

CLASSICS



Scientific theories must always safeguard against pseudoscientists who think that the debates in science reflect the fact that the theory itself is *incorrect*. One example is the use of valid debates on the mechanism of evolution (natural selection, for example) to conclude that evolution itself is invalid, or debatable at best. And to claim therefore that bogus theories like creationism should get equal time in school textbooks. Another example are the paradoxes of Quantum Mechanics resulting from the postulate of *wavefunction collapse* in a measurement, which leads to a close connection between the observer and observed. This has led to many pseudoscientific theories about how parapsychological phenomena could be explained by QM. Wheeler's essay on why this is a quack theory, which resulted in his address to the American Association for the Advancement of Science (AAAS) that it should reconsider its decision to “to dignify parapsychology by giving its researchers an affiliate status in the association”, is reproduced below.

Vasant Natarajan

Quantum Theory and Quack Theory

May 17, 1979

Martin Gardner and John Archibald Wheeler

Earlier this year, at the annual meeting of the American Association for the Advancement of Science, Dr. J.A. Wheeler startled his audience by asking the AAAS to reconsider its decision (made ten years ago at the insistence of Margaret Mead) to dignify parapsychology by giving its researchers an affiliate status in the association. Here is the background to Wheeler's explosive remarks.

John Archibald Wheeler, director of the Center for Theoretical Physics at the University of Texas, is one of the world's top theoretical physicists. In 1939 he and Niels Bohr published a paper on “The Mechanism of Nuclear Fission” that laid the groundwork for atomic and hydrogen bombs. Wheeler later played major roles in their development. He named the black hole. In 1968 he received the Enrico Fermi

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CLASSICS

award for “pioneering contributions” to nuclear science. When Richard Feynman accepted a Nobel Prize for his “spacetime view” of quantum mechanics (QM), he revealed that he had gotten his basic idea from a phone conversation with Wheeler when he was a graduate student of Wheeler’s at Princeton.

No one knows more about modern physics than Wheeler, and few physicists have proposed more challenging speculative ideas. In recent years he has been increasingly concerned with the curious world of QM and its many paradoxes which suggest that, on the microlevel, reality seems more like magic than like nature on the macrolevel. No one wants to revive a solipsism that says a tree doesn’t exist unless a person (or a cow?) is looking at it, but a tree is made of particles such as electrons, and when a physicist looks at an electron something extremely mystifying happens. The act of observation alters the particle’s state.

In QM a particle is a vague, ghostly, formless thing that cannot even be said to have certain properties until measuring it causes a “collapse of its wave packet.” (“Wave packet” refers to the total set of waves, defined in an abstract multidimensional space, that constitutes all that is known about a particle.) At that moment nature makes a purely random, uncaused decision to give the property (say the electron’s position or its momentum) a definite value predicted by the probabilities specified in the particle’s wave function. As Wheeler is fond of saying, we no longer can think of a universe sitting “out there” as if separated from us by a thick plate of glass. To measure a particle we must shatter the glass and alter what we measure. The physicist is no mere observer. He is an active participator. “In some strange way,” Wheeler has said, “the universe is a participatory universe.”

This is not a new suggestion because Niels Bohr constantly emphasized the need to redefine reality on the micro-level, always hastening to add that on the macrolevel of the laboratory classical physics still holds. It is easy to understand, however, how QM would appeal to physicists who are into Eastern religions and/or parapsychology. Consider a spoon. Because its molecules are made of particles it can be regarded as a quantum system. If particles are influenced by observation, may we not suppose that a super-psychic, observing a spoon, could in some mysterious way alter the system and cause the spoon to bend?

In the past, parapsychologists have had an extraordinary lack of success in trying to explain “psi”—i.e., parapsychological—phenomena by familiar forces such as



CLASSICS

electromagnetism and gravity. One difficulty—it was the main reason for Einstein’s skepticism about psi—is that all known forces weaken with distance whereas, if the results of parapsychology are valid, there is no decline of ESP with distance. Is it possible that QM can provide a workable theory of psi?

