PHILIP C. HANAWALT
Curriculum Vitae

(September 2009)

I. Education

Deep Springs College, CA ..... Liberal arts 1949-50
Oberlin College, OH ..... B.A. 1954 ..... Physics major 1950-54
Yale University, CT ..... M.S. 1955 ..... Physics 1954-55
Yale University, CT ..... Ph.D. 1959 ..... Biophysics 1955-58
University of Copenhagen, Denmark ..... Postdoctoral ..... Bacterial Physiology 1958-60
Caltech, Pasadena, CA ..... Postdoctoral ..... Molecular Biology & Genetics 1960-61

II. Appointments — Stanford University, California

Research Biophysicist and Lecturer, Biophysics Laboratory and Graduate Program 1961-65
Associate Professor of Biology, Department of Biological Sciences 1965-70
Director, Biophysics Graduate Program 1968-85
Director of Graduate Studies in Biology 1969-72; 1990-93
Professor of Biology 1970-
Program Director, Cell & Molecular Biology Graduate Training Program 1973-84
Member, Medical Scientist Training Program Committee, School of Medicine 1975-80
Member, Advisory Committee on Engineering in Biology and Medicine 1976-79
Member, Task Force on Biohazards 1977-79
Chair, Administrative Panel on Radiological Hazards 1978-80
Member, Committee on Cancer Biology 1978-81
Faculty Member, Graduate Program in Cancer Biology ..... Ongoing
Faculty Member, Biophysics Graduate Program ..... Ongoing
Professor of Dermatology (Joint appointment), School of Medicine 1979-
Member, Committee on Research 1981-84
Chair, Department of Biological Sciences 1982-89
Chair, Second Senate *ad hoc* Committee on the Professoriate 1988-90
Member, Program in Molecular and Genetic Medicine 1989-
Member, 23rd Senate of the Academic Council 1990-92
Member, Advisory Committee for Medical Free Electron Laser Center 1991-93
Member, School Planning Group, School of Humanities and Sciences 1991-93
Faculty Member, Graduate Training Program in Biotechnology 1994-
Howard H. and Jessie T. Watkins University Professor at Stanford 1997-02
Member, Stanford Comprehensive Cancer Center 2006-
The Dr. Morris Herzstein Professorship in Biology 2008-

III. Government Service and Advisory Committees

Physiological Chemistry Study Section, National Institutes of Health (NIH) 1966-70
Advisory Committee on Nucleic Acids and Protein Synthesis, American Cancer Society 1972-76
Chair, US National Committee, International Union of Pure and Applied Biophysics (IUPAB), ... 1969-75
IUPAB Commission on Education and Development 1975-80
Advisory Committee, Environmental Health Sciences Center, Univ. California, Berkeley 1976-83
Chair, cluster group on "Molecular Effects: Interactions with Chemicals and Viruses"
for Federal Strategy for Research into Biological Effects of Ionizing Radiation 1979-80
Advisory Committee on Low Dose Radiation Program for National Cancer Institute, USPHS 1980
Workshop on Mechanisms of Toxicity and Carcinogenicity for Congressional Task Force
on Environmental Cancer and Heart and Lung Disease 1981
Chemical Pathology Study Section, National Institutes of Health 1981-84
Scientific Advisory Board, Univ. Texas Cancer Center, Science Park, Smithville (Chair 1988-90) 1984-90

Pre-doctoral Fellowship Review Panel, National Science Foundation..... 1985
Board of Scientific Counselors, Division of Biometry and Risk Assessment, NIEHS.....1987-90
Visiting Committee, Brookhaven National Laboratory, Department of Biology, (Chair, 1992)..... 1987-92
Chair, Advisory Committee, Center for Environmental Health Sciences, MIT..... 1988-92
Outside Review Committee, NASA Center for Research and Training in Radiation Health
Lawrence Berkeley Laboratory - Colorado State University 1991-96
Advisory Committee on Biosciences and Biotechnology, Los Alamos National Laboratory, NM..... 1993-95
Special Review Committee, National Cancer Institute 1993
Scientific Advisory Board, Xenometrix Inc., Boulder, Colorado 1993-97
Chair, External Advisory Board, Environmental Health Sciences Center,
Sealy Center for Molecular Science, University of Texas Medical Branch, Galveston..... 1994-97
Outside Review Committee, Lawrence Berkeley Laboratory, University of California 1994
Scientific Advisory Board, Office of Environmental Health Hazard Assessment, CA-EPA 1994-98
External Advisory Committee, City of Hope Cancer Research Center, Duarte, CA.....1995-07
Toxicology Advisory Committee, The Burroughs-Wellcome Fund (Chair 1997-00)..... 1995-04
Scientific Advisory Board, Fogarty International Center , NIH..... 1995-99
Board on Radiation Effects Research, NAS/NRC Commission on Life Sciences..... 1995-98
Consultant, Wireless Technology Research, Ontario, Canada 1996
External Review Working Group , National Institute of Environmental Health Sciences, NIH. 1996-98
MRC Molecular/Cellular Medicine Board, Review of Cell Mutation Unit, Brighton, UK..... 1996
Outside Evaluation Committee, Medical Genetics Center, Southwest Netherlands 1996
NRC Committee on Health Risks of Low Levels of Ionizing Radiation, BEIR VII Phase I 1997-98
Council for Extramural Grants, American Cancer Society..... 1998-01
Board of Trustees, Oberlin College (Chair, Committee on Academic Affairs) 1998-07
External Advisory Board, Program on Structural Biology of DNA Repair, Lawrence Berkeley Lab... 2001-
External Visiting Committee, Department of Biological Sciences, Univ. Southern CA..... 2001
NICHD external site visit committee ……2001;2006
External review committee, Director of NIEHS 2001
Genetics Study Section Boundaries Team, Center for Scientific Review, NIH..... 2002
Abbott–ASM Lifetime Achievement Award Selection Committee, American Acad. of Microbiology2003-06
External Advisory Com. UT MD Anderson Cancer Ctr, TX, Prog. on Processing Complex Lesions 2004-07
Consultant, Achaogen Inc, South San Francisco, CA 2005
International Advisory Board, Chulabhorn Research Institute, Bangkok, Thailand 2005-
Special Conferences Committee, American Association for Cancer Research 2005-
Working Group, Integrated Translational Research on DNA Repair (NIEHS)……2006
NCI intramural site visit committee member, NIH……..2009

