

PHILIP C. HANAWALT
Curriculum Vitae

(December 2015)

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
Calif. Inst. Technology, Pasadena, CA.....	Postdoctoral.....	Molecular Biology & Genetics.. 1960-61

II. Appointments – Stanford University, CA

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	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 <i>ad hoc</i> 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
Member, Faculty Council, School of Humanities and Sciences	1992-94
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.....	2009-17

III. Government Service and Advisory Committees

Physiological Chemistry Study Section, National Institutes of Health (NIH).....	1966-70
Chair, U.S. National Committee, International Union of Pure and Applied Biophysics (IUPAB),	1969-75
Advisory Committee on Nucleic Acids and Protein Synthesis, American Cancer Society	1972-76
IUPAB Commission on Education and Development in Biophysics.....	1975-80
Advisory Committee to Bruce Ames, Environmental Health Sci. Ctr., Univ. California, Berkeley	1976-83
Chair, “Molecular Effects: Interactions with Chemicals and Viruses”, Conference on 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 (NIH).....	1981-84
Scientific Advisory Board, Univ. Tx. 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, Department of Biology, Brookhaven National Laboratory, (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, NIH.	1993
Scientific Advisory Board, Xenometrix Inc., Boulder, Colorado	1993-98
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, California 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, Prog. on Structural Biology of DNA Repair, Lawrence Berkeley Lab	2001-
External Visiting Committee, Department of Biological Sciences, Univ. Southern CA	2001
External site visit committee, National Institute on Child Health and Development, NIH	2001; 06
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. Microbiology	2003-06
External Advisory Com. 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	2005-10
Special Conferences Committee, American Association for Cancer Research	2005-10
Working Group, Integrated Translational Research on DNA Repair (NIEHS)	2006
Intramural site visiting committee member, National Cancer Institute, NIH.....	2009
External Examiner, Biotech. Prog., Universiti Tunku Abdul Rahman, Kuala Lumpur, Malaysia.....	2010-13
External Reviewer for Cancer Research UK (Quinquennial Review)	2010
Fulbright Specialist Grant to teach course in "Genomic Maintenance", Santa Fe, Argentina	2014
Fulbright Specialist Grant to teach in Hollaender Course in "Genetic Toxicology", La Paz, Bolivia	2015

IV. Editorial Service

Co-Founding Editor & Managing Editor: DNA Repair Reports (Mut.Res.), Now: DNA Repair	1982-93
Board of Reviewing Editors: Science	1995-01
Senior Editor: Cancer Research	2003-10
Editorial Board: Proceedings of the National Academy of Sciences, U.S.A. (since 2003)	current
Assoc. Editor: DNA Repair, Special Issues, "Cutting Edge Perspectives in Genomic Maintenance"	2013-
Editorial Board: <i>Mechanisms of Ageing and Development; Aging</i>	current
Editorial Board: <i>Cancer Research 1984-87; Gene Expression 1990-94; Environ.Molec.Mutagenesis</i>	1994-97
Editorial Board: Biotechniques (-2006); Genes and Environment (Japanese EMS)	current
Associate Editor: Environmental Health Perspectives (-2008) Molecular Carcinogenesis	current
Honorary Editorial Boards: <i>Libertas Academica; Translational OncoGenomics</i>	current

V. Professional Recognition and Awards

Honorable Mention, 8th Westinghouse National Science Talent Search	1949
Merit Membership Award, Michigan Academy of Science, Arts and Letters (attained one of highest scores of Michigan physics students in Westinghouse competition)	1949
District Champion in Oratory, Michigan High School Forensic Association Contest	1949
Postdoctoral Research Fellowship, National Institutes of Health	1958-59

