CHEMICAL HERITAGE FOUNDATION

ANDREW D. ELLINGTON

The Pew Scholars Program in the Biomedical Sciences

Transcript of an Interview
Conducted by

Helene L. Cohen

at

University of Texas, Austin
Austin, Texas

on

6-7, 9 March 2000

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 © 2001, The Regents of the University of California) and is made possible through the generosity of

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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:

Laurent Delavaux, Program Intern, Biomedical Sciences and Technologies, Chemical Heritage Foundation. B.S. Molecular Biology, Lehigh University.

David J. Caruso, Program Manager, Biomedical Sciences and Technologies, 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. T042100A

This Interview Agreement is made and entered into this 20th day of 20th April, 2000 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 ANDREW D. ELLINGTON, having an address at Institute for Cellular and Molecular Biology, A500, University of Texas at Austin, 26th Street and Speedway, Austin, Texas 78712, hereinafter called "Interviewee."

Interviewee agrees to participate in a series of University-conducted tape-recorded interviews, commencing on or about March 6, 2000, and tentatively entitled "Interview with Andrew D. Ellington". 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.

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

If to University: Oral History Program
University of California, Los Angeles
Box 951575
Los Angeles, California 90095-1575

Attention: Director

If to Interviewee: Andrew D. Ellington
Institute for Cellular and Molecular Biology, A500
University of Texas at Austin
26th Street and Speedway
Austin, Texas 78712

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

INTERVIEWEE

Andrew Ellington
(Signature)

Andrew D. Ellington
(Typed Name)

University of Texas at Austin
(Address)

Austin, Texas 78712

Date 3/6/00

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA

Dale Treleven
(Signature)

Dale E. Treleven
(Typed Name)

Director, Oral History Program
(Title)

Date 4/20/00

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

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ANDREW D. ELLINGTON

1959 Born in Independence, Missouri on 6 May

Education

1981 B.S., Biochemistry, Michigan State University
1988 Ph.D., Harvard University

Professional Experience

Harvard Medical School
1988-1991 Research Fellowship, Department of Genetics

Massachusetts General Hospital
1988-1991 Research Fellowship, Department of Genetics

Indiana University, Bloomington, Bloomington, Indiana
1992-1998 Research Fellowship, Institute for Molecular and Cellular Biology
1992-1998 Associate Professor, Department of Chemistry

University of Texas, Austin, Austin, Texas
1998-present Associate Professor, Department of Chemistry

Honors

1981-1984 National Science Foundation Fellow
1993 Office of Naval Research Young Investigator Award
1994 American Foundation for AIDS Research Scholar Award
1994 National Science Foundation Young Investigator Award
1994-1998 Pew Scholars Program in the Biomedical Sciences Grant

Selected Publications

Benner, S.A. et al., 1987. Natural selection, protein engineering, and the last riboorganism: rational model building in biochemistry. *Cold Spring Harbor Symposium on Quantitative Biology* 52:53-63.

Benner, S.A. and A.D. Ellington, 1988. Return of the 'last ribo-organism'. *Nature* 332:688-89.

Ellington, A.D. and J.W. Szostak, 1990. *In vitro* selection of RNA molecules that bind