Parapsychologists who are not physicists (J.B. Rhine for instance) take a dim view of explaining psi by any aspect of physics, but there is a growing number of parapsychicists—physicists who believe in and are investigating paranormal phenomena—for whom QM opens exciting possibilities. This approach was given a boost a few years ago by experiments involving a famous paradox of QM known as the EPR paradox after the initials of Einstein and his friends Boris Podolsky and Nathan Rosen. In 1935 they published a thought experiment designed to prove that QM is not a complete description of nature on the microlevel but needs to be incorporated in a deeper theory in a manner similar to the way that Newtonian physics became incorporated in relativity theory.

The EPR paradox involves pairs of “correlated” particles. For example, when an electron and positron meet and annihilate one another, two photons, *A* and *B*, go off in opposite directions. No matter how far apart they get they remain correlated in the sense that certain properties must have opposite values. If *A* is measured for property *X* its wave packet collapses and *X* acquires the value of, say, +1. The corresponding value for *B* is at once known to be –1 even though *B* is not measured. Measuring *A* seems somehow to collapse the wave packet of *B* even though *A* and *B* are not in any way causally related!

Einstein hoped that his paradox could be resolved by a hidden variable theory—a theory that assumes a mechanism within both particles that keeps them correlated like two Frisbees simultaneously tossed left and right with both hands so that they spin in opposite ways. A person catching one Frisbee and noticing that it rotated clockwise would instantly know that the other Frisbee spun the other way even though nobody caught it. Alas, the formalism of QM rules out this possibility. If, for example, two correlated particles have opposite spin, you cannot say particle *A* has either kind of spin until it is measured. Not until the instant of measurement does nature “decide” what spin to give it.

In 1965 J.S. Bell hit on an ingenious proof, now known as “Bell’s theorem,” that no local hidden variables (local means in or near each particle) could explain the EPR correlations. It leaves open the possibility that the particles remain connected, even though light years apart, by a nonlocal subquantum level that no one understands. Moreover, Bell’s theorem provided for the first time a way of testing EPR correlations in a laboratory.



CLASSICS

Many such tests have been made and almost all confirm the EPR paradox. Most physicists have little interest in trying to explain the paradox—they simply accept QM as a tool that works—but physicists concerned with theoretical interpretations of QM are very much in a quandary over what to make of the new results.

For many parapsychologists the EPR paradox suggests that quantum information can be transferred instantaneously (or almost so) from any part of the universe to any other, otherwise how does one particle “know” what happens when its twin is measured? (Relativity theory is not violated because no energy is transferred, only information.) This is the view of parapsychologist Jack Sarfatti, who heads a small San Francisco organization called The Physics/Consciousness Research Group, initially financed by Werner Erhard of est. (Sarfatti and Erhard have since had a violent falling out, and Sarfatti is devoting much of his time to attacking Erhard as a native “fascist.”) For Sarfatti’s far-out views see his article “The Physical Roots of Consciousness” in Jeffrey Mishlove’s wild book, *The Roots of Consciousness* (published by Random House in a fit of absence of mind), and an interview with Sarfatti in *Oui*, March 1979. Last year Sarfatti applied for a patent (disclosure number 071165) on a device he hopes can send faster-than-light messages to any part of the universe.

Five years ago interest in QM as a basis for psi was so widespread that, at the suggestion of Arthur Koestler, an international conference on QM and parapsychology was held at Geneva in the fall of 1974. The *Proceedings* were published the following year by the Parapsychology Foundation, New York City. This quaint volume opens with a long paper by Evan Harris Walker, an American physicist who has made the most elaborate attempt to develop a QM theory of consciousness and psi. Gerald Feinberg of Columbia University spoke on precognition. Harold Puthoff and Russell Targ, the two Stanford Research Institute physicists who “verified” the clairvoyant powers of the Israeli magician Uri Geller, also gave papers. Both are sold on QM as the most likely explanation of psi. Other speakers included Ted Bastin, Helmut Schmidt, and O. Costa de Beauregard.

