

CHEMICAL HERITAGE FOUNDATION

**MARK M. DAVIS**

The Pew Scholars Program in the Biomedical Sciences

Transcript of an Interview  
Conducted by

Robert Kohler and Naomi Morrissette

at

Stanford University  
Palo Alto, California

on

14 December 1989

(With Subsequent Corrections and Additions)

## **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.



THE BECKMAN CENTER FOR THE HISTORY OF CHEMISTRY

Oral History Program

RELEASE FORM

This document contains my understanding and agreement with the Center for History of Chemistry with respect to my participation in a tape-recorded interview conducted by Robert Kohler and Naomi Morrissette on December 14, 1989. I have read the transcript supplied by the Center and returned it with my corrections and emendations.

1. The tapes and corrected transcript (collectively called the "Work") will be maintained by the Center and made available in accordance with general policies for research and other scholarly purposes.
2. I hereby grant, assign, and transfer to the Center all right, title, and interest in the Work, including the literary rights and the copyright, except that I shall retain the right to copy, use and publish the Work in part or in full until my death.
3. The manuscript may be read and the tape(s) heard by scholars approved by the Center subject to the restrictions listed below. The scholar pledges not to quote from, cite, or reproduce by any means this material except with the written permission of the Center.
4. I wish to place the following conditions that I have checked below upon the use of this interview. I understand that the Center will enforce my wishes until the time of my death, when any restrictions will be removed.
  - a.  No restrictions for access.
  - b.  My permission required to quote, cite, or reproduce.
  - c.  My permission required for access to the entire document and all tapes.

This constitutes our entire and complete understanding.

(Signature) \_\_\_\_\_

Mark Davis

(Date) \_\_\_\_\_

10/17/90

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:

Mark M. Davis, interview by Robert Kohler and Naomi Morrissette at Stanford University, Palo Alto, California, 14 December 1989 (Philadelphia: Chemical Heritage Foundation, Oral History Transcript # 0722).



Chemical Heritage Foundation  
Center for Oral History  
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.

## MARK M. DAVIS

1952 Born in Paris, France on November 27

### Education

1974 B.A., Molecular Biology, Johns Hopkins University  
1981 Ph.D., Molecular Biology, California Institute of Technology

### Professional Experience

1980-1982 National Institutes of Health, Bethesda, Maryland  
Post-Doctorate Fellow, Molecular Immunology  
1982-1983 Staff Fellow, Laboratory of Immunology

June 1983 Cold Spring Harbor Laboratory, Cold Spring Harbor, New York  
Instructor, Molecular Cloning Course

1983-1986 Stanford University School of Medicine, Stanford, California  
Assistant Professor, Department of Medical Microbiology  
1986-present Associate Professor, Department of Microbiology and  
Immunology

1987-present Howard Hughes Medical Institute at Stanford University  
Associate Investigator

### Honors

1980 Intra-Science Research Foundation Award  
1981 Milton and Frances Clauser Doctoral Prize, California Institute of  
Technology  
1985 The Passano Foundation Young Scientist Award  
1985-1988 Member, Scientific Advisory Board, Damon Runyon-Walter Winchell  
Cancer Foundation  
1985-1989 Pew Scholar Award  
1986 Eli Lilly Award in Microbiology and Immunology  
1986 Kayden Award from the New York Academy of Sciences  
1988-present Member of the Allergy and Immunology Study Section, Division of  
Research Grants, National Institutes of Health  
1989 Gairdner Foundation International Award

## ABSTRACT

Mark Davis grew up in Pittsburgh, Pennsylvania, the second of five children. His father was a civil engineer, his mother an architect. Davis took an early interest in science, thanks to wide reading and an influential high school biology teacher.

Davis matriculated at Johns Hopkins University. Trouble in a mini organic chemistry class sent him to Peter Johnson's synthetic organic chemistry lab, where he helped produce two papers. He switched majors to biology because he thought it answered important questions. He worked in Michael Beer's lab, trying to sequence DNA with a transfer scanning microscope. Hopkins was known for its membrane biologists, and Davis, interested in molecular biology, wanted to combine the study of DNA with classical genetics studies. He consulted his advisors, who told him to take a physical chemistry class and suggested graduate studies at California Institute of Technology (Caltech). There he went into Edward Lewis' *Drosophila* lab, but he hated flies and found Lewis difficult to work with. He then went to Eric Davidson's lab, where he worked with Glen Galau and William Klein on sea urchins. Davidson was harshly critical and Davis found the lab atmosphere oppressive; he moved to Leroy Hood's lab. There he worked successfully with Philip Early, an early molecular biologist. Davis cloned the first mouse genomic library. His approach to science is to prepare thoroughly, to avoid what others do, and to look for variations.

