

CHEMICAL HERITAGE FOUNDATION

RICHARD W. CARTHEW

The Pew Scholars Program in the Biomedical Sciences

Transcript of an Interview
Conducted by

Helene L. Cohen

at

University of Pittsburgh
Pittsburgh, Pennsylvania

on

2, 3, and 5 July 2001

From the Original Collection of the University of California, Los Angeles

ACKNOWLEDGEMENT

This oral history is part of a series supported by a grant from the Pew Charitable Trusts based on the Pew Scholars Program in the Biomedical Sciences. This collection is an important resource for the history of biomedicine, recording the life and careers of young, distinguished biomedical scientists and of Pew Biomedical Scholar Advisory Committee members.

This oral history was completed under the auspices of the Oral History Project, University of California, Los Angeles (Copyright © 2002, The Regents of the University of California) and is made possible through the generosity of



**From the original collection at the Center for
Oral History Research, UCLA Library, UCLA.**

The following oral history, originally processed at the UCLA Center for Oral History Research, has been reformatted by the Chemical Heritage Foundation. The process involved reformatting the front matter, adding a new abstract, replacing the table of contents, and replacing the index. The paragraph spacing and font of the body of the transcript were altered to conform to the standards of the Oral History Program at the Chemical Heritage Foundation. The text of the oral history remains unaltered; any inadvertent spelling or factual errors in the original manuscript have not been modified. The reformatted version and digital copies of the interview recordings are housed at the Othmer Library, Chemical Heritage Foundation. The original version and research materials remain at the Darling Library, University of California, Los Angeles and at the Bancroft Library, University of California, Berkeley.

REFORMATTING:

David J. Caruso, Program Manager, Oral History, Chemical Heritage Foundation. B.A., History of Science, Medicine, and Technology, Johns Hopkins University; PhD., Science and Technology Studies, Cornell University.

UNIVERSITY OF CALIFORNIA, LOS ANGELES

Oral History Interview Agreement No. _____

This Interview Agreement is made and entered into this _____ day of _____, 2001 by and between THE REGENTS OF THE UNIVERSITY OF CALIFORNIA, a California corporation, on behalf of the Oral History Program at the UCLA campus, hereinafter called "University," and RICHARD W. CARTHEW, having an address at Department of Biological Sciences, University of Pittsburgh, Fifth and Ruskin Avenues, Pittsburgh, Pennsylvania 15260, hereinafter called "Interviewee."

Interviewee agrees to participate in a series of University-conducted tape-recorded interviews, commencing on or about July 2, 2001, and tentatively entitled, "Interview with Richard W. Carthew". This Agreement relates to any and all materials originating from the interviews, namely the tape recordings of the interviews and a written manuscript prepared from the tapes, hereinafter collectively called "the Work."

In consideration of the mutual covenants, conditions, and terms set forth below, the parties hereto hereby agree as follows:

1. Interviewee irrevocably assigns to University all his copyright, title and interest in and to the Work. This assignment applies to University, its successors, and assigns, for and during the existence of the copyright and all renewals and extensions thereof.
2. By virtue of this assignment, University will have the right to use the Work for any research, educational, or other purpose, including electronic reproduction, that University may deem appropriate.
3. Interviewee acknowledges that he will receive no remuneration or compensation for his participation in the interviews or for the rights assigned hereunder.
4. Interviewee will receive from University, free of charge, one bound copy of the typewritten manuscript of the interviews.
5. To insure against substantive error or misquotation, Interviewee will have the right to review the manuscript before it is put into final form. University therefore will send Interviewee a copy of the edited transcript for review and comment. Interviewee will return transcript and comments to University within 30 days of receipt of the transcript. In the event that Interviewee does not respond within 30 days, University will assume that Interviewee has given full approval of the transcript.

All notices and other official correspondence concerning this Agreement will be sent to the following:

If to University: Department of Special Collections
University of California, Los Angeles
Box 951575
Los Angeles, California 90095-1575


Attention: Victoria Steele, Ph.D.


If to Interviewee: Richard W. Carthew
Department of Biological Sciences
University of Pittsburgh
Fifth and Ruskin Avenues
Pittsburgh, Pennsylvania 15260

University and Interviewee have executed this Agreement on the date first written above.