Costa de Beauregard, a French physicist, has the most eccentric of all explanations for the EPR paradox. He believes that information from the measurement of particle *A* travels backward in time to the origin of the particle-pair, then forward in time to particle *B*, arriving there at the exact instant it left *A*. Among leading physicists who did not attend the Geneva meeting but who believe QM is behind psi, there are England’s Nobel-Prize-winner Brian Josephson and Richard Mattuck of the University of Copenhagen.



CLASSICS

What does all this have to do with Wheeler? The answer is important and amusing. For many years Wheeler's views on QM have been widely cited by parapsychologists as strengthening their own. If you check Sarfatti's paper mentioned earlier you'll find Wheeler's name constantly invoked. Wheeler has found this increasingly irritating. Asked to speak in Houston at last January's annual meeting of the American Association for the Advancement of Science, he chose the topic "Not Consciousness But the Distinction Between the Probe and the Probed as Central to the Elemental Quantum Act of Observation." Wheeler hoped he could make clear his agreement with Niels Bohr that acts of QM measurement are made by devices which can be monitored by computers, and thus disassociate himself from those who argue that human consciousness is essential to QM observation. To his amazement he found himself sharing a panel with Puthoff and Targ, and parapsychologist Charles Honorton of Maimonides Medical Center in Brooklyn.

In his paper Wheeler went into considerable detail about the EPR paradox and its perplexing implications. It is a marvelous, subtly argued essay woven around the central theme: "no elementary phenomenon is a phenomenon until it is an observed phenomenon." Wheeler closed his lecture with these strong words: "And let no one use the Einstein-Podolsky-Rosen experiment to claim that information can be transmitted faster than light, or to postulate any 'quantum interconnectedness' between separate consciousnesses. Both are baseless. Both are mysticism. Both are moonshine."

Two appendices that Wheeler added to his paper have shaken the world of parapsychology more than any remarks made by a distinguished scientist in the past half-century. Here are the appendices, accompanied by Wheeler's letter to the president of the AAAS:

DRIVE THE PSEUDOS OUT OF THE WORKSHOP OF SCIENCE

Wheeler, J.A.

The author would be less than frank if he did not confess he wanted to withdraw from this symposium when—too late—he learned that so-called extrasensory perception (SCESP) would be taken up in one of the papers. How can anyone be happy at an accompaniment of pretentious pseudo-science who wants to discuss real issues about real observations in real science? How can pseudo-science fail to profit in prestige and acceptability by being on the same platform as science? And how can science fail to lose? That is why the author, then on the AAAS Board of Directors, voted against the majority of the much larger



CLASSICS

Council at that time and against the admission of “parapsychology” as a new division of the American Association for the Advancement of Science at its meeting in Boston in 1969. That is why, with the decade of permissiveness now well past, he suggests that the Council and the Board of Directors will serve science well to vote “parapsychology” out of the AAAS.

It is not the slightest part of this proposal to prevent anyone from working on “parapsychology” who wants to. Neither does the author yield to anyone in his respect for the idealism and good intentions of some he has known in that field. Nor is there in this proposal any intention to deny investigators full freedom of speech and a forum for their fribbles. There is forum enough already in a country that can afford 20,000 astrologers and only 2,000 astronomers. There is forum enough in a Parapsychological Association, a Boston Society for Psychical Research, an American Society for Psychical Research, an International Society for Psychotronic Research, and a Parapsychology Foundation. No one would think of interfering with the freedom that anyone has to publish in the *International Journal of Parapsychology*, the *Journal of the American Society for Psychical Research*, or the *Journal of Parapsychology*. Neither is it part of this proposal to interfere with the fund raising that keeps parapsychology going in the United States to the tune of from \$1 million to \$20 million a year.¹ Faith healers can be prosecuted, confidence men can be sent to jail, but no one would propose that parapsychologists be prevented from soliciting—even soliciting for government support. But why should the name “AAAS-Affiliate” be allowed to give those solicitations an air of legitimacy?

WHERE THERE’S SMOKE, THERE’S SMOKE

Surely when so much is written about spoon bending, parapsychology, telepathy, the Bermuda Triangle, dowsing, and when others write on “quantified etherics,” bioactochronics, levitation, and occult chemistry there must be *some* reality behind those words? Surely where there’s smoke there’s fire? No, where there’s so much smoke there’s smoke.

