

CHEMICAL HERITAGE FOUNDATION

TATSUYA HIRANO

The Pew Scholars Program in the Biomedical Sciences

Transcript of an Interview
Conducted by

Andrea R. Maestrejuan

at

Cold Spring Harbor Laboratory
Cold Spring Harbor, New York

on

11, 12 and 13 December 2002

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 © 2006, 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:

Kim Phan, Program Intern, Oral History, Chemical Heritage Foundation. B.A. expected 2011, Anthropology, Cornell University.

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. R010703B

This Interview Agreement is made and entered into this 7 day of January, 2002, 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 TATSUYA HIRANO, having an address at Cold Spring Harbor Laboratory, P.O. Box 100, 1 Bungtown Road, Cold Spring Harbor, New York 11724, hereinafter called "Interviewee."

Interviewee agrees to participate in a series of University-conducted tape-recorded interviews, commencing on or about December 11, 2002, and tentatively entitled "Interview with Tatsuya Hirano." 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: Janice L. Reiff

If to Interviewee: Tatsuya Hirano
Cold Spring Harbor Laboratory
P.O. Box 100
1 Bungtown Road
Cold Spring Harbor, NY 11724

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

INTERVIEWEE

THE REGENTS OF THE UNIVERSITY
OF CALIFORNIA

X Tatsuya Hirano
(Signature)

Janice L. Reiff
(Signature)

Tatsuya Hirano
(Typed Name)

Janice L. Reiff
(Typed Name)

Cold Spring Harbor Laboratory
(Address)

Interim Director, Oral History Program
(Title)

1 Bungtown Road

Cold Spring Harbor, NY 11724

X Date December 11, 2002

Date 7 January 2003

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

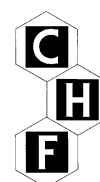
One may view, quote from, cite, or reproduce the oral history with the permission of CHF.

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:

Tatsuya Hirano, interview by Andrea R. Maestrejuan at Cold Spring Harbor Laboratory, Cold Spring Harbor, New York, 11-13 December 2002 (Philadelphia: Chemical Heritage Foundation, Oral History Transcript # 0464).



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.

TATSUYA HIRANO

1960 Born in Chiba, Japan

Education

1984 B.S., Biology, Kyoto University
1989 Ph.D., Molecular Biology, Kyoto University

Professional Experience

1989 Kyoto University, Faculty of Science, Japan
Postdoctoral Fellow, Department of Biophysics

1989-1993 University of California, San Francisco
Postdoctoral Fellow, Department of Pharmacology
1993-1995 Postgraduate Research Pharmacologist, Department of Cellular
and Molecular Pharmacology

1995-1996 Cold Spring Harbor Laboratory
Senior Staff Investigator
1996-1998 Assistant Investigator
1998-1999 Associate Investigator
1999-2003 Associate Professor
2003-present Professor

1995-present SUNY Stony Brook
Member, Graduate Program in Genetics

Honors

1989 Fellowships of the Japan Society for the Promotion of Science
for Japanese Junior Scientists

1989-1991 The Anna Fuller Fund Postdoctoral Fellowship
1992-1995 Leukemia Society of America Special Fellowship
1996-2000 Pew Scholars Program in the Biomedical Sciences Grant
1996-present Recipient, NIH R01 Grant (GM53 926)
1998-2001 Recipient, Human Frontiers Science Program Research Grant
2001-present Recipient, NIH R01 Grant (GM63545)
2005-present Fellow, American Association for the Advancement of Science

