Nobel Laureate Anecdotes
Part 2

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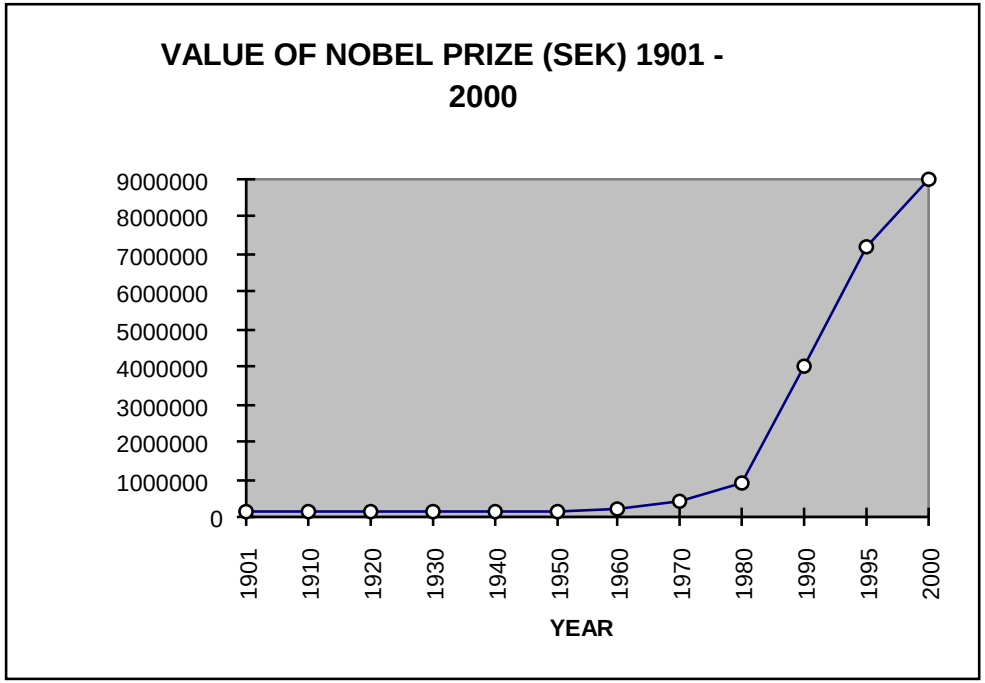
Department of Chemistry, York University
4700 Keele Street, Toronto, ONTARIO M3J 1P3, CANADA

For suggestions, corrections, additional information, and comments please send e-mails to c1000@careerchem.com

http://www.chem.yorku.ca/NAMED/

Source: Hargittai, Istvan *The Road to Stockholm: Nobel Prizes, Science, and Scientists*, Oxford University Press: Oxford, 2002
Note: This compilation fills in some missing details not given in Hargittai's book. I have also amplified and clarified some ideas presented in the book where appropriate. Used with permission.

Growth of Nobel Prize Money



How Do Nobel Laureates Spend Their Winnings?

Albert Einstein (Physics, 1921) used his winnings as part of his divorce settlement from Mileva Maric in 1919.
Michael Smith (Chemistry, 1999) donated his winnings to research on schizophrenia, science outreach programs, and the encouragement of women in science.
Dorothy H. Crowfoot (Chemistry, 1964) donated her winnings to various charities.
Günther Blobel (Medicine, 1999) used his winnings to help in the reconstruction of Dresden, Germany after its destruction in World War II.
Philip W. Anderson (Physics, 1977) bought a new family home.
Frederick Banting (Medicine, 1923) shared part of his prize money with his graduate student Charles Best and **J.J.R. Macleod** (Medicine, 1923) shared his part with the biochemist J.B. Collip who found a method of isolating insulin from the islets of Langerhans in pancreas tissue.
Harold Urey (Chemistry, 1934) shared his prize with F.G. Brickwedde and G.M. Murphy.*
*Personal communication from Dr. Joel S. Leventhal, Emeritus Scientist, U.S. Geological Survey, November 28, 2005.

Parallels Between Nobel Prize Winners and Wolf Prize Winners

(see http://www.aquanet.co.il/wolf/wolfpriz.html)

SCIENTIST	WOLF PRIZE	NOBEL PRIZE
John C. Polanyi	Chemistry, 1982	Chemistry, 1986
Rudolph A. Marcus	Chemistry, 1984/5	Chemistry, 1992
Elias J. Corey	Chemistry, 1986	Chemistry, 1990
Richard R. Ernst	Chemistry, 1991	Chemistry, 1991
John A. Pople	Chemistry, 1992	Chemistry, 1998
Ahmed Zewail	Chemistry, 1993	Chemistry, 1999
Ryoji Noyori	Chemistry, 2001	Chemistry, 2001
K. Barry Sharpless	Chemistry, 2001	Chemistry, 2001
Kenneth G. Wilson	Physics, 1980	Physics, 1982
Gerhardus 't Hooft	Physics, 1981	Physics, 1999
Riccardo Giacconi	Physics, 1987	Physics, 2002
Pierre-Gilles de Gennes	Physics, 1990	Physics, 1991
Joseph H. Taylor, Jr.	Physics, 1992	Physics, 1993
Raymond Davis Jr.	Physics, 2000	Physics, 2002
Masatoshi Koshiba	Physics, 2000	Physics, 2002
Roger W. Sperry	Medicine, 1979	Medicine, 1981
Arvid Carlsson	Medicine, 1979	Medicine, 2000
Cesar Milstein	Medicine, 1980	Medicine, 1984
Barbara McClintock	Medicine, 1981	Medicine, 1983
Cohen, Stanley S.	Medicine, 1981	Medicine, 1986
Sir James W. Black	Medicine, 1982	Medicine, 1988
Edward B. Lewis	Medicine, 1989	Medicine, 1995
Stanley B. Prusiner	Medicine, 1995/6	Medicine, 1997
Eric R. Kandel	Medicine, 1999	Medicine, 2000

Brain Gain vs. Brain Drain
(see Nobel Anecdotes Part 1)

Top importers of Nobel Laureates:

1. United States
2. Great Britain

Top exporters of Nobel Laureates:
1. Germany
2. Austria
3. Canada
4. Hungary
5. Italy
6. Poland

Scientists whose achievements were not recognized by a Nobel Prize

SCIENTIST	CATEGORY	ACHIEVEMENT
AVERY, OSWALD	MED	discovery that DNA is source of heredity
BARTLETT, NEIL	CHEM	discovery of noble gas compounds
BERNAL, JOHN D.	CHEM	x-ray structure of hemoglobin
DYSON, FREEMAN	PHYS	contributions to quantum electrodynamic theory
FURKA, ARPAD	CHEM	combinatorial chemistry concept
GOMBERG, MOSES	CHEM	discovery of stable organic radicals
GOUDSMIT, SAMUEL	PHYS	concept of electron spin to explain atomic fine structure
HEIDELBERGER, MICHAEL	MED	discovery that DNA is source of heredity
HEITLER, WALTER	PHYS	contributions to quantum theory and atomic structure
HORNYKIEWICZ, OLEH	MED	discovery of connection between L-dopamine deficiency and Parkinson's disease
HUND, FRIEDRICH	PHYS	contributions to quantum mechanics and structure of matter
INGOLD, CHRISTOPHER K.	CHEM	concepts in mechanistic chemistry
KAMEN, MARTIN	CHEM	discovery of C-14 isotope
KATO, GENICHI	MED	muscle and nerve fibers, reflex inhibitory and

		excitatory nerves
KEILIN, DAVID	MED	discovery of cytochromes; cell respiration
KUFFLER, STANLEY W.	MED	receptive field arrangements of cat retinal-ganglion cells
LEWIS, GILBERT N.	CHEM	concepts in chemical structure and bonding
LONDON, FRIEDRICH	PHYS	contributions to theoretical chemistry and physics
MACLEOD, COLIN	MED	discovery that DNA is source of heredity
MCCARTY, MACLYN	MED	discovery that DNA is source of heredity
MENDELEEV, DIMITRI I.	CHEM	discovery of periodicity law of elements and concept of periodic table
PIMENTEL, GEORGE	CHEM	contributions to reaction dynamics
RUBEN, SAMUEL	CHEM	discovery of C-14 isotope
SABIN, ALBERT	MED	discovery of polio vaccine
SALK, JONAS E.	MED	discovery of polio vaccine
SCHLENK, WILHELM	CHEM	discovery of stable organic radicals
SHECHTMAN, DAN	PHYS	discovery of quasicrystals
SOMMERFELD, ARNOLD	PHYS	contributions to atomic structure
SZILARD, LEO	PHYS	contributions to nuclear physics (fission, chain reaction)
TELLER, EDWARD	PHYS	contributions to theoretical physics
THOMAS, L.H.	PHYS	discovery of relativistic effect necessary to explain observed fine structure with respect to concept of spin
TSWETT, MIKHAIL	CHEM	discovery of chromatographic separation
UHLENBECK, G.E.	PHYS	concept of electron spin to explain atomic fine structure
WINSTEIN, SAUL*	CHEM	contributions to mechanistic chemistry
WESTHEIMER, FRANK	CHEM	contributions to mechanistic chemistry

*Personal communication from Dr. Joel S. Leventhal, Emeritus Scientist, U.S. Geological Survey, November 28, 2005.