IV. Editorial Service

Board of Reviewing Editors: ***Science*** **..... 1995-01**
Managing Editor: ***DNA Repair (Mutation Research)*****..... 1982-93**
Senior Editor: ***Cancer Research*** ..... … **..current**
Editorial Board: ***Proceedings of the National Academy of Sciences U.S.A.*** **..... …...current**
Editorial Board: *Mechanisms of Ageing and Development* ……current
Editorial Board: *Cancer Research*, 1984-87; *Gene Expression* 1990-94;*Environ.Molec.Mutagen*……..… .1994-97
Associate Editor: *Environmental Health Perspectives,* ***Molecular Carcinogenesis*** **..... current**
Editorial Board: *Biotechniques(-2006)* ***DNA Repai****r; Genes and Environment (*Japanese EMS) ..... **current**
Honorary Editorial Board: *Libertas Academica; Translational OncoGenomics*……*2006-*
Editorial Board, *Aging*……current

V. Professional Recognition and Awards (from 1981)

Fellow, American Association for Advancement of Science.....1981
Inaugural Annual Lecture, Lord Dowding Fund for Humane Research, London.....1982
Spanish Academy of Science & Catalan Society for Biology Lectureship, Barcelona 1982
Annual Lectureship, "Frontiers in Biology," Case-Western Reserve University, Cleveland.....1986
Outstanding Investigator Research Award, National Cancer Institute..... 1987-1994; 1994-2001
Member, National Academy of Sciences, USA..... 1989
Distinguished Lecturer of NIEHS, 6th Annual H. L. Falk Memorial Lecture.....1990
Excellence in Teaching Award, Northern California Chapter, Phi Beta Kappa.....1991

Annual Award for Excellence in Basic Science, Environmental Mutagen Society.....1992
Peter and Helen Bing Award for Distinguished Teaching, Stanford University.....1992
Fellow, American Academy of Microbiology.....1993
Fogarty Senior International Fellowship, at the Imperial Cancer Research Fund Labs, U.K.....1993
President, Environmental Mutagen Society 1994
Annual Research Award, American Society for Photobiology.....1996
Second Severo Ochoa Memorial Honors Lecture, New York University.....1996
Chair, Gordon Conference on Mutagenesis.....1996
Honorary Doctor of Science, Oberlin College, Ohio.....1997
International Mutation Research Award for Excellence in Scientific Achievement..... 1997
Princess Takamatsu Cancer Foundation Annual Lectureship; Tokyo, Sendai & Kumamoto Japan.....1999
Partab Varandani Memorial Lecture, Wright State University.....1999
Chair, Gordon Conference on Mammalian DNA Repair.....1999
Inaugural John Abelson Family Lecture, Washington State University 2000
Senior Scholar Research Award, Ellison Medical Foundation 2001-05
Student Mentoring Award, Environmental Mutagen Society 2001
Elected Foreign Associate, European Molecular Biology Organization (EMBO).....2001
Honorary Member, German DNA Repair Network.....2002
John B. Little Award in Radiation Health Sciences, Harvard School of Public Health 2002
Sonneborn Lecture, Indiana University 2002
Rothschild-Yvette Mayent -Institut Curie Award and Lectureship, Paris 2003
Keynote Lecture, ASM Intl. Conference on DNA Repair and Mutagenesis, Southampton, Bermuda .2004
President/Organizer 9th International Conference on Environmental Mutagens, San Francisco 2005
Special Issue *Mutation Research* Vol.577 "Mechanisms of DNA Repair" dedicated to P.C.Hanawalt. 2005
***Doctor Honoris Caus*a, University of Bio Bio, Concepcion, Chile ……;;;;;…… .2006**
Centennial Lecture, AACR 100th Annual Meeting , Los Angeles…… …… 2007
Honorary Trustee of Oberlin College, Ohio…… …2007
Visiting Research Scholar, Frontier Biosciences Graduate School, Osaka University, Japan…….. 2007
Second Lawrence Grossman Lecture, Johns Hopkins University, Bloomberg School of Public Health…..2008
Elected Fellow of the American Academy of Arts and Sciences (AAAS)…… ……2008
***Doctor Honoris Causa*, University of Seville, Spain…… 2008**
Appointed to the Dr. Morris Herzstein Professorship in Biology at Stanford University……2008
Keynote Lecture, 10th International Conference on Environmental Mutagens, Florence, Italy……2009

