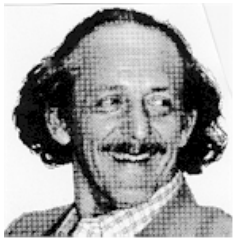

Current Comments

Since 1816 the John Scott and Other Philadelphia Awards Have Recognized "Useful" Scientific Discoveries—James Black and Benjamin Rubin Head a List of Recent Distinguished Recipients

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If you were to ask the average person to name a scientific award, you would doubtless hear the Nobel Prize named. Besides the Nobel, though, most people would be hard pressed to name many more. In a forthcoming essay on "non-Nobel awards," I will discuss several science awards that are well known to many scientists but are not, perhaps, as famous as they should be.

When I first contemplated this essay I had the immediate objective of calling to your attention the work of several award committees on which I have served. The granting of awards is an important part of the reward system of science, but it is not generally known how pervasive a phenomenon it has become. Awards in science come in all sizes and shapes and it would be impossible to name and discuss them all in a reasonable amount of space. A brief discussion of Philadelphia-based science awards follows. I hope it will prove to be an interesting sampling. It also provides me the opportunity to promote our city during its 300th anniversary celebration.[1]

Over 100 science awards are given by local and national organizations based in Philadelphia.[2] Many of them have formidable traditions of their own. One such award is the John Scott Award. It is certainly one of the oldest science awards in the US.

John Scott, an Edinburgh chemist, founded the award in 1816 by willing $4,000 to the City of Philadelphia. He probably chose Philadelphia because he was a great admirer of Benjamin Franklin. To date about 500 people have received the award, which Scott intended to go to "ingenious men and women who make useful inventions." Scott's endowment was to be invested to create a fund for honoraria. Each award now includes an honorarium of about $5,000 and is given annually by the Philadelphia Board of Directors of City Trusts.[3]

The John Scott Award Advisory Committee consists of Chairman William A. Meehan, president, Board of Directors of City Trusts; Randall M. Whaley, president, University City Science Center; Francis Plowman, former vice president, Scott Paper Co.; Ruth J. Armour, secretary, Board of Directors of City Trusts; C. Marshall Dann, patent attorney; Eugene Garfield, president, ISI®; Charles Price, emeritus professor of chemistry, University of Pennsylvania; Jonathan E. Rhoads, professor of surgery, University of Pennsylvania; Sidney Weinhouse, director, Fels Research Institute, Temple University School of Medicine; and Percy A. Wells, former director, Eastern Regional US Department of Agriculture Laboratory.

The committee welcomes carefully documented nominations. The award is not restricted to Philadelphians, or even to Americans. Citizens of many coun-

tries have been honored. The list of recipients includes such names as Marie Curie, Orville Wright, Thomas Edison, Guglielmo Marconi, Nikola Tesla, Edwin H. Land, Vannevar Bush, Alexander Fleming, Glenn T. Seaborg, John Bardeen, Jonas Salk, and ISI's neighbor R. Buckminster Fuller.

Many other Scott Award recipients are not as well known. But they certainly fulfilled Scott's dictum that the award be given to the makers of useful inventions. In 1922, for example, Elwood Haynes received the award for developing stainless steel. Inventor Robert Temple got the award in 1931 for making a dough mixing and kneading device. Paul M. Zoll was the recipient in 1967 for developing the pacemaker.[3]

Better known to *Current Contents®* (*CC®*) readers is Oliver H. Lowry, Washington University, St. Louis, Missouri, the citation laureate. He received the Scott Award in 1963 for a method for isolating, preparing, weighing, and chemically studying single nerve cells and subcellular particles.[4] I have already commented in detail about his famous paper on protein determination,[5] which he himself discussed in a *Citation Classic*.[6] A more recent recipient, in 1978, was Bruce N. Ames, University of California, Berkeley, for his test for mutagenicity.