Missing scientists from recognized Nobel Prizes

NOBEL PRIZE	WINNERS	MISSING SCIENTISTS
1901 MED	VON BEHRING, EMIL	KITASATO, SHIBASABURO
1914 PHYS	VON LAUE, MAX	EWALD, PAUL
1914 PHYS	VON LAUE, MAX	FRIEDRICH, WALTER
1914 PHYS	VON LAUE, MAX	KNIPPING, PAUL
1923 MED	BANTING, FREDRICK	BEST, CHARLES
1927 MED	FIBIGER, JOHANNES	YAMAGIWA, KATSUSABURO
1930 PHYS	RAMAN, C.V.	MANDELSTAM, L.I.
1930 PHYS	RAMAN, C.V.	KRISHNAN, K.S.
1930PHYS	RAMAN, C.V.	LANDSBERG, G.S.
1931 MED	WARBURG, OTTO; LIPMANN, FRITZ A.	ENGELHARDT, VLADIMIR A.
1944 CHEM	HAHN, OTTO	MEITNER, LISE
1944 CHEM	HAHN, OTTO	STRASSMANN, FRITZ
1944 CHEM	HAHN, OTTO	FRITSCH, OTTO
1951 CHEM	SEABORG, GLENN MCMILLAN, EDWIN M.	KENNEDY, JOSEPH; ABELSON, P.*
1952 MED	WAKSMAN, SELMAN A.	SCHATZ, ALBERT I.
1954 CHEM	PAULING, LINUS	ASTBURY, WILLIAM T. LEWIS, GILBERT N.
1957 PHYS	YANG, CHEN N.; LEE, TSUNG-DAO	WU, CHIEN-SHIUNG
1959 PHYS	SEGRE, EMILE; CHAMBERLAIN, OWEN	WIEGAND, CLYDE
1959 PHYS	SEGRE, EMILE; CHAMBERLAIN, OWEN	YPSILANTIS, THOMAS J.
1960 CHEM	LIBBY, WILLARD	ANDERSON, ERNEST C. ARNOLD, JAMES*
1961 CHEM	CALVIN MELVIN	RUBEN, SAMUEL* KAMEN, MARTIN*
1962 MED	WATSON, JAMES; CRICK, FRANCIS;	FRANKLIN, ROSALIND

	WILKINS, MAURICE	
1962 MED	WATSON, JAMES; CRICK, FRANCIS; WILKINS, MAURICE	CHARGAFF, EUGENE
1969 CHEM	BARTON, DEREK; HASSEL, O.	PITZER, KENNETH S.
1969 PHYS	GELL-MANN, MURRAY	NE'EMANN, YUVAL
1973 CHEM	WILKINSON, GEOFFREY	WOODWARD, ROBERT B.
1974 PHYS	HEWISH, ANTONY	BELL, JOCELYN
1977 MED	YALOW, ROSALYN	BERSON, SOLOMON
1980 CHEM	GILBERT, WALTER	SVERDLOV, EUGENE
1981 PHYS	SCHAWLOW, ARTHUR L.; TOWNES, CHARLES H.	GOULD, GORDON
1982 PHYS	WILSON, KENNETH G.	KADANOFF, LEO
1982 PHYS	WILSON, KENNETH G.	FISHER, MICHAEL
1985 CHEM	KARLE, JEROME; HAUPTMAN, HERBERT A.	KARLE, ISABELLA
1986 MED	LEVI-MONTALCINI, RITA	HAMBURGER, VIKTOR
1995 CHEM	CRUTZEN, PAUL	JOHNSTON, HAROLD S.
1996 CHEM	KROTO, HARRY; SMALLEY, RICHARD; CURL, ROBERT	HUFFMAN, DONALD
1996 CHEM	KROTO, HARRY; SMALLEY, RICHARD; CURL, ROBERT	KRAETSCHMER, WOLFGANG
1997 MED	PRUSINER, STANLEY	WEISSMANN, CHARLES
1998 MED	FURCHGOTT, ROBERT F.; IGNARRO, LOUIS J.; MURAD, FERID	MONCADA, SALVADOR
2001 CHEM	NOYORI, R.; KNOWLES, W.S.; SHARPLESS, K.B.	KAGAN, HENRI

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Those missing scientists from recognized or unrecognized Nobel Prizes who received Wolf Prizes

SCIENTIST	**WOLF PRIZE**

Pimentel, George	Chemistry, 1982
Kagan, Henri	Chemistry, 2001
Wu, Chien-Shiung	Physics, 1978
Uhlenbeck, George	Physics, 1979
Fisher, Michael Ellis	Physics, 1980
Kadanoff, Leo P.	Physics, 1980
Dyson, Freeman J.	Physics, 1981
Shechtman, Dan	Physics, 1999
Hornykiewicz, Oleh	Medicine, 1979
McCarty, Maclyn	Medicine, 1990

Compilation of non-Nobel Laureate scientists cited in Hargittai's book

NAME OF SCIENTIST	SCIENCE	DATES	BORN	PHD	PHD	PHD ADVISOR	POST-DOC	POST-DOC ADVISOR
	TYPE			YEAR	LOCATION		LOCATION	
AHLQUIST, RAYMOND PERRY	pharmacologist	1914 -	Missoula, Montana, USA	1940	WASHINGTON	DILLE, JAMES M.		
AMALDI, EDOARDO	physicist	1908 -	Carpaneto, Italy	1929	ROME	SEGRE, EMILIO		
ANDERSON, ERNEST CARL	physicist	1920 -	Rock Island, Illinois, USA	1949	CHICAGO	LIBBY, WILLARD	COPENHAGEN	
ASTBURY, WILLIAM THOMAS	x-ray crystallographer	1889 - 1961	London, England	1919	CAMBRIDGE	HUTCHINSON, A.	ROY. INST. GR. BRITAIN	BRAGG, SIR WILLIAM HENRY
AVERY, OSTWALD THEODORE	medicine	1877 - 1955	Halifax, Canada	1904	COLUMBIA (MD)			
BANGA, ILONA	chemist	1906 -	Hodmezovasarhely, Hungary	1929	SZEGED		VIENNA; BUDAPEST	SZENT-GYORGI, ALBERT
BARANY, ANDERS	physicist				UPPSALA			
BARTLETT, NEIL	chemist	1932 -	Newcastle, England	1957	DURHAM	ROBINSON, PERRY L.		
BASTIANSEN, OTTO	chemist	1918 - 1995	Norway		OSLO	HASSEL, OTTO		
BELL-BURNELL, S. JOCELYN	physicist	1943 -	Belfast, Northern Ireland	1968	CAMBRIDGE	HEWISH, ANTONY		
BERGMANN, MAX	chemist	1886 - 1944	Fuerth, Germany	1911	BERLIN	BLOCH, IGNAZ	BERLIN	FISCHER, EMIL