INTERVIEWEE

THE REGENTS OF THE UNIVERSITY
OF CALIFORNIA


(Signature)


(Signature)

Richard W. Carthew
(Typed Name)

Victoria Steele
(Typed Name)

University of Pittsburgh
(Address)

Head, Department of Special
Collections
(Title)

Fifth and Ruskin Avenues

Pittsburgh, PA 15260

Date July 2, 01

Date 8/20/01

This interview has been designated as **Free Access**.

One may view, quote from, cite, or reproduce the oral history with the permission of CHF.

Please note: Users citing this interview for purposes of publication are obliged under the terms of the Chemical Heritage Foundation Oral History Program to credit CHF using the format below:

Richard W. Carthew, interview by Helene L. Cohen at the University of Pittsburgh, Pittsburgh, Pennsylvania, 2-3 and 5 July 2001 (Philadelphia: Chemical Heritage Foundation, Oral History Transcript # 0627).



Chemical Heritage Foundation
Oral History Program
315 Chestnut Street
Philadelphia, Pennsylvania 19106



The Chemical Heritage Foundation (CHF) serves the community of the chemical and molecular sciences, and the wider public, by treasuring the past, educating the present, and inspiring the future. CHF maintains a world-class collection of materials that document the history and heritage of the chemical and molecular sciences, technologies, and industries; encourages research in CHF collections; and carries out a program of outreach and interpretation in order to advance an understanding of the role of the chemical and molecular sciences, technologies, and industries in shaping society.

RICHARD W. CARTHEW

1956 Born in Toronto, Canada, on 5 September

Education

1978 B.Sc., Biology, Queens University
1980 M.Sc., Botany, University of Toronto
1987 Ph.D., Biology, Massachusetts Institute of Technology

Professional Experience

1980-1982 University of Toronto
Research Technician, Banting and Best Department of
Medical Research

1987-1992 University of California, Berkeley
Postdoctoral Fellow, Department of Molecular and
Cell Biology

1992-1998 University of Pittsburgh
Assistant Professor, Department of Biological Sciences
1998-2001 Associate Professor, Department of Biological Sciences
2001 Professor, Department of Biological Sciences

1995-1999 Chiron Corporation
Scientific Consultant

2001-present Northwestern University
Professor, Department of Biochemistry, Molecular
Biology, and Cell Biology

Honors

1990-1992 Howard Hughes Postdoctoral Fellowship
1995-2000 Pew Scholar in the Biomedical Sciences
1997 Chancellor's Distinguished Research Award, University of
Pittsburgh

Selected Publications

- Carthew, R.W., 1980. The thermodynamics of photosynthetic adaptation to photon fluence rate in the cyanophyte. *Oscillatoria limnetica*. *Photosynthetica* 14:204-12.
- Sopta, M., R.W. Carthew, and J. Greenblatt, 1985. Isolation of three proteins that bind to RNA polymerase II. *Journal of Biological Chemistry* 260:10353-360.
- Carthew, R.W., L.A. Chodosh, and P.A. Sharp, 1985. An RNA polymerase II transcription factor binds to an upstream element in the adenovirus major late promoter. *Cell* 43:439- 48.
- Chodosh, L.A. et al., 1987. The adenovirus major late transcription factor activates the rat gamma-fibrinogen promoter. *Science* 238:101-04.
- Carthew, R.W. and G.M. Rubin, 1990. Seven in absentia, a gene required for specification of R7 cell fate in the *Drosophila* eye. *Cell* 63:561-77.
- Hariharan, I.K., R.W. Carthew, and G.M. Rubin, 1991. The *Drosophila* Roughened mutation: activation of a rap homolog disrupts eye development and interferes with cell determination. *Cell* 67:717-22.
- Kauffmann, R.C. et al., 1995. Activated *Drosophila Ras* is selectively suppressed by isoprenyltransferase inhibitors. *Proceedings of the National Academy of Sciences, USA* 92:10919-923.
- Li, S. et al., 1997. Photoreceptor cell differentiation requires regulated proteolysis of the transcriptional repressor Tramtrack. *Cell* 90:469-78.
- Kennerdell J. and R.W. Carthew, 1998. Use of dsRNA-mediated genetic interference to demonstrate that *frizzled* and *frizzled2* act in the Wingless pathway. *Cell* 95:1017-26.
- Kennerdell J. and R.W. Carthew. 2000. Heritable gene silencing in *Drosophila* using double-stranded RNA. *Nature Biotechnology* 18:896-98.
- Xu, C. et al., 2001. Overlapping activators and repressors delimit transcriptional response to receptor tyrosine kinase signals in the *Drosophila* eye. *Cell* (in press).