Postdoctoral Research Fellowship, American Cancer Society	1960
Elected 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, NIH	1987-1994; 1994-2001
Elected Member, National Academy of Sciences, U.S.A	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 (EMS)	1992
Peter and Helen Bing Award for Distinguished Teaching, Stanford University	1992
Elected 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 Research 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 Lectureship; Tokyo, Sendai & Kumamoto, Japan	1999
Partab Varandani Memorial Lecture, Wright State University, Ohio	1999
Chair, Gordon Research Conference on "Mammalian DNA Repair"	1999
Inaugural John Abelson Family Lecture, Washington State University, Pullman, WA.....	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
Elected Honorary Member, German DNA Repair Network.....	2002
John B. Little Award in Radiation Health Sciences, Harvard University School of Public Health	2002
Sonneborn Lecture, Indiana University	2002
Rothschild-Yvette Mayent-Institut Curie Award and Lectureship, Paris, France	2003
Keynote Lecture, ASM International Conference on DNA Repair and Mutagenesis, Bermuda	2004
President/Organizer 9th International Conference on Environmental Mutagens, San Francisco	2005
Special Issue Mutation Research V.577 "Mechanisms of DNA Repair" dedicated to P.C.Hanawalt	2005
Doctor Honoris Causa, University of Bio Bio, Concepcion, Chile	2006
Centennial Lecture, AACR 99th 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, 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 ...	2009-17
Keynote Lecture, 10th International Conference on Environmental Mutagens, Florence, Italy	2009
Three publications selected for Journal of Biological Chemistry Centennial "Classics Series"	2010
AACR - Princess Takamatsu Lectureship Award, presented at Orlando, Florida	2011
Keynote Lecture, 3rd Erling Seeberg Symposium on DNA Repair, Trondheim & Ørland, Norway	2012
Doctor Honoris Causa, University of Buenos Aires, Argentina	2012
Plenary Lecture, 11th Int. Conf. on Environmental Mutagens, Foz du Iguassu, Brazil	2013
Chair, Gordon Research Conference on "DNA Damage, Mutation and Cancer", Ventura, CA	2014
Allan V. Cox Medal for Faculty Excellence Fostering Undergraduate Research at Stanford University	2014
Appointed to Fulbright Specialist Roster, Council for International Exchange of Scholars (CIES)	2014
Keynote Lecture in Opening Session, 16th Int. Congress on Photobiology, Cordoba, Argentina	2014
Doctor Honoris Causa, National University of El Litoral, Santa Fe, Argentina	2014
Wilbur Cross Medal, from the Yale University Graduate School Alumni Association	2015
Doctor Honoris Causa, Universidad Mayor de San Andres, La Paz, Bolivia	2015

VI. Professional Societies

American Academy of Arts and Sciences (Elected Fellow)	2008
American Association for Advancement of Science (Elected Fellow),	1981
American Association for Cancer Research (AACR)	
Program Committee: Chair, Biochemistry Section.....	1990
Special Conferences Committee	1991-94; 2005-'08
Board of Directors	1994-1997

Chair, <i>Ad Hoc</i> Committee on Research Integrity and Ethics.....	1994
American Society for Biochemistry and Molecular Biology (ASBMB)	
American Chemical Society	
American Society for Microbiology (Elected ASM Fellow)	1993
American Society for Photobiology, Charter Member,	1972
Biophysical Society, Charter Member,	1957
Executive Board.....	1969-71
Program Chair for Annual Meeting, Nominee for president	1971
Environmental Mutagen Society (Now: Environmental Mutagenesis and Genomics Society)	1987
Chair, Future Directions Committee.....	1990-92
Program Chair/President	1993-94
Council Member, and Member of Executive Boardseveral terms
Chair, Alexander Hollaender Outreach Committee	2011-14
European Molecular Biology Organization (EMBO), Elected Associate Member	2001
Genetics Society of America	
National Academy of Sciences of the United States of America, Elected Member	1989
Radiation Research Society	
Sigma Xi	