BERSON, SOLOMON AARON	medicine	1918 - 1972	NYC, NY, USA	1945	NYU (MD)			
BERSTROEM, INGMAR	physicist		Sweden					
BONHOEFFER, KARL FRIEDRICH	physicist	1899 - 1957	Breslau, Prussia	1922	BERLIN	NERNST, WALTER; HABER, FRITZ	KW0-BERLIN	HARTECK, PAUL
BONNER, JAMES F.	biologist	1910 - 1996	Ansley, Nebraska, USA	1934	CAL TECH	DOLK, HERMAN E.; THIMANN, KENNETH V.	UTRECHT; ZURICH	KRUYT; WENT, F.A.F.C.; FREY-WYSSLING, A.
BRADLEY, DAN FORDHAM	biochemist	1929 -	Toledo, Ohio, USA	1953	UC BERKELEY	CALVIN, MELVIN		
BURN, HAROLD	biologist							
CHARGAFF, ERWIN	chemist	1905 -	Chernovtsy, Ukraine	1928	VIENNA	FEIGL, FRITZ	YALE; BERLIN; INST. PASTEUR	
CHEKHOV, ANTON PAVLOVICH	medicine	1860 - 1904	Taganrog, Russia	1884	MOSCOW (MD)			
CHIBNALL, ALBERT C.	biochemist	1894 - 1988	London, England	1922	IMP. COLL.	BLACKMAN, F.F.; SCHRYVER, S.B.	YALE	MENDEL, L.B.
DARWIN, CHARLES GALTON	physicist	1897 - 1962	Cambridge, England	1910	MANCHESTER	RUTHERFORD, ERNEST	CAMBRIDGE	FOWLER, R.H.
DE KRUIF, PAUL	bacteriologist	1890 -	Zeeland, Michigan, USA	1916	MICHIGAN	NOVY, FREDERICK G.	ROCKEFELLER	NORTHROP, JOHN
DHAR, N.R.	chemist	1892 -	Jessore, Bengal, E. Pakistan	1917, 1919	LONDON; SORBONNE	URBAIN, GEORGES		
DUBOS, RENE JULES	bacteriologist	1901 - 1982	Saint-Brice, France	1927	RUTGERS		ROCKEFELLER	
DYSON, FREEMAN JOHN	physicist	1923 -	Crowthorne, England	1945			CORNELL; PRINCETON	BETHE, HANS A.
EDSALL, JOHN TILESTON	medicine	1902 -	Philadelphia, USA	1928	HARVARD (MD)			
EKSPONG, GOSTA	physicist							
ELGUERO, JOSE								
ENGELHARDT, VLADIMIR A.	biochemist	1894 - 1984	Moscow, Russia	1919	MOSCOW (MD)			
EPP, OTTO	biochemist							
ERNSTER, LARS	Biochemist 1920 - 1998		Hungary					
EWALD, PAUL P.	physicist	1888 - 1985	Berlin, Germany	1912	MUNICH	SOMMERFELD, ARNOLD	GOETTINGEN	HILBERT, DAVID
FISHER, MICHAEL	physicist	1931 -	Fyzabad, Trinidad	1957	LONDON	DOMB, CYRIL		

ELLIS								
FRAHM, JENS	physicist			1977	GOETTINGEN			
FRANCIS, THOMAS JR.	medicine	1900 -	Gas City, Indiana, USA	1925	YALE (MD)		ROCKEFELLER	
FRANK, NATHANIEL HERMAN	physicist	1903 -	Boston, Mass., USA	1926	MIT	GOODWIN, H.M.		
FREDGA, ARNE	chemist	1902 -	Uppsala, Sweden	1935	UPPSALA	RAMBERG, LUDWIG		
FRIEDRICH, WALTER	physicist	1883 -	Salbke, Germany	1911	MUNICH	ROENTGEN, WILHELM C.		
FRISCH, OTTO ROBERT	physicist	1904 -	Vienna, Austria	1926	VIENNA	PRZIBRAM, KARL		
FRUTON, JOSEPH STEWART	biochemist	1912 -	Czestochowa, Poland	1935	COLUMBIA	CLARKE, HANS T.	ROCKEFELLER	BERGMANN, MAX
FULLER, MICHAEL	lab steward		England					
FURKA, ARPAD	chemist	1931 -	Kristyor, Romania	1959	SZEGED	FODOR, GABOR	ALBERTA	SMILLIE, L.B.
GARFIELD, EUGENE ELI	chemist	1925 -	NYC, NY, USA	1961	PENNSYLVANIA			
GOLDHABER, MAURICE	physicist	1911 -	Lemberg, Austria	1936	CAMBRIDGE	CHADWICK, JAMES		
GOULD, GORDON	physicist	1920 -	NYC, NY, USA	1952	COLUMBIA (MSC)			
GREENSPAN, NANCY								
GRIFFITH, JOHN S.	mathematician		England					
GROWE, G.R.	physicist		England			RUTHERFORD, ERNEST		
HAMBURGER, VIKTOR	zoologist	1900 -	Landeshut, Germany	1925	FREIBURG		KWI-BERLIN; CHICAGO	
HARGITTAI, ISTVAN	chemist	1941 -	Hungary	1972	EOTVOS			
HEPPEL, LEON ALMA	biochemist	1912 -	Granger, Utah, USA	1938	UC BERKELEY			
HERRING, CONYERS	physicist	1914 -	Scotia, NY, USA	1937	PRINCETON	WIGNER, EUGENE	MIT	
HETTNER, GERHARD	physicist	1892 - 1968	Berlin, Germany	1918	BERLIN	RUBENS, HANS		
HILLMANN, GUENTHER	biochemist	1919 - 1975	Ludwigslust, Germany	1947	BERLIN	BUTENANDT, A.		
HORECKER,	biochemist	1914 -	Chicago, Illinois,	1940	CHICAGO	HOGRESS, THORTIN R.		

BERNARD LEONARD			USA					
HORNYKIEWICZ, OLEH	medicine	1926 -	Sykhiv, Ukraine	1951	VIENNA (MD)			
HUFFMAN, DONALD RAY	physicist	1935 -	Fort Worth, Texas, USA	1966	UC RIVERSIDE	WILD, ROBERT L.	FRANKFURT	
HYLLERAAS, EGIL ANDERSEN	physicist	1898 - 1965	Engerdal, Norway	1924	OSLO	VEGARD, LARS	GOETTINGEN	
IMANISHI-KARI, THEREZA	immunologist							
JOHNSTON, HAROLD SLEDGE	chemist	1920 -	Woodstock, Georgia, USA	1948	CAL TECH			
KADANOFF, LEO PHILIP	physicist	1937 -	NYC, NY, USA	1960	HARVARD	MARTIN, PAUL C.		
KALCKAR, HERMAN MORITZ	biochemist	1908 - 1991	Copenhagen, Denmark	1933	COPENHAGEN	LUNDSGAARD, EJNAR; LIPMANN, FRITZ	CAL TECH; WASHINGTON (ST. LOUIS)	PAULING, L.; CORI, G., CORI, C.
KAMEN, MARTIN DAVID	physicist	1913 -	Toronto, Canada	1937	CHICAGO	HARKINS, WILLIAM D.	UC BERKELEY	MCMILLAN, EDWIN
KARMAN, THEODORE VON	aerospace	1881 - 1963	Budapest, Hungary	1908	GOETTINGEN	PRANDTL, LUDWIG		
KATO, GENICHI	medicine	1890 - 1979	Japan					
KEILIN, DAVID	biochemist	1887 - 1963	Moscow, Russia	1914	SORBONNE	CAULLERY, MAURICE		
KITASATO, SHIBASABURO	medicine	1856 - 1931	Kumamoto, Japan	1883	TOKYO (MD)		GERMANY	KOCH, ROBERT
KLEIN, OSKAR BENJAMIN	physicist	1894 -	Moerby, Sweden	1921	STOCKHOLM			
KNIPPING, C.M. PAUL	physicist	1883 - 1935	Neuweid, Germany	1913	MUNICH	ROENTGEN, WILHELM C.		
KRAETSCHMER, WOLFGANG	chemist	1941 -	Germany	1971	MPI-NUCLEAR PHYSICS	GENTNER, WOLFGANG		
KRISHNAN, K.S.	physicist	1898 - 1961	Watrap, Madras, India	1920	CALCUTTA	RAMAN, C.V.		
KUFFLER, STEPHEN W.	biochemist	1913 - 1980	Tap, Hungary	1937	VIENNA (MD)	KATZ, BERNARD (MENTOR)	SYDNEY	ECCLES, JACK C.
LANDSBERG, GRIGORII S.	physicist	1890 - 1957	Vologda, Russia	1915?	MOSCOW	MANDELSTAM, LEONID I.		