ABSTRACT

Richard W. Carthew was born and raised in Toronto, Canada, the second youngest, and only son, of four siblings. His father received a degree in civil engineering from Queen's University and worked for the province-run hydro-electric utility, Ontario Hydro; his mother was a homemaker. From an early age he was interested in exploring the great outdoors—studying insects, climbing trees, and the like—he played piano, and tobogganed. He excelled in school until junior high and high school when he found the subjects uninteresting, though he regained his interest during his senior year, especially due to classes in science (chemistry and biology) and mathematics.

Carthew entered Queen's University in Kingston, Ontario, Canada with an interest in ecology; he had the opportunity to work for Seward R. Brown, an ecological paleontologist. Though he was hoping to be in the field for his senior thesis work, most of the research on which Brown wanted Carthew to work was laboratory based, serving to further his interest in science and resulting in a publication on the thermodynamics of photosynthetic adaptation to photon fluence rate in the cyanophyte. After completing his undergraduate degree he went on to study at the Royal Conservatory of Music while also pursuing a master's in botany at the University of Toronto. Then he became a research technician in Jack F. Greenblatt's laboratory at the Banting and Best Department of Medical Research at the university and contributed to work isolating three proteins that bind to RNA polymerase II; Greenblatt encouraged him to apply to graduate school. He chose to attend the Massachusetts Institute of Technology and selected to study in Phillip A. Sharp's laboratory, working on transcription regulation (also researching with and training Stephen Buratowski, Pew Class of 1995). While in Sharp's lab, though, Carthew began to develop an interest in neurobiology, deciding, then, to pursue a postdoctoral fellowship with Gerald M. Rubin at the University of California, Berkeley. From there he accepted a faculty position at the University of Pittsburgh, where he studied the *ras* oncogene; his work on *ras* led to consulting work for the Chiron Corporation.

The interview ends with Carthew's thoughts on the Pew Scholars Program in the Biomedical Sciences; race and gender issues in science; combining the teaching of the history of science with methodological and technical approaches; using kits in the lab; his love of sailing; and the ways in which fatherhood has changed his views about his career. The interview concludes with a discussion of his current research on RNAi and *frizzled*; the application of his work to Alzheimer's disease; patents; competition and collaboration; ethics, laboratory practice, and laboratory research; and his pending move to Northwestern University.

UCLA INTERVIEW HISTORY

INTERVIEWER:

Helene L. Cohen, Interviewer, UCLA Oral History Program. B.S., Nursing, UCLA; P.N.P., University of California, San Diego/UCLA; M.A., Theater, San Diego State University.

TIME AND SETTING OF INTERVIEW:

Place: Carthew's office, University of Pittsburgh.

Dates, length of sessions: July 2, 2001 (115 minutes); July 3, 2011 (149); July 5, 2001 (176).

Total number of recorded hours: 7.3

Persons present during interview: Carthew and Cohen.

CONDUCT OF INTERVIEW:

This interview is one in a series with Pew Scholars in the Biomedical Sciences conducted by the UCLA Oral History Program in conjunction with the Pew Charitable Trusts's Pew Scholars in the Biomedical Sciences Oral History and Archives Project. The project has been designed to document the backgrounds, education, and research of biomedical scientists awarded four-year Pew scholarships since 1988.

To provide an overall framework for project interviews, the director of the UCLA Oral History Program and three UCLA faculty project consultants developed a topic outline. In preparing for this interview, Cohen held a telephone preinterview conversation with Carthew to obtain written background information (curriculum vitae, copies of published articles, etc.) and agree on an interviewing schedule. She also reviewed prior Pew scholars' interviews and the documentation in Carthew's file at the Pew Scholars Program office in San Francisco, including his/her proposal application, letters of recommendation, and reviews by Pew Scholars Program national advisory committee members. For technical background, Cohen consulted J.D. Watson et al., *Molecular Biology of the Gene*. 4th ed. Menlo Park, California: Benjamin/Cummings, 1987; Bruce Alberts et al., *Molecular Biology of the Cell*. 3rd ed. New York: Garland, 1994; Horace F. Judson, *The Eighth Day of Creation*. New York: Simon and Schuster, 1979; and recent issues of *Science* and *Nature*.

