we are like a juvenile learner at the piano, just relating one note to that which immediately precedes or follows. To an extent this may be very well when one is dealing with very simple and primitive compositions; but it will not do for the interpretation of a Bach fugue. Quantum physics has presented us with very complex processes and to meet them we must further enlarge and refine our concept of causality."

Where to, Now?

This issue of *21st Century Science and Technology* treats several subjects that have the potential to reveal new facts and provoke new ways of thinking that could fundamentally transform our notion of the scientific method. Academician Marov's paper on V. I. Vernadsky and astrobiology treats the scientific method of Vernadsky, the great Russian-Ukrainian scientist, and how his outlook is necessary today to make the needed breakthroughs in understanding life in the cosmos. Standing in opposition to the ability of the human species to change its relationship to nature in fundamental ways, Hans Joachim Schellnhuber, a top operative in Europe for "climate change" legislation, argues that the next breakthrough in science is to realize *the limits* of the mind, as discussed in the research report on his attempted re-appropriation of Vernadsky's legacy.

Space brings together the greatest challenges and potentials for science. Reports on recent conferences on "Humans 2 Mars" and planetary defense (as part of our ongoing coverage), reveal the potentials and limitations of current programs, and intriguing correlations between solar activity and earthquakes point to new connections to be drawn between the Earth and our entire Solar System.