LILJESTRAND, GOERAN	medicine	1886 -	Gothenburg, Sweden	1917	STOCKHOLM (MD)			
LIVINGSTON, M. STANLEY	physicist	1905 - 1986	Broadhead, Wisconsin, USA	1931	UC BERKELEY	LAWRENCE, ERNEST O.		
LYSENKO, TROFIM DENISOVICH	geneticist	1898 - 1976	Karlovka, Ukraine	1921	BELAYA TSERKOV SELECTION STN., KIEV			
LYUBIMOVA, MILITZA	biochemist		Russia					
MADDOX, SIR JOHN ROYDEN	physicist	1925 -	England		LONDON		ROCKEFELLER	
MAJORANA, ETTORE	physicist		Italy					
MANDELSTAM, LEONID I.	physicist	1879 - 1944	Mogilev, Russia	1902	STRASBOURG	BRAUN, F.		
MARK, HERMANN FRANZ	chemist	1895 -	Vienna, Austria	1921	VIENNA	SCHLENK, WILHELM	BERLIN	
MARSH, RICHARD EDWARD	chemist	1922 -	Jackson, Michigan, USA	1951	UCLA	PAULING, LINUS	CAL TECH	
MATTHAEI, HEINRICH J.	biochemist		Germany				NIH	NIRENBERG, MARSHALL W.
MIKI, KUNIO	biochemist		Japan					
MILEVA, MARIC	physicist	1875 - 1948	Titel, Yugoslavia		ETH			
MIRSKY, ALFRED EZRA	biochemist	1900 - 1974	Flushing, NY, USA	1926	CAMBRIDGE/ HARVARD	HENDERSON, LAWRENCE J.		
MITTAG-LEFFLER, MANGUS GOSTA	mathematician	1846 - 1927	Stockholm, Sweden	1872	UPPSALA		PARIS; BERLIN	HERMITE, C.; WEIERSTRASS, K.
MONCADA, SALVADOR E.	biochemist	1944 -	Tegucigalpa, Honduras	1973	LONDON	VANE, JOHN R.		
MUELLER-HILL, BENNO	geneticist	1933 -	Germany				HARVARD	GILBERT, WALTER
NE'EMANN, YUVAL	physicist	1925 -	Tel-Aviv, Israel	1961	LONDON		CAL TECH	GELL-MANN, MURRAY
NESMEYANOV, ALEKSANDR N.	chemist	1899 - 1980	Moscow, Russia	1920	MOSCOW STATE			
OLIPHANT, SIR MARCUS L.E.	physicist	1901 - 2000	Adelaide, Australia	1929	CAMBRIDGE	RUTHERFORD, ERNEST		
OPARIN, ALEKSANDR	biochemist	1894 - 1980	Uglic, Russia	1921	MOSCOW		HEIDELBERG	KOSSEL, ALBRECHT

IVANOVICH								
OVCHINNIKOV, YURI ANATOLEVICH	medicine	1934 - 1988	Moscow, Russia	1957	MOSCOW	ARBUZOV, YU. A.		
PAIS, ABRAHAM	physicist	1918 -	Amsterdam, Holland	1941	UTRECHT			
POPPER, ERWIN	medicine				VIENNA	LANDERSTEINER, KARL		
RALL, THEODORE WILLIAM	biochemist	1928 -	Chicago, Illinois, USA	1953	CHICAGO	LEHNINGER, ALBERT	WESTERN RESERVE	
RESETTI,	physicist		Italy					
RUBEN, SAMUEL	physicist	1900 -	Harrison, NJ, USA	1938	UC BERKELEY	MCMILLAN, EDWIN; LIBBY, WILLARD		
RYAN, FRANCIS JOSEPH	zoologist	1916 -	Brooklyn, NY, USA	1941	COLUMBIA	TATUM, E.L.	STANFORD	
SABIN, ALBERT BRUCE	medicine	1906 - 1993	Poland	1931	NYU (MD)			
SALK, JONAS EDWARD	medicine	1914 - 1995	NY City, NY, USA	1939	NYU (MD)			
SCHAEFER, FITZPETER	physicist	1931 -	Bad Hersfeld, Germany	1960	MARBURG			
SCHATZ, ALBERT ISRAEL	medicine	1920 -	Norwich, Connecticut, USA	1945	RUTGERS	WAKSMAN, SELMAN	SLOAN-KETTERING INST.	
SELA, MICHAEL	biochemist	1924 -	Tomaszow, Poland	1954	HEBREW U.		GENEVA; NIH	ANFINSEN, A.B.; HARRINGTON, WILLIAM F.
SHECHTMAN, DAN	physicist			1972	TECHNION		WRIGHT-PATTERSON AFB	
SILLEN, LARS GUNNAR	chemist	1916 -	Sweden					
SONNEBORN, TRACY MORTON	geneticist	1905 - 1981	Baltimore, Maryland, USA	1928	JOHNS HOPKINS	JENNINGS, HERBERT S.		
STENT, GUNTHER SIEGMUND	chemist	1924 -	Berlin, Germany	1948	ILLINOIS	WALL, FREDERICK T.	CAL TECH; COPENHAGEN; PASTEUR INST.	
SVERDLOV, EUGENE D.	medicine		Russia					
TABOR, HERBERT	medicine	1918 -	NYC, NY, USA	1941	HARVARD (MD)			
TRUTER, MARY ROSALEEN (NEE JACKMAN)	x-ray crystallographer		England	1952	LEEDS	COX, ERNEST GORDON		
VAINSHTEIN,	physicist	1921 -	Moscow, Russia	1945	MOSCOW			

BORIS K.		1996						
VON VERSCHWER, OTMAR	medicine	1896 -	Richelsdorfer, Germany	1923	MUNICH (MD)		TUEBINGEN	
WADDINGTON, CONRAD HAL	geneticist	1905 - 1975	Evesham, England	1938	CAMBRIDGE	HALDANE, J.B.S.; NEEDHAM, J.; NEEDHAM, D.M.		
WEBER, KLAUS	biochemist		Germany				HARVARD	WATSON, JAMES
WEIDEL, WOLFHARD	chemist	1916 -	Magdeburg, Germany	1940	BERLIN	BUTENANDT, A.		
WEISSMANN, CHARLES	biochemist					KARRER, PAUL	NYU	OCHOA, SEVERO
WERGELAND, HARALD	physicist							
WHETTEN, ROBERT LLOYD	chemist	1959 -	Mesa, Arizona, USA	1948	CORNELL	GRANT, EDWARD R.		BERNSTEIN, RICHARD
WHITEHEAD, ALFRED NORTH	mathematician	1861 - 1947	Ramsgate, Kent, England	1905	CAMBRIDGE			
WIDMAN, KARL OSKAR	chemist	1852 - 1930	Uppsala, Sweden	1877	UPPSALA			
WIEGAND, CLYDE EDWARD	physicist	1915 -	Long Beach, Wash., USA	1951	UC BERKELEY	CHAMBELAIN, OWEN; SEGRE, EMILE		
WOLLMAN, ELIE L.	biochemist						INST. PASTEUR	JACOB, FRANCOIS
WOOLLEY, DILWORTH WAYNE	biochemist	1914 -	Raymond, Alberta, Canada	1938	WISCONSIN	PETERSON, W.H.	ROCKEFELLER	
WU, CHIEN-SHIUNG	physicist	1913 - 1997	Shanghai, China	1940	UC BERKELEY	SEGRE, EMILE		
YAMAGIWA, KATSUSABURO	medicine	1863 - 1930						
YOST, DONALD MERLIN LEE	chemist	1893 - 1977	Tedrow, Ohio, USA	1926	CAL TECH	NOYES, A.A.	UPPSALA; BERLIN	SIEGBAHN, MANNE; PRINGSHEIM, PETER
YPSILANTIS, THOMAS JOHN	physicist	1928 -	Salt Lake City, Utah, USA	1956	UC BERKELEY	SEGRE, EMILE G.		
ZECHMEISTER, LASZLO	biochemist	1889 - 1972	Gyor, Hungary	1913	ETH	WILLSTATTER, RICHARD	KWI-BERLIN; COPENHAGEN	HEVESY, GEORGE DE

Ingredients for success in science

I have always had the feeling that the most efficient way of restituting the benefits that are generously bestowed upon us by the society is by teaching. But why seek such categorical imperatives? I simply love my job as a teacher, and as we all know, one can give only what one has.

Artistic and intellectual goods differ essentially from material ones: by sharing them, they do not diminish but instead they increase and amplify; on being given to others, they are not lost to their owners, but they flourish.

Synthetic organic chemistry may be compared to architecture, because as in architecture, one first sketches a plan and then one proceeds to assemble complex molecules from a few well-defined building blocks.

Research must be learnt from a master, a professor, or a well-qualified researcher. This is the meaning of a scientific school (or a research school), that is often mentioned without actually knowing how it works. The professor must be allowed to choose his/her disciples for creating such a school. It is a costly error to permit that the graduates' selection towards research or factory jobs be dictated by anonymous irresponsible office holders.

A scientific leaders is at most like a conductor of an orchestra, or even less, like a movie director. Success depends on the talent of the performers or of the actors. The role of the scientific director is to coordinate research, but at the same time the director has to perform research and to read the literature along with the team.