Davis's next move was to National Institutes of Health. In William Paul's lab he designed a general technology to find genes expressed at very low levels. At Ronald Schwartz's suggestion Davis used pulse field gel technology to discover delta chain of T-cell receptors. Recognizing that T-cell receptors are important for immunology, Davis, the only molecular biologist in his department, began his work on T-cell receptors, work that continues today.

Davis still works in his lab, which is beginning to do biochemical work on T-cells, trying to engineer expression of membrane proteins in soluble form. His lab is also working with transgenic mice, a more difficult system for which he gets help from Pamela Bjorkman and others. Davis applies to science the strategies of fencing; he compares the principles of economy and mastery in fencing to samurai movies.

## TABLE OF CONTENTS

Early Years	1
<p>Grew up in Pittsburgh, second of five children. Father a civil engineer, mother an architect. Drifted into science. Poor high school. Read a lot. <i>Double Helix</i>. Merv Griffin show. Scientific discovery exciting. Made chlorine gas with chemistry set. Good biology teacher, Michael Tomko, in high school. Good sociology teacher, Mr. Reed, gave him books; <i>Worldly Philosophers</i>, biographies of economists. Made coat hangers in Junior Achievement. Used Junior Achievement experience in interview for college.</p>	
College Years	6
<p>Matriculated at Johns Hopkins University. Economics class good but grades arbitrary. Found biology interesting; liked lab work. Trouble in Brown Murr's intersession organic chemistry lab course. Entered Peter Johnson's synthetic organic chemistry lab. Johnson enthusiastic and hands-on. Davis "just hands," but got two papers. Switched to biology as more interesting; chemistry a kind of "guessing game," while biology had "deeper purpose," answering important questions. National Science Foundation summer project in Alsoph Corwin's lab. Chemistry hard at first but he was good at biology. Transfer scanning electron microscope in Michael Beer's lab, sequencing DNA. Sequencing important, not investigated by James Watson and Francis Crick. Hopkins known for membrane biologists: Saul Roseman, Michael Harrington, Maurice Bessman. Gerald Rubin and Allan Spradling at Carnegie Institution next door to Hopkins doing molecular biology. Trip to Europe.</p>	
California Years	17
<p>Hopkins advisors said to take physical chemistry. Poland's class on macromolecules. Wanted to interface study of DNA with classical genetics studies. Accepted postdoc at California Institute of Technology. Applied to University of Chicago, University of Wisconsin, but Caltech best. No classes; went right into lab. Max Delbrück. James Bonner. Edward Lewis' <i>Drosophila</i> lab. Hated flies; found Lewis distant, hard to understand. Went to Eric Davidson's lab. Davidson's personality, outside interests. Worked with Glen Galau and William Klein. Sea urchins. Exceedingly critical atmosphere. Davidson too controlling and lab oppressive. Interesting work in Ronald Konopka's lab but chose Leroy Hood's lab instead. Philip Early and beginnings of molecular biology. Molecular immunology; Thomas Maniatis. Mammalian cloning. Antibody diversity. First mouse genomic library. Fencing enabled Davis to "threaten" Early, so they got along. Fencing as preparation for science. Davis's approach to science.</p>	
National Institutes of Health (NIH) Years	31
<p>William Paul's lab. Did not want to clone lymphokines. Finding difference in gene expression. Immunoglobulin issues already solved. Designed general technology to get at genes expressed at very low level. Major histocompatibility genes boring; people still working on them ten years later. Medawar quotation again: work on important problems. Ronald Schwartz and T-cell receptors. Equipment ready for Davis; he was only molecular biologist there. T-cell receptors work ongoing; important for immunology.</p>	

Transgenics; put T-cell receptors in mice; found delta chain of T-cell receptor because of pulse field gel.

#### Current Work

36

Still works in lab sometimes. Believes good scientists must be good in lab to keep up with new technology, get new insights. Maniatis and Hood really understood how things work and could teach others. His lab heading to biochemistry about T-cells. Trying to engineer expression of membrane proteins in soluble form. Tried to teach himself protein chemistry, what he considers last part of T-cell recognition. Also working with transgenic mice; more difficult; unique system; having success. Pamela Bjorkman, postdoc, helping him. Elite group of immunologists at NIH; Jewish except Davis; very learned, very disputatious. Fencing techniques applied to science; samurai movies and fencing. Economy and essence of fencing lead to devastation of enemy. Susumu Tonegawa also a samurai in science.