The interview is organized chronologically, beginning with Carthew's childhood in Toronto, Canada, and continuing through his undergraduate work at Queen's University, his master's work at University of Toronto, his work as a research technician in Jack Greenblatt's lab at Banting and Best Department of Medical Research, his Ph.D. studies at Massachusetts Institute of Technology, his postdoc at University of California, Berkeley, and the establishment of his own lab at University of Pittsburgh. Major topics discussed include his research in Phillip A. Sharp's and Gerald M. Rubin's labs, his work at University of Pittsburgh, and his current research on RNAi and *frizzled*.

ORIGINAL EDITING:

Gail Ostergren, editor, edited the interview. She checked the verbatim transcript of the interview against the original tape recordings, edited for punctuation, paragraphing, and spelling, and verified proper names. Words and phrases inserted by the editor have been bracketed

Carthew reviewed the transcript and made a number of corrections.

Gail Ostergren prepared the table of contents. Ostergren assembled the biographical summary and interview history. Victoria Simmons, editorial assistant, compiled the index.

TABLE OF CONTENTS

Early Years, College, and Entering Graduate School	1
<p>Family background. Childhood interests and experiences. Religious Upbringing. Present attitudes toward religion. Attending public schools in TorontoCanada. Junior high and high school. Canadian school system. Extracurricular activities. Influential teachers. Decides to attend Queen's University. Family expectations. Works in Seward R. Brown's laboratory at Queen's University. Studies at the Royal Conservatory of Music while pursuing a master's degree in botany at University of Toronto. Meets his future wife, Janet E. MacDermid. Takes a research technician position in JackF. Greenblatt's laboratory at the Banting and Best Department of Medical Research. Greenblatt encourages Carthew to pursue a Ph.D. in the United States. Decides to study at Massachusetts Institute of Technology (MIT). Life as a Canadian in the United States. Graduate program at MITSelecting Phillip A. Sharp's lab.</p>	
Life in Graduate School, Postdoctoral Work, and a Faculty Position	37
<p>Jack Greenblatt's lab management style. Phil Sharp's lab management and student mentoring styles. Writes first paper while in Sharp's lab. Emerging interest in neurobiology. Decides to do a postdoc in Gerald M. Rubin's lab at University of California, Berkeley. Balancing work and family life. Hunting for jobs in the United States and Canada. Accepts a position at University of Pittsburgh. Research on the <i>ras</i> oncogene leads to consulting work for Chiron Corporation. Starting his lab at Pittsburgh. The grant-writing process.</p>	
Receiving the Pew Scholarship and Life at the University of Pittsburgh	62
<p>Impact of the Pew Scholars in the Biomedical Sciences award. Tenure process at University of Pittsburgh. Teaching responsibilities. Race and gender issues in science. Lab management style. Doing benchwork. Travel commitments. Administrative responsibilities. Sabbatical in his own lab. Combining teaching the history of science with methodological and technical approaches. Advantages and drawbacks of using kits in the lab. Leisure pursuits. A typical workday. Reading interests. Love of sailing. Fatherhood.</p>	
Current Research, Reflections on Science, and Moving to Northwestern	91
<p>Current research on RNAi. Applications of his work in the study of Alzheimer's Disease. Importance of conversation in stimulating scientific ideas. Role of serendipity in science. Patents. Competition and collaboration. Ethical issues in science. Animals in laboratory research. Professional and personal goals. What he likes most and least about being a scientist. What he would do if he wasn't a scientist. Future research and professional plans. Pending move to Northwestern University. Thoughts on the challenges of recording the history of science.</p>	

INDEX

A

African American, 73, 74
Alderdice High School, 59
Allegheny Mountains, 79
Alzheimer's disease, 99, 100, 101
apoptosis, 99, 101
Arms, Ruby (paternal aunt-in-law), 31
AT8, 101
Atwood, Margaret, 91
Axel, Richard, 49

B

B amyloid plaques, 100
Bach, Johann Sebastian, 25
Baltimore, David, 41
Banting and Best Department of Medical Research, 28, 56
Basler, Konrad, 83
Berry, Mrs., 11
Bethesda, Maryland, 33
Boston, Massachusetts, 32, 33, 34, 49, 50, 93, 122
Botstein, David, 36, 37, 44
Brown, Seward R., 24, 28
Buehler, Eugen, 61
Buratowski, Stephen, 42, 45, 47, 104
Burgess, David R., 64, 65, 73, 81