VI. <u>Professional Societies</u>
American Academy of Arts and Sciences……2008
American Association for Advancement of Science (AAAS Fellow)
American Association for Cancer Research (AACR)
Program Committee: Chair, Biochemistry Section.....1990
Special Conferences Committee 1991-94: 2005-08
Board of Directors. .....…..1994-97
Chair, *Ad Hoc* Committee on Research Integrity and Ethics….....1994
American Society for Biochemistry and Molecular Biology
American Chemical Society
American Society for Microbiology (**Fellow, American Academy of Microbiology**)
American Society for Photobiology, Charter Member
Biophysical Society, Charter Member
Executive Board.....1969-71
Nominee for President.....1971
Environmental Mutagen Society (EMS)
Program Chair/President 1993-94
Chair, Future Directions Committee 1990-92
Council Member, and Member of Executive Board.....several terms
European Molecular Biology Organization, (EMBO) Associate Member……2001
Genetics Society of America
National Academy of Sciences of the United States of America……...1989-
Radiation Research Society
Sigma Xi

VII. Scientific Conferences Organized

Annual Meeting, Biophysical Society, New Orleans, Louisiana (Program Chair).....1971
Molecular Mechanisms for DNA Repair, Squaw Valley, CA (Organizer & Program Chair) 1974
DNA Replication and its Regulation, Squaw Valley, CA. (Co-chair with M. Goulian).....1975
DNA Repair Mechanisms, Keystone, Colorado (Co-chair with E. C. Friedberg).....1978
Chemical Carcinogenesis and Oncogenes, Chemical Pathology Study Section Workshop,
Steamboat Springs, Colorado (Co-organizer)..... 1984
Introduction and Expression of Genes in Eukaryotes, Biology Affiliates Symposium, Stanford Univ. 1985
Mechanisms and Consequences of DNA Damage Processing, Taos, New Mexico
(Co-chair with E. C. Friedberg) (Keystone Symposium).....1988
Genomic Instability and Cancer, Tamarron, Colorado
(Co-chair with C. Harris and J. Rowley) (Keystone Symposium)..... 1991
Cellular Responses to Environmental DNA Damage, Banff, Alberta, Canada
(Co-chair with M. Paterson) (AACR Special Conference in Honor of Richard Setlow).....1991
Annual Meeting, Environmental Mutagen Society, Norfolk, Virginia (Program Chair) 1993
Risk Assessment in Environmental Carcinogenesis, Whistler Resort, British Columbia
(Co-chair with J. Swenberg) (AACR/EMS Special Conference) 1994
Gordon Conference on Mutagenesis, Plymouth, New Hampshire (Vice Chair 1994) Chair..... 1996
Gordon Conference on Mammalian DNA Repair, Ventura, California (Vice Chair 1997) Chair.....1999
Chair, Panel on "DNA repair in the CNS," Winter Conf. on Brain Research, Breckenridge, CO..... . …..2000
President/Organizer, 9th International Conference on Environmental Mutagens, San Francisco.. …. .. 2005

VIII. Teaching

Thirty-one graduate students have completed their dissertations in Hanawalt's laboratory; over 70 postdoctoral research associates, fellows and visiting senior scientists have participated in Hanawalt's research program at Stanford since 1962. The laboratory has maintained an international flavor over the years, with **participants from 34 different countries**.

Courses taught at Stanford University (current courses in **bold type**):
Molecular Biophysics, graduate level
DNA Repair and Genomic Stability, graduate lecture course (BioSci 205)
DNA Replication, upper division seminar course (BioSci 134)
Highlights in Photobiology, graduate & upper division lecture course
Molecular Biology, undergraduate core lecture course
Cell Physiology, undergraduate core lecture course
Seminar in DNA Repair and Genetic Toxicology (BioSci 305)
Freshman Seminar, Maintenance of the Genome (BioSci 026)
New course being organized to replace BioSci205 and BioSci134; **Replication and Maintenance of DNA**

IX. Principal Research Accomplishments

As a graduate student, Hanawalt initiated studies in the laboratory of R. B. Setlow at Yale University to provide quantitative assessment of the inhibitory effects of ultraviolet light (UV) on DNA synthesis in *E. coli* and to suggest that "recovery mechanisms can eventually restore the DNA synthesis. . . .". He also showed that photoreactivation reduced the lag in recovery of DNA synthesis in UV-irradiated cells. That work led a few years later to his co-discovery of DNA excision-repair. During postdoctoral study (with O. Maaløe in Copenhagen) he discovered that protein synthesis is required to initiate the bacterial DNA replication cycle. That work was essential to the formulation of the "replicon" concept in the early 1960s and it led to a standard procedure for synchronizing DNA replication cycles.