The mediocre persons in research must not outnumber the creative people, and the mediocre persons must not reach leading positions. In the former case, the creative people would be stifled because they work alone whereas mediocrity is quickly gregarious and powerfully efficient against the better ones. In the latter case, creative elements would be eliminated from the outset because a mediocre leader will choose to become surrounded by similar or inferior associates.

-- Costin Nenitzescu in Balaban, A.T.; Banciu, M.D. *The Chemical Intelligencer*, April 1999, 36

<u>Interactions with other people</u>

A decisive influence for a research career is for it to be launched in a strong environment. The adviser counts the most, but the whole atmosphere is important, the other professors and fellow students, the technological level of the institution, the visitors, and so on. The research seminar is probably the single most critical ingredient in shaping the young researcher's career. It broadens his horizon, introduces him to new fields and outside scientists, with different styles and approaches, and teaches him how to conduct scientific discussions. The beginner sees how questions are asked and answered, witnesses the debates, and gradually becomes part of the process. -- I. Hargittai (p. 129)

Avoid dumb people…always turn to people who are brighter than yourself. -- James Watson (p. 130)

From my late teens I understood that bright people hang out with other bright people. -- Carleton Gajdusek (p. 130)

James Black learned the tremendous importance of contacts with colleagues, and how vital it is to normalize one's intellectual activity. -- I. Hargittai (p. 130 - 131)

The importance of being surrounded by bright minds either by design or by luck in a "great" institution:
Cal Tech: C. Gajdusek, Aage Bohr, Jack Dunitz, R. Feynman, B. Mandelbrot, Linus Pauling, Gunther Stent, James Watson, Ellie Wollman, Wolf Weidel

Indiana: James Watson, H.J. Muller, Salvador Luria, Renato Dulbecco, Max Delbruck

Laboratory of Molecular Biology at Cambridge University: Fred Sanger, Max Perutz, John Kendrew, Francis Crick, James Watson, Aaron Klug, Cesar Milstein, G. Kohler, John Walker

Cavendish Laboratory at Cambridge University: Ernest Rutherford was the Director working with Edward Appleton, Francis Aston, Patrick Blackett, James Chadwick, John Cockcroft, Paul Dirac, Pyotr Kapitsa, Nevill Mott, Joseph J. Thomson, Ernest Walton, and Charles Wilson

*UC Berkeley**: Ernest O. Lawrence, Edwin McMillan, Glenn Seaborg, Emilio Segre, Owen Chamberlain, Luis Alvarez, J. Robert Oppenheimer, G.N. Lewis, W. Latimer, W.F. Giauque, W. Libby, K.S. Pitzer, J. Hildebrand

Copenhagen: Niels Bohr, Paul Dirac, Werner Heisenberg, Georg Hevesy, Lev Landau, Nevill Mott, Wolfgang Pauli, Harold Urey, John Wheeler, Ivar Waller

University of Berlin: Albert Einstein, Max Planck, Max von Laue, Walter Nernst, Denis Gabor, Werner Heisenberg, Wolfgang Pauli, Eugene Wigner

University of Munich: Arnold Sommerfeld, Wolfgang Pauli, Werner Heisenberg, Fritz London, Hans A. Bethe, Georg Wentzel, Karl Herzfeld, Walter Heitler

University of Goettingen: Max Born, J. Robert Oppenheimer, Maria Goeppert-Mayer, Viktor Weisskopf, Friedrich Hund, Max Delbrück, Peter Debye, Erich Hückel

Washington University at St. Louis: Carl Cori, Gerti Cori, Viktor Hamburger, Marshall W. Nirenberg, Heinrich Matthaei, Michael Sela, Edwin G. Krebs, Earl W. Sutherland

Rockefeller University: Gerald Edelman, George Palade, Fritz Lipmann, Gunther Blobel, David Baltimore, Henry G. Kunkel, Bruce Merrifield, Max Bergmann, Stanford Moore, William Stein, Sir John Maddox, Daniel Nathans

Harvard University: Paul D. Bartlett, Konrad Bloch, Louis Fieser, George Kistiakowski, Eugene G. Rochow, Frank Westheimer, E. Bright Wilson Jr., Robert B. Woodward, Elias J. Corey

Vienna: Peter Rona, Ernst Chain, Fritz Lipmann, Hans Krebs

Wisconsin: Eugene Wigner, Joshua Lederberg, Har Gobind Khorana, Howard Temin, Michael Smith, John van Vleck, John Bardeen, Peter Debye, Paul Boyer

*University of Chicago**: Arthur Compton, Enrico Fermi, Willard Libby, Maria Goeppert-Mayer, Robert S. Mulliken, Henry Taube, Edward Teller, Harold Urey

*Princeton Institute for Advanced Studies**: Albert Einstein, J. Robert Oppenheimer, Albert Pais

*Los Alamos National Laboratory**: J. Robert Oppenheimer, Hans Bethe, Richard P. Feynman, Edward Teller, George Kistiakowski, Robert R. Wilson

*Personal communication from Dr. Joel S. Leventhal, Emeritus Scientist, U.S. Geological Survey, November 28, 2005.

<u>Mentorship</u>

- Guide student to read important papers in literature
- Influence by example
- Encourage student independence; letting them shine
- Revise student first drafts of papers
- Allow students to write their own papers
- Emulate and imitate writing style of admired mentor

A good research student is like a fire which needs but a match to start it. -- Sir William H. Bragg (p. 155)

Guy Ourisson provided the spark that lighted everything up. -- Jean-Marie Lehn (p. 155)

Had he [Arthur Kornberg] put his name on the paper, as was traditional, he would've received all the credit and I would have been seen as a promising young student in his lab. As it was, right form the very beginning it was my discovery. I always remembered that it was an incredibly important happening because it provided national recognition. -- Paul Boyer (p. 163)

Man's knowledge has become man's knowledge rather than individual knowledge because people can communicate their knowledge and teach each other. -- Eugene Wigner (p. 166)

Most of what he [Michael Polanyi] taught me about physical chemistry I learned…from him. I was a student for six years in the department that he shaped in Manchester. The professor was one of his favourite students, Meredith Evans, and my PhD supervisor was another of this, Ernest Warhurst. What I learned from his students gave me a sense of scientific values -- where the field was going, what were the important questions to tackle, and, to a degree, how to tackle them. Without those things I would have been lost. But it happens that I didn't get them directly from him, but from people who owed a lot to him. -- John C. Polanyi (p. 167)

Examples of mentoring relationships:

Scientist	**Mentoring Scientist(s)**	**Scientist**	**Mentoring Scientist(s)**
Berg, Paul	Kornberg, Arthur	Molina, Mario	Pimentel, George; Rowland, S.
Bernal, John	Bragg, William Henry	Perutz, Max	Bernal, John; Bragg, William Lawrence
Chamberlain, Owen	Lawrence, Ernest O.	Polanyi, John C.	Polanyi, Michael
Cornforth, John W.	Robinson, Robert	Prelog, Vladimir	Robinson, Robert; Ruzicka, Leopold
Delbecco, Renato	Levi, Giuseppe	Rowland, Sherwood	Libby, Willard
Eigen, Manfred	Eucken, A.; Bonhoeffer, F.; Heisenberg, W.	Samuelsson, Bengt	Corey, E.J.; Bloch, K.; Westheimer, F.H.; Woodward, R.B.
Hofmann, Roald	Woodward, R.B.; Gouterman, Martin; Lipscomb, W.	Schawlow, Arthur	Rabi, I.I.
Hubel, David	Kuffler, S.W.	Segre, Emilio	Lawrence, E.O.; Zeeman, P.; Stern, Otto

Klug, Aaron	Franklin, Rosalind; Bernal, John; Pauling, Linus; Fuller, B.	Tonegawa, Susumu	Delbecco, Renato
Kornberg, Arthur	Ochoa, S.	Vane, John	Burn, Harold
Lederberg, Joshua	Ryan, Francis	Watson, James	Pauling, Linus
Lehn, Jean-Marie	Ourisson, Guy	Westheimer, Frank H.	Conant, James B.
Luria, Salvador	Levi, Giuseppe	Whetten, Robert L.	Bernstein, Richard
McMillan, Edwin	Pauling, Linus; Lawrence, E.O.	Wiesel, Torsten	Kuffler, S.W.
Merrifield, Bruce	Dunn, Max; Woolley, D.W.	Zewail, Ahmed	Bernstein, Richard
Milstein, Cesar	Sanger, Frederick		