C

C. elegans, 47, 49, 97
Cambridge, Massachusetts, 50, 121
Campbell, Joseph E. (brother-in-law), 9
Campbell, Victoria C. (sister), 4
Canada, 2, 7, 11, 12, 16, 20, 21, 22, 29, 31, 33, 34, 47, 49, 54, 56
Canadian Independence Day, 57
Carnegie Mellon University, 31, 75, 124
Carthew, Audrey Pickell (mother), 2
Carthew, Charles W. (father), 1, 93

Carthew, Daniel G. (son), 10, 53, 83, 87, 119
Carthew, Elizabeth M. (paternal grandmother), 1
Carthew, James E. (son), 10, 76, 83, 87, 88, 89, 90, 91
Carthew, Robert W. (son), 10, 52, 83, 87, 119
Carthew, William T. (paternal grandfather), 1
CDK5. *See* cyclin-dependent kinase 5
Charles River, 93
Chicago, Illinois, 125
China, 68, 73
Chiron Corporation, 58, 59, 101, 106
Chodosh, Lewis A., 45
Cold Spring Harbor Laboratory, 54, 55
collaboration, 40, 59, 96, 101, 110, 111
Columbia University, 49
competition, 44, 108, 110
Crick, Francis H.C., 36
cyclin-dependent kinase 5, 99, 100, 101
Czechoslovakia, 74

D

Detroit, Michigan, 1
Dickinson, Marilyn C. (sister), 5, 8
DNA, 104, 110, 124
Drosophila, 47, 49, 80, 96, 97, 110, 123

E

Eastern Europe, 73
eclosion, 101
Eighth Day of Creation, The, 126
Einstein, Albert, 103
Ellison, Larry, 94
England, 1, 57
Evans, Todd, 71

F

Fenway Park, 79
Fire, Andrew Z., 37, 42, 47, 96, 97
Fleming, Sir Alexander, 103
fossils, 7
Frank, Mr., 19
frizzled, 65, 97, 99, 102, 113
frizzled 2, 97

G

Ganoza, M. Celia, 29
Gardner, William, 95
Germany, 74
Gilbert, Walter, 30
Glass, Ira, 30
Gordon Conference, 93
grants/funding, 25, 61, 62, 63, 64, 65, 66, 120
Great Britain, 51, 57
Greenblatt, Jack F., 29, 30, 31, 35, 39, 40

H

Hanly, Sarah, 39
Harvard University, 16, 30, 31
Hawaii, 121
Hellebust, Johan A., 24, 28
high performance liquid chromatography, 86
Horvitz, H. Robert, 36, 49
Howard Hughes Medical Institute, 50, 51, 74

I

India, 73
Ingles, C. James, 40
Irwin, Mrs., 12

J

Jackson, Margaret "Granny Jacks", 1
Johns Hopkins University, 54, 55
Jorgensen, Richard A., 105
Judson, Horace F., 126
Junior Academy of Science, 59

K

Kandel, Eric R., 48, 49
Kauffmann, Rachele C., 59, 75
Kennerdell, Jason, 96, 104
Kingston, Ontario, Canada, 2, 3, 20
Kneip, Ina C. (paternal aunt), 5
Korenman, Alicia, 59, 60

L

Lake Ontario, 3, 6, 93
Lake Simcoe, 93
Lash, Frank A., 47
Laski, Frank, 50
Latino, 73, 74
Li, Joyce, 39, 40
Lichtman, Jeff W., 48
London, England, 122
Los Angeles, California, 30

M

MacDermid, Edgar S. (father-in-law), 27, 31
MacDermid, Janet E. (wife), 10, 31, 49, 88, 124
MaDermid, Marion M. (mother-in-law), 27
Manitoba, Canada, 3
Massachusetts Institute of Technology, 31, 32, 35, 36, 37, 44, 47, 48, 49, 50, 71, 73, 74, 121
McGill University, 49, 54
McKay, Ronald D.G., 48
Mello, Craig C., 96, 97, 98
Meselson, Matthew S., 36
MIT. *See* Massachusetts Institute of Technology
molecular biology, 22, 29, 30, 36, 39, 45, 47, 48, 49, 84, 85, 86, 96, 98
Montreal, Québec, Canada, 2, 30, 54, 55
Mozart, Wolfgang Amadeus, 25
music, 8, 25, 26, 28, 29
piano, 8, 25, 87, 88