VII. *Scientific Conferences Organized*

Biophysical Society Annual Meeting, New Orleans, Louisiana (Program Chair)	1971
First International Workshop on "Molecular Mechanisms for DNA Repair", Squaw Valley, CA (ICN-UCLA conference) (Organizer and Program Chair)	1974
DNA Replication and its Regulation, Squaw Valley, (ICN-UCLA), CA. (Co-chair with M. Goulian)	1975
DNA Repair Mechanisms, Keystone Symposium, 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 Symp., Stanford (Organizer) ..	1985
Mechanisms and Consequences of DNA Damage Processing, Keystone Symposium, Taos, NM (Co-chair with E. C. Friedberg).....	1988
Genomic Instability and Cancer, Keystone Symposium, Tamarron, Colorado (Co-chair with Curt Harris and Janet Rowley)	1991
Cellular Responses to Environmental DNA Damage, AACR Special Conference in Honor of Richard Setlow, Banff, Alberta, Canada (Co-chair with M. Paterson)	1991
Environmental Mutagen Society Annual Meeting, Norfolk, Virginia (Program Chair)	1993
Risk Assessment in Environmental Carcinogenesis, AACR/EMS Special Conference, Whistler Resort, British Columbia, Canada (Co-chair with James Swenberg)	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
Panel on "DNA repair in the CNS", Winter Conf. on Brain Research, Breckenridge, CO (Chair).....	2000
9th International Conference on Environmental Mutagens, San Francisco (President/Organizer)	2005
Gordon Conference on DNA Damage, Mutation and Cancer, Ventura, CA (Vice Chair, 2012), Chair ...	2014

VIII. *Teaching*

Twenty-nine graduate students have completed Ph.D. dissertations in Hanawalt's laboratory; several M.S. students and 42 undergraduates have completed research theses for graduation with Honors; over 60 postdoctoral fellows and visiting senior scientists have contributed to Hanawalt's research program at Stanford since 1962. (Complete list of names and current affiliations is provided on Hanawalt's Web Site.) Hanawalt's group has maintained an international flavor, with participants from over 36 different countries.

Courses taught at Stanford University from 1964 (current courses in bold type):

- Maintenance of the Genome, Freshman Seminar (BioSci 26N)
 - DNA Replication and Genomic Maintenance, upper division & graduate course (BioSci 110/210)**
 - Molecular Biophysics, graduate level lecture course (BioPhys 250)** (initiated this course in 1965)
 - 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 (Course Director/lecturer for 7 years)(Bio 21)
 - Cell Physiology, undergraduate core lecture course, (taught with Prof. Arthur Giese for 4 years)
-

IX. Principal Research Accomplishments

As a graduate student at Yale, Hanawalt initiated studies in the laboratory of R. B. Setlow to quantitatively assess the inhibitory effect of ultraviolet light (UV) on DNA synthesis in *E. coli*, to conclude that "recovery mechanisms can eventually restore the DNA synthesis...". He also showed that the lag in recovery of DNA synthesis could be shortened by photoreactivation, implicating the removal of obstructions. That work led some years later to his discovery of repair replication, which together with the reports of damage removal in the laboratories of Setlow and Paul Howard-Flanders, constituted the discovery of the ubiquitous pathway of DNA excision-repair. During his postdoctoral apprenticeship (with O. Maaløe) he discovered that protein and RNA synthesis are required to initiate the bacterial DNA replication cycle. That work contributed to formulation of the "replicon" concept in the early 1960s and it provided a widely used procedure for synchronizing DNA replication cycles.

Hanawalt has been a productive researcher in the field of DNA repair since his pioneering report of repair replication in 1963. He also first demonstrated repair replication in mycoplasmata and in a eukaryote, (*Tetrahymena pyriformis*), and he developed a number of experimental approaches for studying DNA repair, beginning with the BrdUrd density labeling method for resolving semiconservatively replicated DNA from parental DNA containing repair patches; enabling determination of patch lengths. Hanawalt's approach was employed by James Cleaver in 1968 to document a DNA repair defect in xeroderma pigmentosum (XP), the first example of a cancer prone human disease due to a deficiency in DNA repair. The method was also used to validate the phenomenon of unscheduled DNA synthesis as a measure of repair. Other significant research contributions from Hanawalt's laboratory in early years included: demonstration of preferential mutagenesis by N-methyl nitrosoguanidine at DNA replication forks and its application to physical mapping of genes in *E. coli*; early evidence for membrane association of DNA replication complexes in *E. coli* and in human 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 (evidence for inducible repair in human cells); discovery that the repair enzyme, T4 endonuclease V, operates processively on damaged DNA; discovery that certain types of damage in transfecting plasmid DNA markedly enhance 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, to provide a plausible mechanism for pre-biotic assembly of high molecular weight duplex nucleic acids.