Selected Publications

- Hirano, T., S. Funahashi, T. Uemura, and M. Yanagida. (1986). Isolation and characterization of *Schizosaccharomyces pombe cut* mutants that block nuclear division but not cytokinesis. *EMBO J.* 5:2973-2979.
- Yanagida, M., Y. Hiraoka, T. Uemura, S. Miyake, and T. Hirano. (1986). Control mechanism of chromosome movement in mitosis of fission yeast. In *Yeast Cell Biology*. UCLA Symposia on Molecular and Cellular Biology. Vol.3 3. J. Hicks, ed. Alan R. Liss Inc., New York. pp279-297.
- Hirano, T., Y. Hiraoka, and M. Yanagida. (1988). A temperature-sensitive mutation of the *Schizosaccharomyces pombe* gene *nuc2⁺* that encodes a nuclear scaffold-like protein blocks spindle elongation in mitotic anaphase. *J. Cell Biol.* 106:1171-1183.
- Hirano, T., and M. Yanagida. (1989). Controlling elements in the cell division cycle of *Schizosaccharomyces pombe*. In *Molecular and Cell Biology of Yeasts*. E. F. Waltan, ed. Blackie and son Ltd., Glasgow. pp223-245.
- Hirano, T., G. Konoha, T. Toda, and M. Yanagida. (1989). Essential roles of the RNA polymerase I largest subunit and DNA topoisomerases in the formation of fission yeast nucleolus. *J. Cell Biol.* 108:243-253.
- Hirano, T., N. Kinoshita, K. Morikawa, and M. Yanagida. (1990). Snap helix with knob and hole: essential repeats in *S. pombe* nuclear protein *nuc2⁺*. *Cell* 60:319-328.
- Masuda, H., T. Hirano, M. Yanagida, and W. Z. Cande. (1990). *In Vitro* reactivation of spindle elongation in fission yeast *nuc2* mutant cells. *J. Cell Biol.* 110:417-425.
- Uzawa., S., I. Samejima, T. Hirano, K. Tanaka, and M. Yanagida. (1990). The fission yeast *cut1⁺* gene regulates spindle pole body duplication and has homology to the budding yeast *ESP1* gene. *Cell* 62:913-925.
- Hirano, T., and T. J. Mitchison. (1991). Cell cycle control of higher-order chromatin assembly around naked DNA *in vitro*. *J. Cell Biol.* 115:1479-1489.
- Hirano, T., and T. J. Mitchison. (1993). Topoisomerase II does not play a scaffolding role in the organization of mitotic chromosomes assembled in *Xenopus* egg extracts. *J. Cell Biol.* 120:601-612.
- Hirano, T., and T. J. Mitchison. (1994). A heterodimeric coiled-coil protein required for mitotic chromosome condensation *in vitro*. *Cell* 79:449-458.
- Vernos, I., J. Raats, T. Hirano, J. Heasman, E. Karsenti, and C. Wylie. (1995). Xklp1, a chromosomal *Xenopus* kinesin-like protein essential for spindle organization and chromosome positioning. *Cell* 81:117-127.
- Hirano, T., T. J. Mitchison, and J. R. Swedlow. (1995). The SMC family: from chromosome condensation to dosage compensation. *Curr. Opin. Cell Biol.* 7:329-336.
- Hirano, T. (1995). Biochemical and genetic dissection of mitotic chromosome condensation. *Trends Biochem. Sci.* 20: 357-361.
- Swedlow, J. R., and T. Hirano. (1996). Chromosome dynamics: fuzzy sequences, specific attachment? *Curr. Biol.* 6:544-547.
- Hirano, T., R. Kobayashi, and M. Hirano. (1997). Condensins, chromosome condensation protein complexes containing XCAP-C, XCAP-E and a *Xenopus* homolog of the