Hanawalt has been a productive researcher in the field of DNA repair since his pioneering discovery of repair replication in *E. coli* in 1963. He also first demonstrated repair replication in mycoplasmata and in a eukaryote (Tetrahymena), and he has developed a number of important experimental approaches for studying repair, beginning with the BrdUrd density labeling method for resolving semiconservatively replicated DNA from parental DNA containing repair patches. Hanawalt's approach was used by James Cleaver in 1968 to document a DNA repair defect in xeroderma pigmentosum (XP) (the first example of a human disease with DNA repair defect). The method was also used to validate the widely-used phenomenon

of unscheduled DNA synthesis as a measure of DNA repair. Other significant research contributions from Hanawalt's laboratory have included: the demonstration of preferential mutagenesis by N-methyl nitrosoguanidine at DNA replication forks and its application to mapping genes; early evidence for membrane association of DNA replication complexes in *E. coli* and in mammalian cells; discovery of long-patch excision-repair in *E. coli* and the demonstration that it is an inducible component of the RecA-LexA (SOS) regulatory circuit; discovery of a gene controlling nucleoside uptake in *E. coli*; development of permeabilized bacterial and mammalian cell systems to study excision-repair pathways by complementation analysis; demonstration of enhanced survival of UV irradiated Simian Virus 40 upon treating the host cells with low doses of UV or chemical carcinogens; discovery that the repair enzyme, T4 endonuclease V, operates processively on damaged DNA; discovery that certain types of damage in transfecting plasmid DNA markedly enhances the efficiency of stable transformation in human cells; and the discovery that UV irradiation of short sequences of nucleotides can result in their ligation through pyrimidine dimerization, providing a plausible mechanism for prebiotic assembly of high molecular weight duplex DNA.

In 1982 Hanawalt and his colleagues reported the first example of intragenomic DNA repair heterogeneity: chemical adducts in the highly-repetitive alpha DNA sequences in African green monkey kidney cells were not as efficiently repaired as in the genome overall. In 1983 Mansbridge and Hanawalt discovered that cells from XP-complementation group C only repair limited genomic domains, now known to be expressed genes. Hanawalt and his colleagues discovered that repair of some types of damage is selective; active genes are preferentially repaired, and in fact a special repair pathway, termed transcription-coupled repair (TCR), operates to remove transcription blocking lesions from the transcribed strands of expressed genes. Hanawalt and his students documented TCR in mammalian cells, in *E. coli*, and in yeast chromosomal and plasmid borne genes. The discovery of TCR in Hanawalt's laboratory has had profound implications for the fields of mutagenesis, environmental carcinogenesis, aging, and risk assessment.

The prototype *recQ* gene was discovered in *E. coli* in Hanawalt's laboratory, and we now know of five homologues in humans including the genes mutated in the cancer prone hereditary diseases: Bloom's syndrome, Werner's syndrome, and Rothman Thompson syndrome. In *E. coli* the RecQ helicase was shown to play an important role in the accurate recovery of arrested replication forks. It also provides a key to understanding the classic phenomenon of thymineless death, by which the gene was first identified.

More recent studies have focused upon the regulation of TCR and the global genomic nucleotide excision repair (GGR) pathway. Features of the TCR pathway (that is defective in Cockayne syndrome) include the possibility of "gratuitous TCR" at transcription pause sites in undamaged DNA. The GGR pathway was shown to be controlled through the SOS stress response in *E. coli* and through the activated product of the *p53* tumor suppressor gene in human cells. These regulatory systems particularly affect the efficiency of repair of the predominant UV-induced photoproduct, the cyclobutane pyrimidine dimer, as well as that of chemical carcinogen DNA adducts, such as benzo(a)pyrene diol-epoxide and benzo(g)chrysene. Rodent cells (typically lacking the *p53*-controlled GGR pathway) and tumor virus infected human cells (in which *p53* function is abrogated) are unable to carry out efficient GGR of some lesions. Therefore, caution should be exercised in the interpretation of results from such systems for risk assessment in genetic toxicology.

A recent research contribution was the surprising discovery by Thierry Nouspikel in Hanawalt's laboratory that the attenuated GGR observed in terminally differentiated human cells, is in fact a consequence of reduced activity of the E1 ubiquitin activating enzyme. Thus, E1 levels control excision repair, and E1 may operate as a "master switch" to regulate classes of genes during terminal differentiation. This has profound implications for our understanding of DNA repair regulation, and the possibility of modulating the repair response in tumors of patients undergoing chemotherapy.

Current research efforts focus upon naturally occurring non-canonical DNA structures as encumbrances to transcription and the likelihood of gratuitous TCR.

Another area of current research interest is the molecular bases of the DNA repair defects in patients with Cockayne syndrome(CS) and UV-sensitive syndrome (UVSS). Unlike XP, the patients with CS or UVSS, although sunlight sensitive, do not develop cancers of any type. Graciela Spivak in Hanawalt's group has shown that although both CS and UVSS cell are deficient in TCR of UV-induced DNA damage, only CS appears to be defective in the repair of oxidative DNA damage. The severe developmental and neurological problems in CS may be a consequence of defective processing of endogenous oxidative DNA lesions.

X. Selected Publications (467 total, including those from Hanawalt's group without coauthorship)

Hanawalt PC "Use of Phosphorous-32 in Microassay for Nucleic Acid Synthesis in *E. coli" Science 130:*386-387 (1959) **First Publication.**

Hanawalt PC, Buehler J "Photoreactivation of Macromolecular Synthesis in *E.coli*" Biochim Biophys Acta 37: 141-143 (1960)

Hanawalt PC, Setlow RB "Effect of Monochromatic UV on Macromolecular Synthesis in *E. coli" Biochim Biophys Acta 41:*283-294 (1960)

Maaloe O, **Hanawalt** PC "Thymine deficiency and the normal DNA replication cycle I" *J Mol Biol* 3:144-155 (1961)

Hanawalt PC, Maaløe O, Cummings D and Schaecter M "The Normal DNA Replication Cycle II" *J Mol Biol* 3:156-165 (1961)

Pettijohn D, **Hanawalt** PC "Deoxyribonucleic Acid Replication in Bacteria Following Ultraviolet Irradiation" *Biochim Biophys Acta* 72:127-129 (1963)