Doing research

Lars Ernster's concept of **driller** versus **digger**: the driller pursues the same project throughout an entire career and may or may not make an important discovery; the digger changes from topic to topic and in a lucky case may make one or more important discoveries. (p. 61)

Chance favours the prepared mind in scientific discovery. -- Louis Pasteur (p. 67)

Three components in deliberate effort to win Nobel Prize: (1) Do exceptional research; (2) Bring research to scientific marketplace via publications and conference presentations; (3) Longevity -- Donald J. Cram (p. 78)

We have a habit in writing articles published in scientific journals to make the work as finished as possible, to cover all the tracks, to not worry about the blind alleys or to describe how you had the wrong idea first, and so on. -- Richard Feynman (p. 84)

The path of research rarely leads in straightforward fashion from starting point to desired goal…chance occurrences along the way often enforce a change of course…as we come upon various points of interest which invite us to linger awhile. Ours, like all such rambling tours, possesses that special attention that comes from knowing that the landscape spread out before us will be opened to view, not by intention, but by chance and surprise. -- Georg Wittig (p. 84)

Concentrate on problems of central importance, approach them directly, and waste no time on trivialities. -- Sir William Lawrence Bragg (p. 89)

Never attempt a difficult problem, but it is an attribute of genius to see which of the problems are not really difficult. -- Ernest Rutherford (p. 89)

The right problem will be significant when you have solved it and will be solvable with the means at your disposal. So it's not good picking too large a problem or a problem where there are no tools to tackle it. -- Sir Derek Barton (p. 89)

No scientist is admired for failing in the attempt to solve problems that lie beyond his competence. -- Peter Medawar (p. 90)

It's no trick to get the right answer about some scientific question when you have got all the data. A computer can do that. A real trick is to get the right answer when you've only got half the data and half of what you have is wrong, and you don't know which half is wrong. Then when you get the right answer you're doing something creative…That philosophy can lead you also into great troubles, and it frequently does but you can make advances that way because then you won't be bothered too much by the dogma of the day. -- Melvin Calvin (p. 90 - 91)

It is essential in scientific research to make decisions on the basis of incomplete information. -- Istvan Hargittai (p. 90)

Concept of "gap jumping" for connecting remote observations. -- Sir Derek Barton (p. 91)

Research is to see what everybody has seen and think what nobody has thought. -- Albert Szent-Györgyi (p. 92)

Principle of "limited sloppiness": *If you are too sloppy, then you never get reproducible results, and then you never can draw any conclusions. But if you are just a little sloppy, then when you see something startling you….nail it down.* -- Max Delbrück (p. 92)

Research is not just going from mountain top to mountain top, you also have to work in the valleys, and that takes time and freedom. -- Aaron Klug (p. 97)

From [Hans] Fischer I learnt the trade secrets of being a research chemist; I learnt from how to pose a research problem, what one may and what one may not investigate, where to start and where to stop. I learnt the tenacity which must accompany a research work. I learnt that one must have the audacity to attack difficult problems, even when they will take a long time and will require a substantial effort. -- Costin Nenitzescu in Balaban, A.T.; Banciu, M.D *The Chemical Intelligencer*, April 1999, 36.

<u>Encourage cross-fertilization between groups, particularly between different disciplines.</u>

In science you sometimes find the solution to a problem from another field. -- Aaron Klug (p. 172)

There is nothing more rewarding that linking two quite different subjects. -- George Porter (p. 197)

Being an inventor involves knowing all kinds of apparently irrelevant connections about the world. -- Thomas Edison (p. 182)

Donald Cram philosophy: Retaining the fascination with science requires periodic changes in research areas -- these new areas are necessarily risky and the chances of failure is consequently high. (p. 174)

Institutional/Administrative/Funding

Experimental research needs a lot of support and it takes a far-sighted view from the funding agencies to back a scientist when he wants to leave a successful area of investigation for a new and risky one. -- I. Hargittai (p. 173)

It is not easy to get money for a thing which is wild -- where you cannot say this is going to have results. -- Peter Debye (p. 173)

Some additional pointers given by John C. Polanyi to students at an invitational lecture sponsored by the York Chemical Society, York University (February 20, 2002)

How research is done cannot be codified.
On the qualities of a researcher: (a) you need to have a willingness to ask questions -- big questions. Knowing what questions to ask is key. (b) You need to have a willingness to commit yourself to answering them. A distinguishing feature of a "great" university is that it is a place where people dare to answer big questions. (c) One must be able to admit to mistakes and accept the pain of errors -- this is how ideas are reshaped.
John Polanyi used the questions asked by his professors at Manchester as the basis for his own questioning and line of research.
The pursuit of truth is more important than who found it.
A discovery is getting a counter-intuitive result that can't be explained.
Good areas of science are selected on the basis of whether the ideas matter, whether they will change people's thinking rather than if the ideas will generate wealth.
There is a greater chance of making significant discoveries at universities that have an intellectual ferment of people who exchange ideas and who have great skill in generating ideas. One needs to learn the "style" of producing great ideas by apprenticing with such people. Good teachers tell students what to pay attention to, what to accept, what to reject, what to retain, what to discard.

Terms coined by scientists for a discovery or idea:

Actinide elements -- Glenn Seaborg
ATPase -- Vladimir Engelhardt
Black hole -- John Wheeler

Carbocation, carbenium ion, carbonium ion -- George Olah
Crown ethers -- Charles Pedersen
Fast reactions -- Manfred Eigen
Host-guest chemistry, container, cavitands, caviplexes, carcerands -- Donald J. Cram
Macromolecule -- Hermann Staudinger
Magic acid -- George Olah
Molecular biology -- Warren Weaver
Nuclear fission -- Otto Frisch
Prion -- Stanley Prusiner
Quark -- R. Serber and Murray Gell-Mann
Strangeness, eight-fold way -- Murray Gell-Mann
Super acid -- James B. Conant
Supramolecular biology -- Salvador Luria
Ultrastructural biology -- Conrad H. Waddington

Good nomenclature elicits images and aids reasoning by analogy; it is the organic chemists 'best friend'. -- Donald J. Cram (p. 189)

Inspiration for Nobel Laureates at a young age

Books
Paul de Kruif *The Microbe Hunters*, 1926 inspired:

Paul Berg (Chemistry, 1980), Leon Lederman (Physics, 1988), Gertrude Elion (Medicine, 1988), Carleton Gajdusek (Medicine, 1976), Aaron Klug (Chemistry, 1982), Cesar Milstein (Medicine, 1984), and Frederick Robbins (Medicine, 1954).

The writings of Bertrand Russell inspired: Herbert Hauptman (Chemistry, 1985) and Edward Lewis (Medicine, 1995).

Chemistry Sets
William Lipscomb (Chemistry, 1976), Paul Boyer (Chemistry, 1997), Robert Curl (Chemistry, 1996), John Vane (Medicine, 1982), and George Porter (Chemistry, 1967).

Home or private laboratories

Nikolai Semenov (Chemistry 1956), George Olah (Chemistry, 1994), Leon Lederman (Physics, 1988), Jean-Marie Lehn (Chemistry, 1987), Karl Mullis (Chemistry, 1993), Ahmed Zewail (Chemistry, 1999)

Primary and high school teachers
Edward Teller, Arthur Kornberg, Jerome Karle, Paul Berg, Glenn Seaborg, John Cornforth, James Black, Joshua Lederberg, Roald Hoffmann, Leon Lederman, John Vane, John Walker, Jean-Marie Lehn, Eugene Wigner, Denis Gabor, George de Hevesy, George Olah, Albert Szent-Gyorgyi, Michael Polanyi, Leo Szilard

College teachers
Herbert C. Brown (Julius Stieglitz), Sune Bergstrom (Erik Jorpes), Aaron Klug (R.W. James)

Mentoring relatives
Mario Molina -- aunt
John Polanyi -- father Michael Polanyi
Kenneth Wilson -- father E. Bright Wilson Jr.
Carleton Gajdusek -- aunt Irene Dobroczki, a friend of Barbara McClintock
Richard Smalley -- aunt Sara Jane Rhoads; mother
Gertude Elion -- grandfather
Joshua Lederberg -- rabbi
Emilio Segre -- uncles
Owen Chamberlain -- father
Ilya Prigogine -- father; brother
Frederick Sanger -- father; brother

Interesting Tidbits from Hargittai's book:

1. **György de Hevesy** (Chemistry, 1944) dissolved the Nobel medals of Max von Laue (Physics, 1914) and James Franck (Physics, 1926) in aqua regia at the Niels Bohr Institute in Copenhagen during the Nazi occupation of Denmark.
2. **Howard W. Florey** (Medicine, 1945) smeared spores of penicillin mould into the linings of his clothing as a precaution to prevent the Germans from acquiring this product should Oxford be invaded by Nazi forces during World War II.
3. **György de Hevesy's** (Chemistry, 1944) true name is **György Bischitz**. The name Hevesy comes from the region of Hungary called Heves.