- Drosophila* Barren protein. *Cell* 89:511-521.
- Kimura, K., and T. Hirano. (1997). ATP-dependent positive supercoiling of DNA by 13S condensin: a biochemical implication for chromosome condensation. *Cell* 90:625-634.
- Hirano, T. (1998). SMC protein complexes and higher-order chromosome dynamics. *Curr. Opin. Cell Biol.* 10:317-322.
- Losada, A., M. Hirano, and T. Hirano. (1998). Identification of *Xenopus* SMC protein complexes required for sister chromatid cohesion. *Genes Dev.* 12:1986-1997.
- Kimura, K., M. Hirano, R. Kobayashi, and T. Hirano. (1998). Phosphorylation and activation of 13S condensin by cdc2 in vitro. *Science* 282:487-490.
- Hirano, M. and T. Hirano. (1998). ATP-dependent aggregation of single-stranded DNA by a bacterial SMC homodimer. *EMBO J.* 17:7139-7148.
- Hirano, T. (1999). SMC-mediated chromosome mechanics: a conserved scheme from bacteria to vertebrates? *Genes Dev.* 13:11-19.
- Kimura, K., V. V. Rybenkov, N. J. Crisona, T. Hirano*, and N. R. Cozzarelli*. (1999). 13S condensin actively reconfigures DNA by introducing global positive writhe: implications for chromosome condensation. *Cell* 98:239-248 (*co-corresponding authors).
- Losada, A., T. Yokochi, R. Kobayashi, and T. Hirano. (2000). Identification and characterization of SA/Scp3p subunits in the *Xenopus* and human cohesin complexes. *J. Cell Biol.* 150:405-416.
- Hirano, T. (2000). Chromosome cohesion, condensation and separation. *Annu. Rev. Biochem.* 69:115-144.
- Losada, A. and T. Hirano. (2000). New light on sticky sisters. *Curr. Biol.* 10:R615.
- Neuwald, A. F., and T. Hirano. (2000). HEAT repeats associated with condensins, cohesins, and other chromosome-related complexes. *Genome Res.* 10:1445-1452.
- Kimura, K., and T. Hirano. (2000). Dual roles of the 1 1S regulatory subcomplex in condensin functions. *Proc. Natl. Acad. Sci. USA.* 97:11972-11977.
- Kimura, K., O. Cuvier, and T. Hirano. (2001). Chromosome condensation by a human condensin complex in *Xenopus* egg extracts. *J. Biol. Chem.* 276:5417-5420.
- Losada, A., and T. Hirano. (2001). Intermolecular DNA interactions stimulated by the cohesin complex in vitro: implications for sister chromatid cohesion. *Curr. Biol.* 11:268-272.
- Hirano, M., D. E. Anderson, H. P. Erickson, and T. Hirano. (2001). Bimodal activation of SMC ATPase by intra- and inter-molecular interactions. *EMBO J.* 20:3238-3250.
- Losada, A., and T. Hirano. (2001). Shaping the metaphase chromosome: coordination of cohesion and condensation. *BioEssays.* 23:924-935.
- MacCallum, D. E., A. Losada, R. Kobayashi, and T. Hirano. (2002). ISWI remodeling complexes in *Xenopus* egg extracts: identification as major chromosomal components that are regulated by INCENP-aurora B. *Mol. Biol. Cell.* 13:25-39.
- Anderson, D. E., A. Losada, H. P. Erickson, and T. Hirano. (2002). Condensin and cohesin display different arm conformations with characteristic hinge angles. *J. Cell Biol.* 156:419-424.
- Hirano, T. (2002). The ABCs of SMC proteins: two-armed ATPases for chromosome condensation, cohesion and repair. *Genes Dev.* 16:399-414.
- Eide, T., C. Carlson, K. A. Tasken, T. Hirano, K. Tasken, and P. Collas. (2002). Distinct but overlapping domains of AKAP95 are implicated in chromosome condensation and condensin targeting. *EMBO Report.* 3:426-432.