Hanawalt PC ,Ray D "Isolation of the Growing Point in the Bacterial Chromosome" *Proc Natl Acad Sci USA* 52:125-132 (1964)

Pettijohn D ,**Hanawalt** PC "Evidence for Repair Replication of Ultraviolet Damaged DNA in Bacteria" *J Mol Biol* 9:395-410 (1964)

Hanawalt PC, Haynes R "Repair Replication of DNA in Bacteria: Irrelevance of Chemical Nature of Base Defect" *Biochem Biophys Res Comm 19:*462-467 (1965)

Pauling C, **Hanawalt** PC "Nonconservative DNA Replication in Bacteria After Thymine Starvation" Proc Natl Acad Sci USA 54:1728-1735 (1965)

Hanawalt PC "The UV Sensitivity of Bacteria: Its Relation to the DNA Replication Cycle" *Photochem Photobiol 5:*1-12 (1966)

Cerda-Olmedo E**, Hanawalt** PC **"**Repair of DNA damaged by N-Methyl-N'nitro-N-nitrosoguanidine in *E.col***i"** *Mut. Res***.** 4:369-371 (1967)

Hanawalt PC "Normal Replication of DNA Following Repair Replication in Bacteria" *Nature* 214:269-270 (1967)

Brunk C, **Hanawalt** PC "Repair of Damaged DNA in a Eucaryotic Cell: *Tetrahymena pyriformis" Science 158:*663-664 (1967)

Hanawalt PC, Haynes R "The Repair of DNA" *Scientific American* 216:36-43 (1967)

Cerda-Olmedo E, **Hanawalt** PC and Guerola N "Mutagenesis of the Replication Point by Nitrosoguanidine: Map and Pattern of Replication of the *Escherichia coli* Chromosome" *J Mol Biol* 33:705-719 (1968)

Newman J, **Hanawalt** PC "Role of Polynucleotide Ligase in T4 DNA Replication" *J Mol Biol 35:*639-642 (1968)

Hanawalt PC "Repair of Genetic Material in Living Cells" *Endeavor* 31:83-87 (1972)

Hanawalt PC, Pettijohn DE, Pauling CE, Brunk CF, Smith DW, Kanner LC and Couch JL "Repair Replication of DNA *in vivo" Symposia on Quantitative Biology XXXIII* pp 187-194 Cold Spring Harbor (1968)

Cooper PK, **Hanawalt** PC "Role of DNA Polymerase I and the Rec System in Excision-Repair in *E. coli*" *Proc Natl Acad Sci USA* 69:1156-1160 (1972)

Edenberg H, **Hanawalt** PC "Size of Repair Patches in the DNA of Ultraviolet Irradiated HeLa Cells" *Biophys Biochim Acta 272:*361-372 (1972)

McKeown M, Kahn M, **Hanawalt** PC "Thymidine Uptake and Utilization in *E. coli*: A New Gene Controlling Nucleoside Transport" *J Bact* 126:814-822 (1976)

Little J, **Hanawalt** PC "Induction of Protein X in *Escherichia coli" Molecular Gen Genetics 150:*237-248 (1977)

Sarasin AR, **Hanawalt** PC "Carcinogens Enhance Survival of UV-irradiated Simian Virus 40 in Treated Monkey Kidney Cells: Induction of a Recovery Pathway?" *Proc Natl Acad Sci USA* 75:346-350 (1978)

Smith CA, **Hanawalt** PC "Phage T4 Endonuclease V Stimulates DNA Repair Replication in Isolated Nuclei from Ultraviolet-irradiated Human Cells, Including Xeroderma Pigmentosum Fibroblasts" *Proc Natl Acad Sci USA* 75:2598-2602 (1978)

Hanawalt PC, Cooper PK, Ganesan AK, Smith CA "DNA Repair in Bacteria and Mammalian Cells" *Ann Review of Biochemistry* 48:783-836 (1979)

Sarasin AR, **Hanawalt** PC "Replication of Ultraviolet Irradiated Simian Virus 40 in Monkey Kidney Cells" *J Mol Biol* 138:299-319 (1980)

Lloyd RS, **Hanawalt** PC, Dodson ML "Processive Action of T4 Endonuclease V on Irradiated DNA" *Nucl Acids Res* 8:5113-5127 (1980)