The 1981 corecipient of the Scott Award was Sir James Whyte Black. He was given this recognition for work which led to the development of two important drugs. Black was elected to the Royal Society in 1976, and since 1978 has been director of therapeutic research at Wellcome Research Laboratories, UK. He was born in Scotland in 1924 and has lectured at the University of St. Andrews and at the University of Glasgow. He has also been head of the department of pharmacology at University College London, and deputy director of research at SmithKline Corp.[3]

Black was honored for the 1964 discovery of propranolol, a drug used to treat angina, arrhythmia, and hypertension.[7] (p. 393-4) It has also been shown useful in preventing migraine headaches[8] and in prolonging the lives of heart attack patients.[9]

Marketed in the US by Ayerst Laboratories as Inderal, propranolol is one of a family of drugs known as beta blockers. According to a recent review of the subject, beta blockers are so known because they block the absorption of hormones by sites in the nervous system called beta-receptors. Blocking these receptors causes the heart to slow down so that it uses less oxygen. It also lowers the blood pressure.[10]

The idea of beta blockers was conceived in 1906 when H.H. Dale found that involuntary responses of various organs were inhibited by certain alkaloids. This led R.P. Ahlquist and others to investigate different types of receptor cells. However, it was not until 1958 that researchers at Eli Lilly Laboratories were able to block some of the beta responses to isoprenaline, a chemical involved in respiration.[10]

Though beta blockers are not new, Black and colleagues were the first to recognize their real clinical potential.[10] They theorized that anginal pain, which results from lack of oxygen to the heart as it beats faster, might be reduced by blocking the stimulants that increase heart rate.

Working with chemist J.S. Stephenson, Black discovered the first clinically useful beta blocker, called pronethalol. But to be effective, pronethalol had to be used in high doses, and these doses seemed to cause cancer in mice. So the researchers went on to develop propranolol, a drug ten times stronger than pronethalol.[10]

Propranolol does have some side effects. It can cause low blood pressure, fatigue, faintness, bizarre dreams, occa-

sional depression, and gastrointestinal problems. But not many patients experience these side effects, and the effects can usually be avoided by taking lower dosages.[10]

In addition to those who have benefited from this drug, there are also millions of others who suffer from chronic duodenal ulcer. They should feel, as I do, personally grateful to Black for his other major discovery. His research on H_2 antagonists laid the groundwork for cimetidine. Cimetidine is the anti-ulcer drug marketed worldwide by SmithKline. In the US it goes under the trade name Tagamet.[11]

Gastric and duodenal ulcers may be caused by excess secretion of gastric acid, or, in some patients, by the inability of the mucosa to absorb normal amounts of acid. The secretion of gastric acid is influenced by the hormone histamine. Histamine causes the release of chemicals when it interacts with points along cell walls known as H-receptors. According to a reminiscence by William A.M. Duncan and Michael E. Parsons, two of Black's colleagues, Black theorized that there are really two types of H-receptors. H_1-receptors cause allergic reactions and cold symptoms such as runny eyes and sore throat. Antihistamines suppress those symptoms. But they do not suppress the release of gastric acid, which theoretically occurs when histamine binds with the second type of H-receptor, called the H_2-receptor.[12]

In 1964, a team of scientists at SmithKline, led by Black, began to search for a way to block that histamine-H_2 reaction. They wanted to make a "key" that would fit into the receptor "lock" even better than histamine did, but would not cause gastric acid secretion.[12]

Black's team tested about 700 compounds. It didn't find an effective H_2 antagonist until 1970. This drug, burimamide, was not potent enough. In 1971 the team produced metiamide, which is strong enough to be effective in humans.

In late 1972, as Black left SmithKline, metiamide turned out to adversely affect laboratory animals. So a new compound had to be found. Cimetidine was made at SmithKline late in 1972, first marketed in the UK in 1976, and approved by the Food and Drug Administration for US use nine months later. While Black did not directly participate in the synthesis of cimetidine, his basic research laid the essential groundwork.[12]

Cimetidine is still not perfect. There have been reports that it can cause impotence or low sperm count.[13] Ironically, more recent reports indicate it may also help *prevent* cancer.[14] More research needs to be done on cimetidine, but there is no doubt that it or other H_2 antagonists are the most successful methods now available for combating ulcers.

Black's original paper on H_2-receptors has accrued over 1,000 citations.[15] Based on *Science Citation Index*® (*SCI*®) data, only about 300 papers have ever achieved this distinction, and only 17 were published between 1972 and 1980. Many of Black's other papers have been well cited, from about 50 times[16-19] to over 100 times.[20-24]

Both propranolol and cimetidine are now the subject of intensely active fields of research. Tables 1 and 2 list the titles of the most active research fronts identified in the 1982 *ISI/BIOMED*™ online file. The literature on these compounds is enormous.