- Bazett-Jones, D. P., K. Kimura, and T. Hirano. (2002). Efficient supercoiling of DNA by a single condensin complex as revealed by electron spectroscopic imaging. *Mol. Cell.* 9:1183- 1190.
- Gillespie, P. J., and T. Hirano. (2002). SMC proteins. *Curr. Biol.* 12:R513.
- Hirano, M., and T. Hirano. (2002). Hinge-mediated dimerization of SMC protein is essential for its dynamic interaction with DNA. *EMBO J.* 21:5733-5744.
- Losada, A., M. Hirano, and T. Hirano. (2002). Cohesin release is required for sister chromatid resolution, but not for condensin-mediated compaction, at the onset of mitosis. *Genes Dev.* 16:3004-3016.
- Cuvier, O., and T. Hirano. (2003). A role of topoisomerase II in linking DNA replication to chromosome condensation. *J. Cell Biol.* 160:645-655.
- Swedlow, J. R., and T. Hirano. (2003). The making of the mitotic chromosome: modern insights into classical questions. *Mol. Cell* 11:557-569.
- Almagro, S., S. Dimitrov, T. Hirano, M. Vallade, and D. Riveline. (2003). Individual chromosomes as viscoelastic copolymers. *Europhys. Lett.* 63:908-9 14.
- Ono, T., A. Losada, M. Hirano, M. P. Myers, A. F. Neuwald, and T. Hirano. (2003). Differential contributions of condensin I and condensin II to mitotic chromosome architecture in vertebrate cells. *Cell* 115:109-121.
- Hirano, T. (2004). Chromosome shaping by two condensins. *Cell Cycle* 3:26-28.
- Almagro, S., D. Riveline, T. Hirano, B. Houchmandzadeh, and S. Dimitrov. (2004). The mitotic chromosome: an assembly of rigid elastic axes, organized by SMC proteins and surrounded by a soft chromatin envelope. *J. Biol. Chem.* 279:5118-5126.
- Strick, T., T. Kawaguchi, and T. Hirano. (2004). Real-time detection of single-molecule DNA compaction by condensin I. *Curr. Biol.* 14:874-880.
- Ono, T., Y. Fang, D. L. Spector, and T. Hirano. (2004). Spatial and temporal regulation of condensins I and II in mitotic chromosome assembly in human cells. *Mol. Biol. Cell.* 15:3296-3308.
- Hirano, M., and T. Hirano. (2004). Positive and negative regulation of SMC-DNA interactions by ATP and accessory proteins. *EMBO J.* 23:2664-2673.
- Gillespie, P., and T. Hirano. (2004). Scc2 couples replication licensing to sister chromatid cohesion in *Xenopus* egg extracts. *Curr. Biol.* 14:1598-1603.
- Kireeva, N. M. Lakonishok, I. Kireev, T. Hirano, and A. S. Belmont. (2004). Visualization of early chromosome condensation: a hierarchical folding, axial glue model of chromosome structure. *J. Cell Biol.* 166:775-785.
- Hirano, T. (2005). Holding sisters for repair. *Nature*, 433:467-468.
- Hirano, T. (2005). Condensins: organizing and segregating the genome. *Curr. Biol.* 15:R265-R275.
- Hirano, T. (2005). SMC proteins and chromosome mechanics: from bacteria to humans. *Philos. Trans. R. Soc. Lond. B. Biol. Sci.* 360:507-514.
- Losada, A., T. Yokochi, and T. Hirano. (2005). Functional contribution of Pds5 to cohesin-mediated cohesion in human cells and *Xenopus* egg extracts. *J. Cell Sci.* 118:2133-2141.
- Losada, A. and T. Hirano. (2005). Dynamic molecular linkers of the genome: the first decade of SMC proteins. *Genes Dev.* 19:1269-1287.
- Hirano, M. and T. Hirano. (2005) The mechanochemical cycle of SMC proteins: long-distance

cooperation between the hinge and head domains. Under revision.

Trimborn, M., D. Shindler, H. Neitzel, and T. Hirano. (2005). Microcephalin inhibits premature activation of condensin II: a link between the chromosome condensation machinery and brain development. Submitted.

ABSTRACT

Tatsuya Hirano was born and raised in Chiba, Japan—a fishing village and an agricultural suburb of Tokyo—the youngest of three siblings. Hirano’s father was a civil servant who educated local farmers about methods in agricultural production, obtaining his doctoral degree later in life and, after retiring from civil service, becoming faculty at the University of Tokyo; his mother was a housewife. Hirano’s childhood, according to him, was rather typical; he had an early interest in the arts (he liked drawing and carpentry). He excelled in school and decided to pursue a college education in science.

He entered Kyoto University intending to study physics, but interest in contemporary advances in molecular biology pulled him much more in that direction. He was unaffected by his professors during college, as, according to Hirano, undergraduate education in Japan was much more self-directed than instructor-led. In this spirit, graduate students, unlike in the United States, usually stayed at the same university for their graduate degree as their undergraduate and only applied to a specific lab in which to work for graduate study (unlike the rotation system in the United States); Hirano remained at Kyoto University and worked in Mitsuhiro Yanagida’s laboratory on the genetics of chromosome structure in fission yeast. Since there were no postdoctoral positions available in Japan, and even fewer faculty positions, Hirano decided, like many of his fellow graduate students, to undertake a postdoctoral fellowship abroad. Wanting to broaden his experience in his field, Hirano decided that he wanted to work in the United States and chose to study with Timothy J. Mitchison—someone Hirano considered one of the brightest cell biologists of his age—at the University of California, San Francisco. Hirano worked on chromosome condensation and the condensin complex in Mitchison’s lab, all the while adjusting to American life and culture. From there, he accepted a position at the Cold Spring Harbor Laboratory in New York, where he continued his research on condensin and cohesion.