Lewis RJ, **Hanawalt** PC “Ligation of Oligonucleotides by Pyrimidine Dimers - A Missing ‘Link’ in the Origin of Life?” *Nature* 298:393-396 (1982)
Zolan ME, Smith CA, Calvin NM, **Hanawalt** PC “Rearrangement of mammalian chromatin structure following excision repair” *Nature 299:*462-464 (1982)
Zolan ME, Cortopassi GA, Smith CA , **Hanawalt** PC “Deficient Repair of Chemical Adducts in Alpha DNA of Monkey Cells” *Cell* 28:613-619 (1982)
Mansbridge JN, **Hanawalt** PC “Domain-Limited Repair of DNA in Ultraviolet Irradiated Fibroblasts from Xeroderma Pigmentosum Complementation Group C” In Cellular Responses to DNA Damage, (eds EC Friedberg and BR Bridges) UCLA Symp on Mol and Cellu Biol New Series Vol II pp 195-207 Alan R. Liss, Inc., New York (1983)
Spivak G, Ganesan AK, **Hanawalt** PC “Enhanced Transformation of Human Cells by UV-Irradiated pSV2 Plasmids” *Mol Cellu Biol* 4:1169-1171 (1984)
Nakayama H, Nakayama K, Nakayama R, Irino N, Nakayama Y, **Hanawalt** PC “Isolation and Genetic Characterization of a Thymineless Death-resistant Mutant of *Escherichia coli* K-12: Identification of a New Mutation (recQ1) that Blocks the RecF Recombination Pathway” *Mol Gen Genet* 195:474-480 (1984)
Bohr VA, Smith CA, Okumoto DS, **Hanawalt** PC “DNA Repair in an Active Gene: Removal of Pyrimidine Dimers from the DHFR Gene of CHO Cells is Much More Efficient Than in the Genome Overall” *Cell* 40:359-369 (1985)
Madhani HD, Bohr VA, **Hanawalt** PC “Differential DNA Repair in Transcriptionally Active and Inactive Protooncogenes: c-abl and c-mos” *Cell* 45:417-422 (1986)
Hanawalt PC, Sarasin A “Cancer-Prone Hereditary Diseases with DNA Processing Abnormalities” *Trends in Genetics* 2:124-129 (1986)
Vos J-M, **Hanawalt** PC “Processing of Psoralen Adducts in an Active Gene: Repair and Replication of DNA Containing Monoadducts and Interstrand Crosslinks” *Cell* 50:789-799 (1987)
Mellon I, Spivak G, **Hanawalt** PC “Selective Removal of Transcription Blocking DNA Damage from the Transcribed Strand of the Mammalian DHFR Gene” *Cell* 51:241-249 (1987)
Bohr VA, Phillips DH, **Hanawalt** PC “Heterogeneous DNA damage and repair in the mammalian genome” *Cancer Research 47:*6426-6436 (1987)
Scicchitano D, **Hanawalt** PC “Repair of N-methylpurines in specific DNA sequences in CHO cells: Absence of Strand Specificity in the DHFR gene” *Proc Natl Acad Sci USA* 86:3050-3054 (1989)
Mellon I, **Hanawalt** PC "Induction of the *Escherichia coli* lactose operon selectively increases repair of its transcribed DNA strand" *Nature* 342:95-98 (1989)
Ljungman M, **Hanawalt** PC "Efficient protection against oxidative DNA damage in chromatin" *Molecular Carcinogenesis* 5:264-269 (1992)
Ljungman M, **Hanawalt** PC "Localized torsional tension in the DNA of human cells" *Proc Natl Acad Sci USA* 89:6055-6059 (1992)
Spivak G, **Hanawalt** PC "Translesion DNA synthesis in the DHFR domain of UV-irradiated CHO cells" *Biochemistry* 31:6794-6800 (1992)
Sweder KS, **Hanawalt** PC "Preferential repair of cyclobutane pyrimidine dimers in the transcribed DNA strand in yeast chromosomes and plasmids is dependent upon transcription" *Proc Natl Acad Sci USA* 89:10696-10700 (1992)
Hanawalt PC, Mellon I "DNA Repair: Stranded in an active gene" *Current Biology* 3(1):67-69 (1993)
Christians FC, **Hanawalt** PC "Lack of transcription-coupled repair in mammalian ribosomal RNA genes" *Biochemistry* 32:10512-10518 (1993)
Hanawalt PC, Donahue BA, Sweder KS "Repair and transcription: Collision or collusion?" *Current Biology* 4:518-521 (1994)
Donahue BA, Yin S, Taylor J-S, Reines D, **Hanawalt** PC "Transcript cleavage by RNA polymerase II arrested by a cyclobutane pyrimidine dimer in the DNA template" *Proc Natl Acad Sci USA* 91:8502-8506 (1994)
Lommel L, Carswell-Crumpton C, **Hanawalt** PC "Preferential repair of the transcribed DNA strand in the dihydrofolate reductase gene throughout the cell cycle in UV-irradiated human cells" *Mutation Research: DNA Repair* 336:181-192 (1995)
Hanawalt PC "Transcription-coupled repair and human disease" "Perspective" *Science* 266:1957-1958 (1994)
Hanawalt PC "DNA repair comes of age" *Mutation Research: DNA Repair* 336:101-113 (1995)
Eisen JA, Sweder KS, **Hanawalt** PC "Evolution of the SNF2 family of proteins: Subfamilies with distinct sequences and functions" *Nucl Acids Res* 23:2715-2723 (1995)