#### Index

42

## INDEX

### A

A.C. Gilbert Company, 6  
*Advice to a Young Scientist*, 16  
American Museum of Natural History, 3  
Axel, Richard, 38

### B

Baltimore, Maryland, 10, 14  
Beer, Michael, 13, 15, 16, 17, 18  
Bessman, Maurice J., 9, 13, 16, 17  
Bjorkman, Pamela J., 38  
Bonner, James F., 18  
Britten, Roy J., 24, 38  
Brown, Donald D., 14

### C

California Institute of Technology, 16, 17, 18, 19, 20,  
21, 23, 24, 27, 34, 38  
Kerckhoff Marine Laboratory, 24  
Caltech. *See* California Institute of Technology  
Cantor, Charles C., 35, 36  
Carnegie Institute of Washington, 14  
Cebra, John J., 16, 17  
Chargaff, Erwin, 2  
Christ, Carl, 6  
City High School, 1  
Cohen, David I., 34  
Cole, Michael D., 14  
Columbia, Maryland, 1  
*Copia*, 23  
Corwin, Alsoph, 12  
Costantini, Franklin D., 21  
Crick, Francis H.C., 13, 19  
*Current Contents*, 22

### D

da Vinci, Leonardo, 16  
Dallas, John R., 7  
Davidson, Eric H., 20, 21, 23, 26, 27, 28, 32, 37, 39  
Davis, Ronald W., 35  
Delbrück, Max L.H., 18  
DNA, 2, 13, 14, 17, 21, 23, 27, 34, 35, 38

*Double Helix, The*, 2, 19, 20  
*Drosophila*, 14, 18, 19, 25, 27

### E

Early, Philip W., 26, 27, 28  
Edelman, Gerald M., 39  
Europe, 15

### F

fencing, 28, 29, 39, 40  
Fox Chase Cancer Center, 41  
Franklin, Rosalind, 2  
Fresno, California, 27

### G

Galau, Glen A., 21  
*Gene Activity and Early Development*, 20  
Gordon [Research] Conference, 23

### H

Harrington, Michael, 14  
Harvard University, 27  
Hedrick, Stephen M., 34  
Hogness, David S., 23  
Hood, Leroy E., 23, 26, 27, 28, 37

### I

International Business Machines Corporation, 5

### J

Johns Hopkins University, 6, 7, 8, 11, 13, 14, 16, 17,  
18, 33  
Johnson, Peter Y., 10, 11, 12  
Junior Achievement, 8

### K

Klein, William H., 21  
Konopka, Ronald J., 27  
Kornberg, Arthur, 9  
Kuhn, Thomas, 19

**L**

Leder, Philip, 32, 41  
Lewis, Edward B., 18, 19, 20  
lymphokines, 31

**M**

Maniatis, Thomas P., 27, 33, 37  
McConnell, Harden M., 7  
Medawar, Peter, 15, 33  
Mifune, Toshiru, 40  
Morgan, Thomas H., 19  
Murr, Brown L., Jr., 9

**N**

National Institutes of Health, 31, 34, 38, 39  
National Science Foundation, 12  
NIH. *See* National Institutes of Health  
NSF. *See* National Science Foundation

**O**

Olson, Maynard V., 36

**P**

Pasadena, California, 16, 18, 22  
Paul, William E., 31, 34  
Pew Scholars Program in the Biomedical Sciences, 2,  
7, 14, 21, 38  
Pittsburgh, Pennsylvania, 1, 3, 5, 8, 10  
Poland, Douglas, 11, 17  
Posakony, James W., 21  
Prince George's County, 1

**R**

Reed, Mr., 6  
RNA, 15, 21, 25, 27, 28, 32, 38  
Roseman, Saul, 14  
Rouse Company, 1

Rubin, Gerald M., 14

**S**

San Antonio, Texas, 4  
Santa Monica, California, 4  
Scheller, Richard H., 21, 22  
Schwartz, Ronald H., 33, 38  
sea urchin, 20, 21, 24, 25, 32  
Seton, Ernest Thompson, 7  
Spradling, Allan C., 14  
Staten Island, New York, 3  
Strauss, Ellen [Glowacki], 20  
Strauss, James H., 20  
Sturtevant, Alfred H., 19  
Switzerland, 28

**T**

T-cell, 32, 33, 35, 36, 37, 38  
Tomko, Michael, 5  
Tonegawa, Susumu, 23, 26, 27, 28, 32, 34, 40, 41

**U**

U.S. Navy, 1  
United States of America, 40  
University of California, Santa Cruz, 25  
University of Chicago, 18  
University of Wisconsin, 18

**V**

Virginia, 4

**W**

Washington University in St. Louis, 36  
Watson, James D., 2, 13, 19, 20  
Wigler, Michael H., 38  
World War II, 1  
*Worldly Philosophers, The*, 6