In 1981, the John Scott Award Committee also recognized another inventive, large-scale contribution to health. It selected Benjamin A. Rubin, the inventor of the bifurcated needle. The World Health Organization used it in its global campaign to eradicate smallpox.[25]

Rubin began working on a way to apply smallpox vaccine in 1961, when he

Table 1: *ISI/BIOMED*™ research front specialties on propranolol.

Code Number	Research Front Name
79-0932	Long-term propranolol therapy
79-1331	Plasma concentrations of propranolol
79-1950	Propranolol and hypertension
80-0312	Propranolol in chronic schizophrenia
80-1809	Beta-adrenergic receptor blocking therapy by propranolol in myocardial infarction
80-2205	Propranolol beta-blocking activity in thyrotoxicosis and hyperthyroid treatment
80-2234	Effects of propranolol on CNS beta-adrenergic receptors during antihypertensive therapy
80-2461	Propranolol as a beta-adrenergic receptor antagonist in tryptamine-induced behavioral changes in rodents
81-1185	Pharmacokinetics of propranolol
81-3078	Propranolol, chlorpromazine and beta-adrenergic blocking drugs in schizophrenia

Table 2: *ISI/BIOMED*™ research front specialties on cimetidine.

Code Number	Research Front Name
79-0204	Cimetidine effects on prolactin secretion
79-0538	Cimetidine in the treatment of duodenal ulcer
80-0663	Clinical evaluation of cimetidine on gastrointestinal ulcers
80-0664	Cimetidine effects on pituitary and gastric secretion
80-1416	Effects of cimetidine and pancreatic enzymes following pancreatic-replacement therapy
80-1701	Clinical aspects of cimetidine
80-1984	Pharmacology of cimetidine in treatment of gastrointestinal bleeding
81-0265	Effects of histamine antagonists, cimetidine and ranitidine on H-receptors
81-0347	Effects of cimetidine
81-0417	T-cell-response to histamine
81-0546	Cimetidine for the treatment of gastroesophageal reflux
81-0677	Management of peptic ulcers with cimetidine and other drugs
81-1007	Clinical pharmacokinetics of cimetidine
81-1369	Cimetidine and cytopenia
81-1507	Drug interactions with cimetidine
81-2292	Effects of cimetidine on calcitonin and calcium transport

collaborated with Reading Textile Machines Company of Pennsylvania, now a division of Rockwell International. A new method of freeze-drying vaccine had made the earlier method, using capillary tubes, obsolete, because capillary tubes wasted vaccine. So Rubin tried to design a needle that would hold less vaccine and be easier to use. He ground down the eyes of sewing needles to make pronged forks. These prongs held exactly 1 mg of fluid vaccine. Later, Rubin sharpened the needle so that it could be used to scar as well as puncture the skin, and thus use much less vaccine than older techniques.[26] Using Rubin's modified sewing needle as a prototype, Reading Textile Machines began mass production. The simplicity of the device also allowed a vaccinator to be trained in about 15 minutes. It greatly increased the vaccination success rate.[26]

Rubin, born in 1917, has followed a career which encompasses radiology, chemistry, endocrinology, genetics, pathology, and microbiology. A prolific author in his many fields, Rubin has published over 135 papers on subjects including gene mutation,[27] influenza,[28] radiation microbiology,[29] steroids,[30] immunology and cancer,[31] rabies virus,[32] the separation of viral components in zero gravity,[33] and protein synthesis inhibitors.[34] He is now manager of biological product development at Wyeth Laboratories, Radnor, Pennsylvania.

The John Scott Award is not, of course, the only prestigious scientific award based in Philadelphia. Philadelphia is not only a large city; it was the original capital of the US. So not surprisingly it has a long tradition of science. There are many other awards but space doesn't permit me to list them all. Indeed, most of the organizations listed below administer more awards than those that we have the space to name. The following brief overview should give

an impression of the variety of individuals and fields recognized in this city.