During the interview, Hirano talks about his wife’s role in his lab (she worked as a technician in several Japanese and American labs before joining his own), and balancing his career with his family life. In addition, he regularly compares the American and Japanese scientific systems, talking about the “brain-drain” issue and its impact on Japanese science. As the interview concludes, Hirano discusses the impact of cultural diversity on science; his mentoring style and its relationship to the mentoring he received; the privatization of science; and the role of the scientist in public policy. At the end of the interview, he speaks more about how he met his wife and about her career; the future direction of chromosome dynamics; and being an award recipient of the Pew Scholars Program in the Biomedical Sciences.

UCLA INTERVIEW HISTORY

INTERVIEWER:

Andrea R. Maestrejuan, Interviewer, UCLA Oral History Program. B.S., Biological Sciences, University of California, Irvine; M.A., History, University of California, Riverside; C. Phil., History, UCLA.

TIME AND SETTING OF INTERVIEW:

Place: Dr. Tatsuya Hirano's office, Cold Spring Harbor Laboratory.

Dates, length of sessions: December 11, 2002; December 12, 2002; December 13, 2002.

Total number of recorded hours: 5.0

Persons present during interview: Hirano and Maestrejuan.

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, Maestrejuan held a telephone preinterview conversation with Hirano to obtain written background information (curriculum vitae, copies of published articles, etc.) and agree on an interviewing schedule. She also reviewed documentation in Hirano's file at the Pew Scholars Program office in San Francisco, including Hirano's proposal application, letters of recommendation, and reviews by Pew Scholars Program national advisory committee members.

ORIGINAL EDITING:

Carol Squires 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.

Hirano did not review the transcript. Consequently, some names and places remain unverified.

Carol Squires prepared the table of contents. TechniType Transcripts compiled the guide to proper names.

TABLE OF CONTENTS

Childhood and Undergraduate Years	1
Parents and siblings. Growing up in rural Chiba, Japan. Parental expectations. Childhood interests. Early schooling. Family background. Influential junior high school teacher. The Japanese educational system. Decision to go to Kyoto University. College entrance. Change of interest from physics to molecular Biology. College extracurricular activities.	
Graduate School and Postdoctoral Years	17
Attends graduate school at Kyoto University to study chromosome structure. College laboratory experience. Graduate program in Japan. Graduate work in Mitsuhiro Yanagida's laboratory on the genetics of chromosome structure in fission yeast. The structure of Japanese laboratories. Yanagida's mentoring style. Postdoctoral fellowship in Timothy J. Mitchison's laboratory at the University of California, San Francisco. Work on chromosome condensation and the condensin complex. Impressions of San Francisco	
Faculty Years	38
Accepts a position at Cold Spring Harbor Laboratory. Research on condensin and cohesion. Setting up his laboratory. Teaching. His wife's role in the lab. Views of Cold Spring Harbor Laboratory. Tenure. The process of doing science in Japan and in the United States. Reasons for fewer students pursuing science as a career.	
Final Thoughts	62
Cultural diversity and science. Impact of funding on setting research priorities. Broader applications of his work. The privatization of science. The peer-review System. The role of the scientist in public policy. Balancing his personal life and career. His wife's career. The future direction of chromosome dynamics. Impact of the Pew Scholars Program in the Biomedical Sciences on his work.	
Index	80

INDEX

A

adenosine triphosphate, 40, 41
Alberts, Bruce, 32, 35, 59
Anna Fuller Fund, 35
ATP. *See* adenosine triphosphate

B

Baltimore, David, 30
Baltimore, Maryland, 28, 30
biophysics, 74, 76
Boston, Massachusetts, 55, 70
Buddhism/Buddhist, 29, 30

C

California, 73
Caribbean Sea, 78
cell biology, 21, 27, 31, 32, 47, 59, 66, 75
Chiba, Japan, 1
China, 63
chromatin, 39
chromodynamics, 74
chromosome condensation, 22, 23, 34, 40, 42, 43, 45, 66, 67
chromosome structure, 19, 20, 21, 22, 23, 24, 27, 31, 44, 45
cohesin, 40, 41, 42, 43, 44, 45, 65, 67, 74
Cold Spring Harbor Laboratory, 1, 29, 38, 39, 40, 46, 47, 48, 49, 53, 54, 55, 59, 61, 63, 70, 73, 74, 76, 77
condensin, 34, 35, 38, 39, 40, 41, 42, 43, 44, 45, 65, 67, 74
cytoskeleton, 32