Every science that is a science has hundreds of hard results; but search fails to turn up a single one in “parapsychology.” Would it not be fair, and for the credit of science, for “parapsychology” to be required to supply one or two or three battle-tested findings as a condition for membership in the AAAS?

Self-delusion or conscious fraud was Houdini’s diagnosis of psychic phenomena. “He



CLASSICS

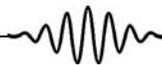
threw down a challenge...offering any medium five thousand dollars if he could not duplicate any phenomenon of alleged spirits himself.... Early in 1926 Houdini made a pilgrimage to Washington to enlist the aid of President Coolidge in his campaign 'to abolish the criminal practice of spirit mediums and other charlatans who rob and cheat griefstricken people with alleged messages.'"²

Hudson Hoagland, in an editorial in *Science* magazine,³ tells us:

A famous case was that of a Boston medium in the 1920s, who had a wide following. She was the wife of an eminent surgeon and claimed communication with her dead brother. The old *Scientific American* magazine had offered a prize of \$5,000 to anyone who could demonstrate supernormal physical phenomena to a committee of its choosing. At her request, she was investigated in 1924 by this committee, composed of several Harvard and M.I.T. professors along with Harry Houdini, the magician. The committee reported that evidence for her supernormal powers was inconclusive, although Houdini denounced her as fraudulent.

Following wide press publicity, a group at Harvard, of which I was one, later investigated her in a series of seances in the psychological laboratories and found not only that the phenomena were due to trickery, but also how the tricks were done. Our findings, published in an article by me in the *Atlantic Monthly* of November 1925, resulted in violent recriminations and denunciations of us in published pamphlets and press statements by her followers. Our exposure enhanced her publicity and she gained more adherents. She was skillful in modifying her mode of operation, depending upon the gullibility of her audience and other circumstances. On several subsequent occasions she was also exposed by other scientists, but at no time until her death did she lose a diminishing circle of devoted believers.

The basic difficulty inherent in any investigation of phenomena such as those of psychic research or of UFO's is that it is impossible for science ever to prove a universal negative. There will be cases which remain unexplained because of lack of data, lack of repeatability, false reporting, wishful thinking, deluded observers, rumors, lies, and fraud. A residue of unexplained cases is not a justification for continuing an investigation after overwhelming evidence has disposed of hypotheses of supernormality, such as beings from outer space or communications from the dead. Unexplained cases are simply unexplained. They can never constitute evidence for any hypothesis."



CLASSICS

Let parapsychology pass, or try to pass, the *Scientific American*-Houdini test with one or two or three of its findings. Is there any more searching way to make a first trial whether there is anything in parapsychology worth further scrutiny?

For every phenomenon that is proven to be the result of self-delusion or fraud or misunderstanding of perfectly natural everyday physics and biology, three new phenomena of “pathological science” spring up in its place. The confidence man is able to trick person after person because so often the victim is too ashamed of his gullibility or too mouse-like in his “stop, thief” to warn others. Happily a journal now exists called the *Skeptical Inquirer*⁴ which provides a list of some of the items of pathological science currently in vogue. Some other references which the reader may want to consult are Gardner’s *Fads and Fallacies*⁵, Condon’s *Scientific Study of Unidentified Flying Objects*,⁶ and Jastrow’s *Error and Eccentricity in Human Belief*⁷.