Philadelphia's tradition of excellence in the biomedical sciences was demonstrated recently when I described the Wistar Institute.[35] Considering the fact that there are five medical schools in Philadelphia, it's no surprise that there are many prizes in biomedicine. In 1958, for example, the American College of Physicians (ACP), located in Philadelphia since 1923, established the annual ACP Award, with a gold medal, for medical research. The 1982 award went to Daniel Nathans, Johns Hopkins University. Nathans was corecipient of the 1978 Nobel Prize for Physiology or Medicine.[36] He was also among the 1,000 most-cited contemporary scientists.[37]

The American Society of Cytology (ASC), based in Philadelphia since 1962, also sponsors several awards. One is named after George Papanicolaou, inventor of the "Pap smear" method to detect uterine cancer. This annual award includes a bronze medal and a $750 honorarium. In 1979, the award went to Torbjorn O. Caspersson for his work in cellular physics.[38] Caspersson, Karolinska Institutet, Stockholm, also appeared in our study of 1,000 most-cited contemporary scientists.[37]

In 1972, Caspersson received another yearly ASC award, the Guest Lectureship Award on Basic Cell Research in Cytology. Other 1,000 most-cited authors who received it are Paul Eston Lacy (1981), Baruj Benacerraf (1980), Joseph Louis Melnick (1978), Emmanuel Farber (1977), Robert Alan Good (1974), Don Wayne Fawcett (1971), Zanvil A. Cohn (1970), and Harris Busch (1968).[37] The award carries a $500 honorarium.

The American Philosophical Society (APS), founded by Franklin and others in 1743, has a number of awards in the life sciences as well as other fields. One of them is for research in neurobiology. The award is named after its founder, Karl Spencer Lashley, the neurobiologist. It was established in 1957, the year before his death. Among the recipients is Nobelist Roger Wolcott Sperry. He received the Lashley Award in 1976.[39] Included with this annual award is an honorarium of $2,000.

The APS also administers the John F. Lewis Prize for "some truth which the Council of the Society shall deem worthy of the award."[39] It was established in 1935 with a $10,000 donation by Lewis's wife, in her husband's memory. This $300 annual award is not restricted to science. The 1979 award, for example, went to Roland Mushat Frye, University of Pennsylvania, for a paper on Milton's influence on the visual arts.[40] But since the award was established in 1935, it has been bestowed on authors of papers dealing with spectroscopy,[41] paleontology,[42] population biology and economics,[43] hummingbirds,[44] the placenta,[45] and the lunar surface.[46] The 1977 winner was Choh Hao Li, Hormone Research Laboratory, University of California, San Francisco. This pharmacologist, also among the 1,000 most-cited scientists,[37] was honored for a paper on pituitary hormones.[47]

Yet another APS award falls into the natural sciences category. John Hyacinth de Magellan, descendant of Ferdinand Magellan, donated to the APS funds for an award for the most useful invention in navigation, astronomy, or natural philosophy. Today the award is called the Magellanic Premium, and includes a gold medal.[39] It is bestowed irregularly. The most recent selection neatly combines the fields of navigation and the life sciences. It was given in 1980 to Martin Lindauer, University of Würzburg, Federal Republic of Germany, for his studies on animal orientation and flight guidance.[48]

The natural sciences are well represented by the awards of the Academy of

Natural Sciences. The academy was founded in Philadelphia in 1812. The Joseph Leidy Medal is given every three years, for publication or exploration in natural science.[49] Leidy (1823-1891) was a physician noted for his work on parasitology and paleontology. The award includes a bronze medal and a $500 honorarium. The Leidy Medal was given in 1979 to Edward O. Wilson, Harvard University, for his research on the classification of ants. Wilson, of course, is better known to the public as the founder of the controversial field of sociobiology.[50] Other recipients have been Henry A. Pilsbry (1928), known for research on shellfish,[51] and Ernst Mayr (1946), noted for his work on evolution.[52]

The academy also has an award for research in geology and paleontology. It's called the Hayden Memorial Geological Award. A bronze medal and $500 comes with it. It was founded in 1888 by Emma W. Hayden, in honor of her husband, who was an early director of the American Geological Survey. One of the earliest recipients of the award was Thomas Huxley, in 1893. The most recent recipient is Daniel Isaac Axelrod, University of California, Davis. He got the award in 1979. He too is known for his research on evolution.[53] This prize is awarded every three years.