4. According to B. Feldman *The Nobel Prize: A History of Genius, Controversy, and Prestige*, Arcade Publishing: New York, 2000 there are a total of 116 Jewish science Nobel Laureates representing about 20% of all science Nobel prizes: 36 in physics, 22 in chemistry, and 39 in physiology and medicine. More information can be found at the website **http://www.science.co.il**
5. Otmar von Verschuer (1896 - ?, MD 1923 Munich) was Josef Mengele's advisor.
6. **Frederick Sanger**, the only double chemistry Nobel Laureate, was not included in the top 75 chemists given in the 75th anniversary issue of *Chem. Eng. News* (**give reference**) commemorating the most influential chemists of the century.
7. The following British Nobel Laureates refused knighthoods: **Frederick Sanger** (Chemistry 1958 and 1980), **Francis Crick** (Medicine, 1962), and **Max Perutz** (Chemistry, 1962).
8. **Sir William Henry Bragg** (Physics, 1915) started doing research at age 42 and **Max Planck** (Physics, 19) came up with quantum theory also at age 42.
9. Nobel Laureates without doctoral degrees: **Francis W. Aston** (Chemistry, 1922), **Charles J. Pedersen** (Chemistry, 1987), **Gertrude Elion** (Medicine, 1988), and **Sir James W. Black** (Medicine, 1988).
10. Leo Szilard patented the idea of nuclear chain reactions:

GB 440,023 (1935-12-12) Artificial radioactive preparations
US 2,161,985 (1939-06-13) Radioactive elements
US 2,708,656 (1955-05-17) Neutronic reactor (with Enrico Fermi)
US 2,796,396 (1957-06-18) Intermittent operation of a neutronic reactor
US 2,807,581 (1957-09-24) Neutronic reactor (with Enrico Fermi)
US 2,832,733 (1958-04-29) Heavy water moderated neutronic reactor
US 2,836,554 (1958-05-27) Air cooled neutronic reactor (with Enrico Fermi)
US 2,798,847 (1957-07-09) Operating a neutronic reactor (with Enrico Fermi)
US 2,825,689 (1958-03-04) Fuel elements for neutronic reactors (with G.J. Young)

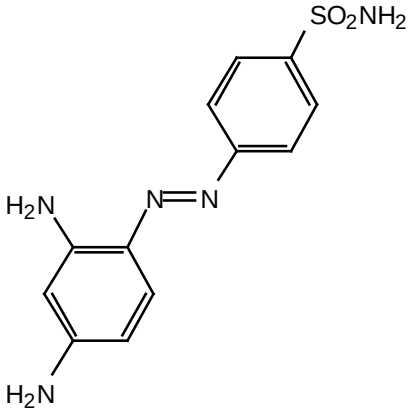
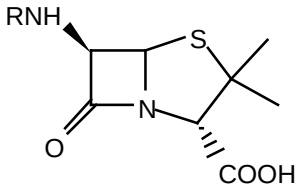
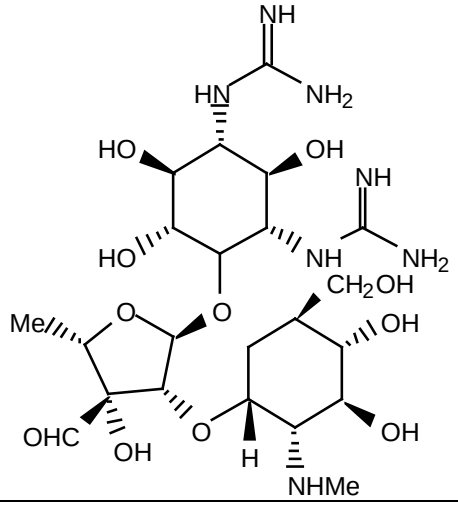
11. Categories of Physiology & Medicine Nobels: (I) Anatomy, Histology, Genetics (II) General Biology, Physiology, Physiological Chemistry, Theory of Drugs (III) Pathology, Pathological Anatomy (IV) Medicine, Surgery, Therapy (V) Bacteriology, Ethology, Hygiene (VI) Immunology. Basic science awards prevail over clinical medicine awards.
12. Industrial and technological Nobel Prizes:

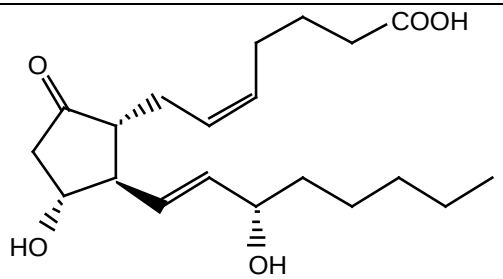
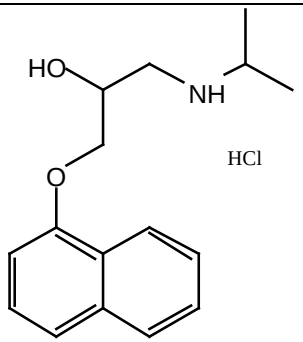
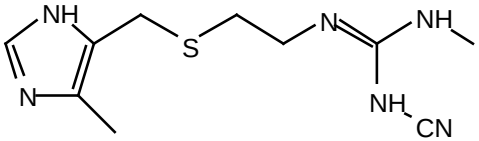
Nobel Prize	Scientists	Citation
Physics, 1909	Guglielmo Marconi, Carl F. Braun	In recognition of their contributions to the development of wireless

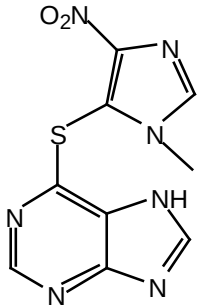
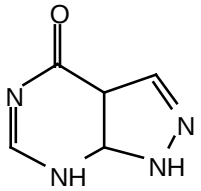
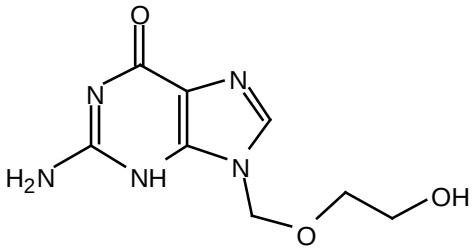
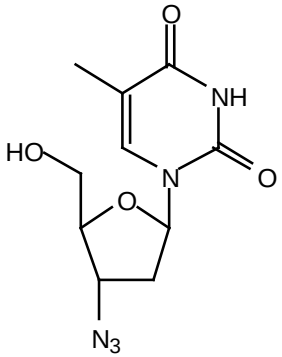
		telegraphy
Physics, 1912	Nils Gustaf Dalen	For his invention of automatic regulators for use in conjunction with gas accumulators for illuminating lighthouses and buoys
Chemistry, 1931	Carl Bosch, Friedrich Bergius	In recognition of their contributions to the invention and development of chemical high pressure methods
Chemistry, 1945	Artturi I. Virtanen	For his research and inventions in agricultural and nutritional chemistry, especially for his fodder preservation method
Chemistry, 1963	Karl Ziegler, Giulio Natta	For their discoveries in the field of the chemistry and technology of high polymers

13. Therapeutic drugs spawned by work of Nobel Laureates:

Nobel Prize	**Drug**	**Chemical Structure**	**Therapy**

Gerhard Domagk (Medicine, 1939)	prontosil		antibacterial
Ernst Chain, Alexander Fleming, Howard Florey (Medicine, 1945)	penicillin		antibiotic
Selman Waksman (Medicine, 1952)	streptomycin		Antibiotic against tuberculosis

Sune Bergström, Bengt Samuelsson, John Vane (Medicine, 1982)	Prostaglandins (prostaglandin E2 shown)		Blood coagulant
Sir James W. Black, Gertrude Elion, George Hitchings (Medicine, 1988)	Propranolol hydrochloride		Beta blocker
	cimetidine		Anti-ulcer
	6-mercaptopurine		Anti-leukemia for children

	azathioprine		immunosuppressive
	allopurinol		Anti-cancer, gout treatment
	acyclovir		Anti-viral
	azidothymidine		Anti-AIDS/HIV