Ford JM, **Hanawalt** PC "Li-Fraumeni syndrome fibroblasts homozygous for p53 mutations are deficient in global DNA repair but exhibit normal transcription-coupled repair and enhanced UV-resistance" *Proc Natl Acad Sci USA* 92:8876-8880 (1995)
Donahue BA, Fuchs RPP, Reines D, **Hanawalt** PC "Effects of aminofluorene and acetylaminofluorene DNA adducts on transcriptional elongation by RNA polymerase II" *J Biol Chem* 271:10588-10594 (1996)
Koehler DR, **Hanawalt** PC "Recruitment of damaged DNA to the nuclear matrix in hamster cells following ultraviolet irradiation" *Nucl Acids Res* 24:2877-2884 (1996)
Satoh MS, **Hanawalt** PC "TFIIH mediated nucleotide excision repair and initiation of m-RNA transcription in an optimized cell-free DNA repair and RNA transcription assay" *Nucl Acids Res* 24:3576-3582 (1996)
Courcelle J, Carswell-Crumpton C, **Hanawalt** PC "recF and recR are required for the resumption of replication at DNA replication forks in *Escherichia coli" Proc. Natl. Acad. Sci*. 94:3714-3719 (1997)
Liu S-K, Tseng J-N, Shiuan D, **Hanawalt** PC, "Preferential mutagenesis of lacZ integrated at unique sites in the *Escherichia coli* chromosome" *Molec. Gen. Genet*. 255:449-459 (1997)
Satoh MS, **Hanawalt** PC "Competent transcription initiation by RNA polymerase II in cell-free extracts from xeroderma pigmentosum groups B and D in an optimized RNA transcription assay" *Biochim Biophys Acta*. 1354:241-251 (1997)
Ford JM, **Hanawalt** PC "Expression of wild type p53 is required for efficient global nucleotide excision repair in UV-irradiated human fibroblasts" *J Biol Chem* 272:28073-28080 (1997)
Tornaletti S, Donahue BA, Reines D, **Hanawalt** PC "Nucleotide sequence context effect of a cyclobutane pyrimidine dimer upon RNA polymerase II transcription" *J Biol Chem*. 272:31719-31724 (1997)
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XI. Invited Lectures (2002 – present)

January	2002	Seminar, University of Arizona, Tucson "Inducible Nucleotide Excision Repair"
March	2002	Plenary lecture, Keystone Symposium on "DNA helicases, cancer and aging" Granlibakken, CA.
March	2002	Seminar, Yale University, "Regulating DNA repair in bacteria and humans"
April	2002	Symposium Co-organizer/Speaker, Environmental Mutagen Society, Anchorage, Alaska
April	2002	Videoconference/Seminar, Biotechnology Research Program, Lawrence Livermore National Laboratory "Half a century of DNA repair: an historical perspective"
May	2002	Seminar, UC Davis "Regulating excision repair in human cells"
June	2002	COE International Symposium on "Replication, maintenance and expression of genomic information" – lecture on "Transcription-coupled DNA repair," Osaka, Japan
June	2002	Seminar, Tokoku University, Sendai, Japan
July	2002	Lecture in Ellison Medical Foundation course on the Molecular Biology of Aging," DNA repair in terminal differentiation and aging" Woods Hole, MA
July	2002	Keynote Lecture and Chair of opening session, Gordon Conference on Mutagenesis, Bates College, Lewiston, Maine
July	2002	Symposium lecture, American Society for Photobiology, Quebec, Canada
July	2002	Seminar, Laval University, Quebec
September	2002	Seminar, Institute of Toxicology, University of Mainz, Germany
September	2002	Keynote Lecture, German DNA Repair Network Annual Mtg, Karlsruhe, Germany
October	2002	Lecture, EMBO Mtg. On "Frontiers of Molecular Biology," Oslo Norway
October	2002	Keynote Lecture, Conference on Structure and Function of the Cell Nucleus, Russian Acad. of Science, St. Petersburg, Russia
November	2002	Award Lecture, J.B. Little 5th Annual Symposium. "Cell signaling in radiobiology and carcinogenesis
November	2002	Seminar, Graduate Center for Toxicology, University of Kentucky, Lexington
November	2002	The Annual Sonneborn Lecture, University of Indiana, Bloomington
January	2003	Speaker, Chemical Pathology Study Section (NIH) Workshop, Ventura, CA
January	2003	Session Chair and Speaker, Gordon Conference on Mutagenesis, Ventura, CA
May	2003	Opening Lecture, "Conference on Fundamental Aspects of DNA repair and Mutagenesis" University of Sao Paulo, Brazil
May	2003	Plenary Lecture, 4th International Conf. On Environmental Mutagens in Human Populations, Florianopolis, Brazil
May	2003	Keynote Lecture, 5th Annual Midwest DNA Repair Symposium, Mayo Clinic, Rochester, MN
July	2003	Symposium Co-chair, 19th Int. Congress of Genetics, Melbourne, Australia
August	2003	Keynote Speaker, Gordon Conf. on Genetic Toxicology, Queens College, Oxford, U.K.
September	2003	Keynote Speaker, Conference on "Transformation and DNA repair," Oslo Norway
Sept-Dec	2003	Lecture series on "DNA Repair and Cancer," Curie Institute, Paris, France
October	2003	Plenary Lecture, 8th Int Conf. On Mechanisms of Antimutagenesis and Anticarcinogenesis, Pisa, Italy
November	2003	Participant, Nineteenth Annual Forbeck Forum, on "DNA Damage and Cancer Susceptibility Syndromes," Hilton Head, S.C