The academy's Gold Medal, though not specifically for science, is another noteworthy natural science award. It was founded in 1980 to honor artists who deal with natural sciences subjects. It has been given to both Ansel Adams and Roger Tory Peterson.[49]

The Academy of Natural Sciences also presents an occasional award for exploration in the natural sciences. This prize, the Richard Hopper Day Memorial Medal, was established in 1960 by Margaret Day Dilks, in honor of her grandfather.[49] One of the first recipients was famed deep-sea diver Jacques Piccard. L.S.B. Leakey, noted for his landmark work in human paleontology, received it in 1964. Appropriately enough, the award has also gone to an astronaut turned geologist, Harrison Schmitt. He is the only scientist so far to walk on the moon, and is now a member of the US Senate.

Exploration is also the field for which the Geographical Society of Philadelphia gives honors. Its Elisha Kent Kane Gold Medal was established in 1900. This medal is named after the Philadelphia native who in the nineteenth century explored the Arctic while on an unsuccessful expedition to rescue another exploration team. Kane spent two years marooned on Greenland before he was rescued in 1855. Kane Medal recipients have included Arctic explorer Robert E. Peary (1902); aviator Richard E. Byrd (1926); William R. Anderson (1959), commander of the nuclear submarine *Nautilus*; Jacques-Yves Cousteau (1961); John H. Glenn, Jr. (1962), another astronaut turned senator; and astronaut M. Scott Carpenter (1968).[54] The medal is awarded irregularly.

Physical sciences are well covered by Philadelphia-based awards. The Franklin Institute sponsors many of them. The Franklin Medal, for instance, is a gold medal given annually to physical science or technology workers who have done the most to advance or apply physical knowledge. Stephen W. Hawking, the well-known British astrophysicist, received the award in 1981 for his revolutionary work on cosmology, relativity, and black holes.[55]

Another Franklin Institute physical sciences award, the John Price Wetherill Medal, is a gold medal bestowed in recognition of new physics discoveries, or for new combinations of older principles and methods. In 1981, the award went to five IBM researchers for their work on the physics of transistors. The recipients were Frank Fang, Alan Fowler, Web-

ster Howard, Frank Stern, and Philip Stiles. Another Franklin award, the Albert A. Michelson Medal, goes to contributors to the field of optics. The 1982 Michelson Medal was given to Hermann P. Haken, University of Stuttgart, Federal Republic of Germany, for his work in quantum optics and laser theory.[55]

Theoretical and applied mathematics are also recognized by Philadelphia-based awards. The Society for Industrial and Applied Mathematics (SIAM), founded in 1952, sponsors several such awards.[56] The Norbert Weiner Prize was established in 1967 for contributions to applied mathematics. It is awarded every five years and carries an honorarium of $300. It is cosponsored by the American Mathematical Society, Providence, Rhode Island. Three of the four recipients—Richard Ernest Bellman, University of Southern California; Peter David Lax, New York University; and Tosio Kato, University of California, Berkeley—appeared on our list of most-cited mathematicians. Three recipients of the John von Neumann Lecture Award also appeared on our list. That yearly award was established in 1960 to recognize a lecturer who shows how pure mathematics contributes to applied math. The most-cited math list recipients were Lars Valerian Ahlfors (1960), Lax (1968), and Garrett Birkhoff (1981).[57]

Naturally, I'm happy to report that information science is represented. The National Federation of Abstracting and Information Services (NFAIS), founded in Philadelphia in 1958, offers the Miles Conrad Memorial Award to recognize outstanding contributors to the field of abstracting and indexing. Recipients deliver the Miles Conrad Lecture. The annual award is named after my close friend and colleague. Miles was also the first president of NFAIS. The 1980 lecture, by Carlos A. Cuadra, Cuadra Associates, Inc., considered how and whether publishers may survive the technology explosion of the 1980s.[58] The 1981 lecture, by Russell J. Rowlett, Jr., Chemical Abstracts Service, dealt with the changing role of the abstract.[59] Rowlett retires this year and will be missed by all his friends. The 1982 lecture, by Saul Herner, Herner and Co., dealt with the business and science aspects of abstracting and indexing services.[60] My association with Herner goes back to 1951 when we were both affiliated with Johns Hopkins University.

I am certain that most award committees, including the ones I serve on, are glad to receive suggestions for candidates, especially those who have not been adequately recognized in the past. Too often suggestions are received naming scientists who have been widely and amply recognized for their accomplishments. As our studies have repeatedly stressed, the world of science is large and blessed with an incredible number of brilliant people. The democracy of science demands that more of them be recognized publicly. In Philadelphia, at least, we are trying to be a little bit more systematic about it.

* * * * *

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