14. Misguided prizes: **Johannes Fibiger** (Medicine, 1927) for spiroptera carcinoma; **Gustaf Dalen** (Physics, 1912) for gas accumulators in lighthouses and buoys, and **Antonio Moniz** (Medicine, 1949) for lobotomy procedure.
15. Intermarriages between Nobel Laureate relatives:

Svante Arrhenius's grandson + George de Hevesy's daughter
Sir Henry Dale's daughter Alison Dale + Lord Alexander Todd
Peyton Rous's daughter Marion Rous + Alan L. Hodgkin
John Northrop's daughter Alice Havemeyer Northrop + Frederick Robbins
Eugene Wigner's sister Margit (Manci) Wigner + Paul Dirac
Charles Townes's sister Aurelia Townes + Arthur Schawlow
Edwin McMillan's wife Elsie Blumer is sister of Ernest O. Lawrence's wife, Mary (Molly) Blumer

16. Women Nobel Laureates:

Marie Curie (Physics, 1903; Chemistry, 1911)
Irene Joliot-Curie (Physics, 1935)
Gerti Cori (Medicine, 1947)
Maria Goeppert-Mayer (Physics, 1963)
Dorothy Hodgkin Crowfoot (Chemistry, 1964)
Rosalyn Yalow (Medicine, 1977)
Barbara McClintock (Medicine, 1983)
Rita Levi-Montalcini (Medicine, 1986)
Gertrude Elion (Medicine, 1988)
Christiane Nüsselein-Volhard (Medicine, 1995)

17. Foreign names for graduate advisors: German -- *Doktorvater* (doctor + father), French -- *Patron*.
18. **Luis Alvarez** (Physics, 1968) invented the first ground control approach for landing planes, the hydrogen bubble chamber, and he initiated the theory that dinosaurs became extinct by comet or meteor hitting the earth.
19. **Eugene Garfield** is the founder and publisher of:

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20. Rejections and/or delays in the publication of scientific papers that later proved to be recognized for Nobel Laureates and other scientists:

Polymerase chain reaction (PCR) method
Mullis, K.; Faloona, F.; Scharf, S.; Saiki, R.; Horn, G; Erlich, H. *Cold Spring Harbor Symp. Quant. Biol.* **1986**, 51, 260

Krebs citric acid cycle
Krebs, H.A., *Biochem. J*. **1935**, 29, 1620; 1951

Belousov-Zhabotinsky oscillating reaction
Belousov, B.P. *Sb. Ref. Radiats. Med. Za 1958 Medgiz, Moscow* **1959**, 1, 145
Zhabotinsky, A.M. *Proc. Acad. Sci. USSR* **1964**, 157, 392
Zhabotinsky, A.M. *Biofizika* **1969**, 9, 306

Ozone depletion in atmosphere
Molina, M.J.; Rowland, F.S. *Nature* **1974**, 249, 810

Discovery of quasicrystals
Shechtman, D.; Blech, I.; Gratias, D.; Cahn, J.W. *Phys. Rev. Lett.* **1984**, 53, 1951

Discovery of insulin binding antibodies in insulin treated patients
Berson, S.A.; Yalow, R.S.; Bauman, A.; Rothschild, M.A.; Newerby, K. *J. Clin. Invest.* **1956**, 35, 170

Crystallization of photosynthetic center in *Rhodopseudomonas viridis* bacteria
Michel, M. *J. Mol. Biol.* **1982**, 158, 567

Deisenhofer, J.; Epp, O.; Miki, K.; Huber, R.; Michel, H. *Nature* **1985**, 318, 618

Energy coupling in oxidative phosphorylation
Boyer, P.D.; Cross, R.L.; Momsen, W. *Proc. Natl. Acad. Sci.* **1973**, 70, 2837

Discovery of nerve growth factor
Angeletti, P.U.; Liuzzi, A.; Levi-Montalcini, R. *Biochim. Biophys. Acta* **1964**, 90, 445

Proposal of chemical laser
Polanyi, J.C. *J. Chem. Phys.* **1961**, 34, 347

21. The most cited paper of all time (greater than 250,000 citations: Lowry, O.H.; Rosebrough, N.J.; Farr, A.L.; Randall, R.J. *J. Biol. Chem.* **1951**, 193, 265 "Protein measurement with the folin phenol reagent"
22. The most cited British scientist is Salvador E. Moncado for work on nitric oxide as a signalling molecule in cardiovascular systems. He is the Director of the Wolfson Institute for Biomedical Research at UC London.
23. Cited benefits of winning Nobel prize:

- A personal parking spot on campus (applies to Nobel Laureates at an American university)
- Knighthoods
- Attendance at triennial meetings for Nobel Laureates in Lindau, Germany
- Free seats in theatres
- High political profile
- Opening all doors to meet anyone of importance
- Widens circle of friends and contacts
- Elections to prestigious societies as the Royal Society of London
- Giving invited lectures and addresses
- Invitations to be on committees and advisory boards (of journals, companies, etc.)
- Prizes are launched in the name of the Nobel Laureate: Merrifield Prize in New Jersey high school where Merrifield was educated; John C. Polanyi Prize in Ontario, Canada
- Meeting the President of the United States (applies to American Nobel Laureates)
- Foundations are launched in the name of the Nobel Laureate

- New university labs are built for or in the name of the Nobel Laureate, e.g., Center for Nanoscale Science and Technology at Rice University after Richard Smalley and Robert Curl (Chemistry, 1996)

24. Nobel Laureates whose prize further fuelled their continued scientific pursuits:

Sir Derek H. Barton	Chemistry, 1969
Sir James W. Black	Medicine, 1988
Herbert C. Brown	Chemistry, 1979
Melvin Calvin	Chemistry, 1961
Owen Chamberlain	Physics, 1959
Donald Cram	Chemistry, 1987
Robert Curl	Chemistry, 1996
Manfred Eigen	Chemistry, 1967
Kenichi Fukui	Chemistry, 1981
Robert Furchgott	Medicine, 1998
Aaron Klug	Chemistry, 1982
Arthur Kornberg	Medicine, 1959
Cesar Milstein	Medicine, 1984
Rita Levi-Montalcini	Medicine, 1986
Rudolf Mossbauer	Physics, 1961
Marshall Nirenberg	Medicine, 1968
Charles Pedersen	Chemistry, 1987
Max Perutz	Chemistry, 1962
Vladimir Prelog	Chemistry, 1975
Frederick Sanger	Chemistry, 1958 and 1980
Melvin Schwartz	Physics, 1988
Albert Szent-Gyorgyi	Medicine, 1937

25. Nobel Laureates whose prize lead to public service:

Richard Ernst (Chemistry, 1991) -- science policy
Rolf Zinkernagel (Medicine, 1996) -- demonstrations in support of genetic technology
Jean-Marie Lehn (Chemistry, 1987) -- responsibility of science to society

Aaron Klug (Chemistry, 1982) -- president of Royal Society; science policy statements
Sherwood Rowland and **Paul Crutzen** (Chemistry, 1995) -- environmental protection
James Watson (Medicine, 1962) -- Human Genome Project
Paul Berg (Chemistry, 1980) -- director of Beckman Center at Stanford
Glenn Seaborg (Chemistry, 1951) -- national science and energy policies for U.S. government
John Polanyi (Chemistry, 1986) -- Pugwash movement; anti-war movement; responsibility of science to society
Roald Hoffmann (Chemistry, 1981) -- playright; popularizing science in books for lay readers
Sir George Porter (Chemistry, 1967) -- president of Royal Society; Royal Institution of Great Britain science public lectures

26. Nobel Laureates whose prize lead to administrative positions:

Joshua Lederberg (Medicine, 1958) -- President of Rockefeller University
David Baltimore (Medicine, 1975) -- President of Rockefeller University, President of Cal Tech
Harold E. Varmus (Medicine, 1989) -- President of National Institutes of Health (1993 - 1999), President of Memorial Sloan-Kettering Cancer Center (2000 -)
Thomas Cech (Chemistry, 1989) -- President of Howard Hughes Medical Institute (2000 -)
Sune Bergström (Medicine, 1982) -- President of Royal Swedish Academy of Sciences
Bengt Samuelsson (Medicine, 1982) -- Director of Nobel Foundation
Leon Lederman (Physics, 1988) -- Director of FermiLab; President of American Association for the Advancement of Science
Kenneth Wilson (Physics, 1982) -- National Science Foundation supercomputing; Ohio State University physics education reform