specific ligands. *Nature* 346:818-22.
Green, D.R. et al., 1990. *In vitro* genetic analysis of the tetrahymena self-splicing intron. *Nature* 347:406-8.
Michael, F. et al., 1990. Phylogenetic and genetic evidence for base-triples in the catalytic domain of group I introns. *Nature* 347:578-80.
Benner, S.A. et al., 1991. RNA world. *Science* 252:1232.
Ellington, A.D. and J.W. Szostak, 1992. Selection *in vitro* of single-stranded DNA molecules that fold into specific ligand-binding structures. *Nature* 355:850-52.
Conrad, R. et al., 1994. Isozyme specific inhibition of protein kinase C by RNA aptamers. *The Journal of Biological Chemistry* 269:32051-54.
Saldanha, R. et al., 1996. Analysis of the CYT-18 protein binding site at the junction of stacked helices in group I intron RNA by quantitative binding assays and *in vitro* selection. *Journal of Molecular Biology* 261:23-42.
Conrad, R. et al., 1997. Natural and unnatural answers to evolutionary questions. *Proceedings of the National Academy of Sciences USA* 94:7126-28.
Robertson, M.P. and A.D. Ellington, 1997. Ribozymes red in tooth and claw. *Current Biology* 7:R376-79.
Baskerville, S. et al., 1999. Anti-Rex aptamers as mimics of the Rex-binding element. *Journal of Virology* 73:4962-71.
Matsumura, I. et al., 1999. Directed evolution of the surface chemistry of beta-glucuronidase. *Nature Biotechnology* 17:696-701.
Ye, X. et al., 1999. RNA architecture dictates the conformations of a bound peptide. *Chemistry & Biology* 6:657-69.

ABSTRACT

Andrew D. Ellington was born in 1956 in Missouri; the elder of two siblings. His father was a title lawyer, and his mother was a high school mathematics and computer science teacher. From a very young age Ellington's parents, specifically his mother, pushed him very hard to succeed in academics. Ellington credits his love of science and research to many influential high school teachers whom he still speaks with on occasion.

Ellington attended Michigan State University, where he earned his B.S. in biochemistry in 1981. During his undergraduate years, Ellington worked tirelessly in the lab, often sleeping in classrooms or computer labs. In 1988 he earned his Ph.D. from Harvard University, where he pursued research in Stephen C. Harrison's lab, followed by research with Steven A. Benner whom he would later follow to Switzerland. It was in Benner's lab that he developed his Palimpsest Theory for Evolution based on his observations of RNA. Ellington accepted a postdoctoral research fellowship in the Department of Genetics at Harvard Medical School; there he did his research at the Massachusetts General Hospital, in Jack W. Szostak's lab. He studied Type 1 self-splicing introns and performed his best-known research on *in vitro* selection in Szostak's lab.

In 1992 Ellington was appointed associate professor in the Department of Chemistry at Indiana University, Bloomington. In 1998 he was appointed associate professor in the Department of Chemistry at the University of Texas, Austin. His current research is varied, but focuses most interestingly on aptazymes—allosteric ribosomes that can be engineered to recognize almost any molecule. Ellington hopes to show that these aptazymes can be used to effectively recognize and subdue the HIV virus population of infected individuals. He is also working on designing defensive biosensors for the United States Military which would allow for quick recognition of pathogens or noxious substances.

Throughout his oral history Ellington stressed the importance of innovation and the need to bridge the divide between technologists and scientists. He has received several grants and awards, including a fellowship from the National Science Foundation, the Office of Naval Research Young Investigator Award, the American Foundation for AIDS Research Scholar Award, the National Science Foundation Young Investigator Award, and the Pew Scholars Program in the Biomedical Sciences grant, which he discusses in the oral history.

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: Ellington's office, University of Texas, Austin.

Dates, length of sessions: March 6, 2000 (98 minutes); March 7, 2000 (119); March 9, 2000 (123).

Total number of recorded hours: 5.7

Persons present during interview: Ellington 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' 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 Ellington 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 Ellington's file at the Pew Scholars Program office in San Francisco, including his 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 Ellington's childhood in Olathe, Kansas, and continuing through his undergraduate work at Michigan State University; his graduate work at Harvard University; his postdoc at Massachusetts General Hospital; and the establishment of his own laboratories at Indiana University, Bloomington and the University of Texas, Austin. Major topics discussed include the impact of good teachers on Ellington, the development and application of technology in science, and the funding of his laboratory.

ORIGINAL EDITING:

Ji Young Kwon, editorial assistant, 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.

Ellington did not review the transcript, and therefore some names have not been verified.

William Van Benschoten, editor, prepared the table of contents. Kwon assembled the biographical summary and interview history. Deborah Truitt, editorial assistant, compiled the index.

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