February	2004	Keynote Lecture: 4th Intl. Conf. On Unstable Microsatellites and Human Disease, Banff Centre, Alberta, Canada
April	2004	Seminar: UCLA, Molecular Toxicology
May	2004	Seminars: Texas A&M Univ., MD Anderson Cancer Ctr., Houston; and Science Park – Research Division
May	2004	Speaker: Conference on Cockayne syndrome and related disorders, Natl. Conf Ctr, Virginia
June	2004	Speaker: U.S.-Japan DNA repair meeting, Hawaii
June	2004	Symposium organizer/speaker: 14th Int. Cong. Photobiology, Jeju, Korea
August	2004	Discussion Leader, Burroughs-Welcome Fund Summer Conference on "Coexistence and Collisions at the host/microbe interface", Clearwater Beach, Florida
August	2004	Plenary Lecture, 5th Princess Chulabhorn Int. Science Congress "Evolving Genetics and its Global Impact" Bangkok, Thailand
September	2004	Plenary Lecture, Mtg. on Germ Cell Mutagenesis, Bar Harbor, Maine
November	2004	Keynote Address, ASM Conference on "DNA Repair and Mutagenesis: From Molecular Structure to Biological Consequences," Southampton, Bermuda
May	2005	Educational Lecture, American Society for Clinical Oncology (ASCO) Annual Mtg, Orlando, FL
September	2005	Keynote Lecture, 9th Int. Conference on Environmental Mutagens, San Francisco, CA
		Lecturer, CMB/Genetics Short Course, Radiation Oncology, Univ.Michigan, Ann Arbor
October	2005	Keynote Lecture, VI Latin American Congress on Environmental. Mutagenesis, Carcinogenesis and Teratogenesis, Mendoza, Argentina
Nov-Dec	2005	Plenary Lecture/Session Chair, 2nd EU-US DNA Repair Mtg, Erice, Sicily
March	2006	Session Chair/ Discussion Leader, Gordon Conference on "DNA damage mutagenesis and cancer", Ventura, CA.
April	2006	Chair of Opening Session, "DNA repair: from molecular mechanism to human disease" (Noordwijkerhout, The Netherlands
May	2006	Plenary Lecture, Memorial Symposium on DNA Repair (in honor of Erling Seeberg), Lofoten Islands, Norway
October	2006	Short Course lectures on DNA Repair, Montevideo, Uruguay
October	2006	Lectures in an Alexander Hollaender Course on Enviromental Mutagenesis and DNA Repair, University of Bio Bio, Concepcion, Chile
November	2006	Keynote Lecture for Japanese Environmental Mutagen Society Annual Meeting, Sakai, Japan: followed by seminars in Osaka and Sendai.
February	2007	Session chair and speaker, Gordon Conference on Mammalian DNA Repair, Ventura,CA
April	2007	Centennial Lecture, AACR Annual Meeting, Los Angeles, CA
July	2007	Seminar, Dept Biochemistry, Baylor University, Houston, TX
September	2007	Symposium lecture, Oregon Health Sciences University, Portland, Oregon
October	2007	Symposium lecture, Kyushu University, Fukuoka, Japan
November	2007	Lecture series, Graduate School of Frontier Biosciences, Osaka University, Japan
	2007	Plenary Lecture, Princess Chulabhorn Science Congress, Bangkok, Thailand
January	2008	Second Lawrence Grossman Lecture, Johns Hopkins University, Baltimore
		Seminar, Molecular Gerontology Dept., National Institute on Aging , Baltimore
June	2008	Session Chair,2nd Intl. Genome Dynamics and Neuroscience Conf.,Asilomar, CA
		Symposium speaker, Annual Mtg, American Soc. Photobiology, Burlingame, CA
July	2008	Workshop lecture, FASEB conf. on DNA palindromes…structurally ambivalent DNA
September	2008	Plenary Lecture, Brazilian Genetics Congress, Salvador, Brazil
May	2009	Keynote Lecture, 11th Annual Midwest DNA Repair Symposium, Ann Arbor, MI
June	2009	Keynote Lecture, Symp. on DNA Repair and Human Health, Ctr for Integrative Genetics, Lausanne, Switzerland
		Co-Chair and Speaker, 15th International Congress on Photobiology Dusseldorf, Germany
August	2009	Session Co-Chair/Speaker, Gordon Conference on Genetic Toxicology, New London, NH
		Keynote Lecture, 10th Int. Conference on Environmental Mutagens, Firenze, Italy
September	2009	Session Chair/Speaker, International workshop on Cockayne syndrome, Boston, MA

XII. Current Research Support

Role of Transcription in Genomic Stability

2R01 CA77712 - 11A1 Hanawalt (PI) 04/01/09 - 01/31/14 NCI, NIH
To characterize unique features of the transcription complex encountering different impediments (non-canonical DNA structures and lesions) to learn precise signals for transcription-coupled repair, and possible gratuitous repair. We will attempt to reconstitute transcription coupled DNA repair with purified proteins and complexes.

Completed Research

Role of RNA Polymerase II in DNA Repair
R01 CA77712-1 Hanawalt (PI) 04/01/03-03/31/08: No-cost extension through 07/31/08.
2R56 CA077712-11 Hanawalt (PI) 08/01/08-03/31/09: NIH Director's Bridging Support

Transcription-coupled DNA Repair and Human Disease
R01 CA90915-05 Hanawalt (PI) 01/28/02-12/31/06: No-cost extension through 12/31/08.

Transcription-coupled DNA Repair in *E. coli*
RO1 CA91456-05 Hanawalt (PI) 01/28/02-12/31/06: No-cost extension through 12/31/08

The Ellison Medical Foundation Senior Scholar Award
DNA Repair in Human Neurons
AG-SS-0550-00 Hanawalt (PI) 01/01/01-12/31/04:

NIH/National Cancer Institute -- Outstanding Investigator Grant (OIG)
Cellular Processing of Damaged DNA: Role in Oncogenesis
5R 35 CA44349 Hanawalt (PI) 06/01/87-03/31/01: No-cost extension through 11/30/01

NIH/Fogarty International Research Collaboration Award (FIRCA)
Domain Organization of DNA Repair in Human Cells
R03 TW001385-03 Hanawalt (PI) 06/01/00-08/31/03:

XIII. Personal Data

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