N

Naismith, Susan C. (sister), 5

Narragansett Bay, 94
National Institutes of Health, 61, 63, 76, 82,
120, 126
National Public Radio, 30
National Science Foundation, 76, 82
neurobiology, 48, 49, 98, 100, 102, 117
New York City, New York, 30
New York Times, 91, 94
Newport, Rhode Island, 93, 94
Niagara Falls, 4
NIH. *See* National Institutes of Health
Nobel Prize, 118
Northwestern University, 124, 125
NSF. *See* National Science Foundation

O

O'Brian, Patrick, 92
Ontario Hydro, 4
Ontario, Canada, 12
Oppenheimer, J. Robert, 125
Oracle Corporation, 94

P

Packard Fellowships for Science and
Engineering, 64
Parkinson's disease, 115
Parti Québécois, 55
patent, 59, 106, 108
Pennsylvania, 72
Pennsylvania State University, 72
People for the Ethical Treatment of
Animals, 116
Peritz, Linda, 39
PETA. *See* People for the Ethical Treatment
of Animals
Pew Scholars Program in the Biomedical
Sciences, 61, 64, 96, 97, 124
Philadelphia, Pennsylvania, 110
Pickell, Bill O. (maternal uncle), 7
Pickell, Donald K. (maternal uncle), 4
Pickell, Irwin O. (maternal grandfather), 3
Pickell, Lillian L. (maternal grandmother), 3
Pickell, William O. (maternal uncle), 4
Pipas, James M., 81
Pittsburgh, Pennsylvania, 93

Principles of Neural Development, 48
Purves, Dale, 48

Q

Québec, Canada, 22
Queens University, 2, 9, 16, 19, 23, 28, 35,
54

R

ras, 58, 59, 64, 101, 102
religion
Anglican, 9
Bible, 10
Buddhism, 10
Christianity, 10
Episcopalian, 9
Renton, Ida, 18
Rhode Island, 93
RNA, 42, 96, 97, 98, 99, 104, 105
RNAi, 96, 97, 98, 102, 104, 105, 109, 123
Rockefeller, John D., 91, 125
Roosevelt, President Theodore, 2, 5, 19
Royal Conservatory of Music, 25
Royal Navy, 92
Rubin, Gerald M., 47, 49, 50, 51, 53, 54, 55,
68, 78, 79, 89, 97

S

Saccharomyces, 48
Samuels, Mark, 47
San Diego, California, 124
San Francisco, California, 31, 32, 49
Saskatchewan, Canada, 3
Sault Sainte Marie, Ontario, Canada, 4
Scottish, 16
sea slugs, 49
Searle Scholars Program, 64
Sebti, Said, 58
serendipity, 28, 105, 118
Sharp, Phillip A., 35, 37, 39, 41, 42, 44, 45,
47, 48, 50, 51, 52, 53, 55, 68, 78, 79, 104,
114
Simon, Michael, 111
Solomon, Frank, 36, 37

Spence, Paul, 22
Spradling, Allan C., 80
Stahl, Franklin W., 36
Stewart, Mr., 19
Switzerland, 83

T

Tarelton, Evan, 6, 7
tau, 99, 100, 101
tenure, 67, 76, 77, 118
This American Life, 30
Toronto, Ontario, Canada, 1, 2, 4, 5, 6, 9,
20, 24, 25, 27, 28, 31, 33, 34, 40, 49, 56,
57, 93, 125
transcription, 32, 37, 42, 45, 48, 84, 97, 110
trilobites, 7
Trinidad, 34

U

U.S. Congress, 115
United States of America, 1, 2, 15, 17, 30,
33, 34, 47, 56, 57, *See*
University of British Columbia, 54
University of California, Berkeley, 37, 49,
50, 61, 70, 111
University of California, San Francisco, 31
University of Pittsburgh, 55, 56, 60, 123

University of Toronto, 16, 25, 27, 54

V

Varmus, Harold E., 32
Vietnam War, 6

W

Watson, James D., 30, 36
Weinberg, Robert A., 41
Westinghouse Science and Technology
Awards, 59
Windsor, Ontario, Canada, 1, 2
Winnipeg, Manitoba, Canada, 3
Wolfe, Sheila M. (sister-in-law), 27
Wood, Mr., 28, 29
World War II, 6, 125, 126

Y

Yale University, 16
Yamamoto, Keith R., 32
Yorktown (Toronto), Ontario, Canada, 57
Young Presidential Investigators Award, 64

Z

Zhang, Jianjun, 61
Zheng, Limin, 61