Robert Buckhout’s article⁸ on “Eyewitness Testimony” remarks “although such testimony is frequently challenged, it is still widely assumed to be more reliable than other kinds of evidence. Numerous experiments show, however, that it is remarkably subject to error.” Irving Langmuir’s colloquium talk at the General Electric Company’s Knolls Research Laboratory⁹ on December 18, 1953, tells of his own experience investigating delusions, conscious and unconscious. Langmuir analyzes the Davis-Barnes effect, N-rays (for which also see especially the famous encounters between R.W. Wood¹⁰ and R. Blondlot), mitogenetic rays, characteristic symptoms of pathological science, Allison effect (see also a recent review),¹¹ extrasensory perception and flying saucers. Langmuir’s table of symptoms of pathological science are as appropriate today as they were when he gave his lecture in 1953:

1. The maximum effect that is observed is produced by a causative agent of barely detectable intensity, and the magnitude of the effect is substantially independent of the intensity of the cause.
2. The effect is of a magnitude that remains close to the limit of detectability; or, many measurements are necessary because of the very low statistical significance of the results.
3. [There are] claims of great accuracy.
4. Fantastic theories contrary to experience.
5. Criticisms are met by *ad hoc* excuses thought up on the spur of the moment.



CLASSICS

6. Ratio of supporters to critics rises up to somewhere near 50 percent and then falls gradually to oblivion.

There's nothing that one can't research the hell out of. Research guided by bad judgment is a black hole for good money. No one can forbear speaking up who has seen \$10,000 cozened out of a good friend, \$100,000 milked out of a distinguished not-for-profit research organization, and \$1,000,000 syphoned away from American taxpayers—all in the cause of “research” in pathological science.

Where there is meat there are flies. No subject more attracts the devotees of the “paranormal” than the quantum theory of measurement. To sort out what it takes to define an observation, to classify what it means to say “no elementary phenomenon is a phenomenon until it is an observed phenomenon” is difficult enough without being surrounded by the buzz of “telekinesis,” “signals propagated faster than light,” and “parapsychology.”

Now is the time for everyone who believes in the rule of reason to speak up against pathological science and its purveyors.

LETTERS

The Superluminal September 27, 1979

- 1 Order of magnitude of p2G 200 actively working in the field. Costs per full-time PhD investigator per year in industry, p2G100,000 per year; perhaps half of this in academic work when ancillary costs are included; figures for less than full-time workers tapering down to a few \$1,000 per year; rough average adopted here, p2G \$20,000 per year; this times p2G 200 gives p2G \$4 million per year or, with uncertainties, a number in the range of \$1 million to \$20 million a year.
- 2 B.R. Sugar, “Houdini,” Braniff Airlines *Flying Colors* 5, No. 2, pp. 31–39 and 58 (1975); the quotation comes from p. 39. The papers of Houdini are on deposit in the library of the University of Texas at Austin.
- 3 Hudson Hoagland, “Beings from outer space—corporeal and spiritual,” *Science* 163, p.625 (February 14, 1969).
- 4 *The Skeptical Inquirer* (published by the Committee for the Scientific Investigation of Claims of the Paranormal), Box 29, Kensington Station, Buffalo, NY 14215.



CLASSICS

- 5 The curious theories of modern pseudoscientists and the strange, amusing, and alarming cults that surround them; a study in human gullibility with topics including flying saucers, Atlantis, Bridey Murphy, Alfred Korzybski, eccentric sexual theories, Dr. W.H. Bates, Wilhelm Reich, L. Ron Hubbard, psionics machines.
- 6 E.U. Condon, *Scientific Study of Unidentified Flying Objects*, edited by D.S. Gillmor (Bantam, 1969).
- 7 The author chronicles one episode after another from the record of human credulity ... to support his central contention, that man tends to fashion his beliefs out of his desires, not out of rational thought.
- 8 R. Buckhout, "Eyewitness Testimony," *Scientific American* 231, pp. 23–30 (December 1974).
- 9 I. Langmuir, "Pathological Science," R.N. Hall, ed., Colloquium at the Knolls Research Laboratory, December 18, 1953, 13 pp. (On deposit with the Manuscript Division of the Library of Congress as a microgroove disk recording.)
- 10 R.W. Wood, "The N Rays" (Letter exposing delusion), *Nature* 70, p. 530 (1940). W. Seabrook, *Doctor Wood* (Harcourt, Brace and Co., 1941).
- 11 H. Mildrum and B. Schmidt, "The Allison method of chemical analysis," United States Air Force Aeropropulsion Laboratory Technical Report AFA PLTR-66-52, 1966. Contains extensive bibliography.