D

developmental biology, 21, 62
DNA, 19, 31, 33, 41, 43, 67, 74
cDNA, 33, 35, 43, 44

E

Earnshaw, William, 27
England, 16, 26, 56, 70

EST. *See* expressed sequence tags
Europe, 16, 22, 26, 27, 55, 56
expressed sequence tags, 44

G

German, 11, 24, 48
Germany, 56
Gordon Research Conferences, 70
Graduate School of Agriculture and Life Sciences, University of Tokyo, 2

H

Harvard Medical School, 33
Hatakeyama, Shigeto, 8
Helfman, David M., 47
Hirano, Hiroyuki (brother), 3, 75
Hirano, Kazuko (mother), 3
Hirano, Kojyuro (paternal grandfather), 4, 8
Hirano, Kou (paternal grandmother), 4
Hirano, Michiko (wife), 48, 55, 63, 72
Hirano, Satoru (father), 1, 29
histone H1, 22
Hotani, Hirokazu, 76
Human Frontier Science Program Research Grant, 64
Huntington, New York, 73

J

Japan, 2, 4, 9, 11, 16, 18, 21, 24, 26, 29, 30, 32, 37, 43, 48, 53, 55, 56, 57, 58, 59, 60, 62, 68, 72, 75
Johns Hopkins University, 27, 28

K

Kansas City, Missouri, 37
Kimura, Keiji, 41
kinetichore, 31, 32, 65
Kirschner, Marc W., 32
Koza system, 24
Kubota, Tomoko (sister), 3, 75
Kyoto University, 2, 10, 12, 13, 14, 15, 16,

26, 76

L

Los Angeles, California, 55

Losada, Ana, 41

M

Manhattan, New York, 49, 61, 70, 72

microtubules, 31, 35

Mitchison, Timothy J., 26, 27, 28, 30, 31, 32, 33, 35, 36, 40, 59, 75, 77

molecular biology, 15, 16, 17, 19, 20, 21, 48, 76, 77

Molecular Biology of the Gene, 76

Mori, Tama (maternal grandmother), 4, 7

Murray, Andrew W., 32, 33

N

National Institute of Child Health and Human Development, 39

National Institutes of Health, 38, 39, 46, 50, 52, 59, 63, 64, 65, 68, 69, 77

New York, 73

New York City, New York, 61

Newport, John W., 27

NIH. *See* National Institutes of Health

Nobel Prize, 67

Nurse, Sir Paul, 67

O

Osaka, Japan, 48, 72

P

patent, 68

PCR. *See* polymerase chain reaction

Pew Scholars Program in the Biomedical Sciences, 1, 29, 39, 52, 63, 77

polymerase chain reaction, 43

R

RNA, 44

RNAi, 44, 45

S

Saccharomyces cerevisiae, 22

San Francisco, California, 28, 37, 48, 55

Schizosaccharomyces pombe, 22

Scotland, 27

SDS-polyacrylamide, 35

SMC. *See* structural maintenance of chromosomes

soaring/hang gliding/glider, 17

Spector, David L., 47

Stanford University, 59

State University of New York, Stony Brook, 47, 53

structural maintenance of chromosomes, 40, 45, 65

sushi, 1

Switzerland, 26

T

tenure, 38, 49

rolling, 49

Tohoku University, 12

Tokyo, Japan, 1, 2, 3, 4, 9, 10, 12, 13, 14, 73

topoisomerase II, 34

U

U.S. *See* United States of America

UCSF. *See* University of California, San Francisco

United Kingdom, 27

United States of America, 2, 5, 8, 16, 24, 27, 37, 53, 54, 55, 56, 57, 59, 60, 61, 62, 68, 72

University of California, Los Angeles, 61

University of California, San Diego, 27

University of California, San Francisco, 32, 35, 36, 38, 48, 49, 58, 59, 64, 72

University of Edinburgh, 27

University of Hawaii, 68

University of Tokyo, 3, 26

V

Vale, Ronald, 32

W

Watson School of Biological Sciences, 47,
48, 49, 53, 76
Watson, James D., 53
Wolffe, Adam P., 39
World Trade Centers, 61

X

Xenopus laevis, 23, 31, 32, 34, 43, 44, 45,

46, 77

Xenopus tropicalis, 43

Y

Yanagida, Mitsuhiro, 20, 21, 24, 25, 30, 31,
33, 37, 42, 48, 76