In 1982 Hanawalt and his colleagues reported the first example of intragenomic heterogeneity of DNA repair in mammalian cells. Then they discovered that repair of some types of damage is selective; active genes are preferentially repaired; they discovered the dedicated repair pathway, termed transcription-coupled repair (TCR), which removes 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 profound implications for the fields of mutagenesis, environmental carcinogenesis, aging, and risk assessment. The mutation profiles in cells from tumors reveal a predictable strand bias, superimposed upon the mutagenic signature from the likely causal agent.

The prototype *recQ* gene was discovered in *E. coli* by Hiroaki Nakayama 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, Rothman Thompson syndrome, and RecQ1, which has been implicated in cancer cell migration and invasion. In *E. coli* the RecQ helicase was shown by Justin Courcelle in Hanawalt's laboratory to play an important role in the accurate recovery of arrested replication forks, as it participates in selective degradation of the nascent lagging strand, facilitating fork regression and repair of the blocking lesion. RecQ also provides a key to understanding the classic phenomenon of *thymineless death*, by which the gene was originally identified. Hanawalt has participated in more recent collaborative studies to document selective degradation of DNA from the chromosomal origin during thymine starvation.

Recent studies have focused upon the regulation of TCR and the global genomic nucleotide excision repair (GGR) pathways. Features of the TCR pathway (defective in Cockayne syndrome) include the

possibility of "gratuitous TCR" at transcription arrest sites in undamaged DNA. The GGR pathway was shown to be controlled through the SOS genomic stress response in *E. coli* and through the activated product of the *p53* tumor suppressor gene in human cells. It was shown that these regulatory systems particularly affect the repair efficiency 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 deficient in the *p53*-controlled GGR pathway) and tumor virus infected human cells (in which *p53* function is abrogated) were shown to be unable to carry out efficient GGR of some lesions. These findings limit the utility of such systems for quantitative risk assessment.

It was reported by Thierry Nospikel and Hanawalt that attenuated efficiency of GGR in terminally differentiated human cells is a consequence of reduced activity of the E1 ubiquitin-activating enzyme. Thus, E1 controls excision repair, and 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.

An area of current research interest is the molecular basis of the DNA repair defects in patients with Cockayne syndrome (CS) and UV-sensitive syndrome (UVSS). Although these patients are sun sensitive, unlike XP, they do not develop cancers of *any type*. Graciela Spivak in Hanawalt's group has shown that although both CS and UVSS cells are deficient in TCR of UV-induced DNA damage, CS appears to be additionally defective in the processing of oxidative DNA damage. The severe developmental and neurological problems in CS might be a consequence of defective processing of endogenous oxidative DNA lesions. An ultrasensitive assay for repair of the prominent oxidative base lesion, 8oxoGuanine (at physiological levels ~100-fold lower than typically studied) was recently developed, termed "comet-FISH" by which a postdoc, Jia Guo, along with Spivak and Hanawalt have shown that CS and UVSS cells are equally deficient in TCR of this important lesion.

Another current research effort focuses upon naturally-occurring non-canonical DNA structures as encumbrances to transcription. A novel method for cancer chemotherapy employing peptide nucleic acid (PNA) for generating a stable R-loop (RNA-DNA hybrid) in a uniquely expressed gene in selected tumor cells is being developed to render the very act of transcription toxic in these cells.

X. Selected Publications from Hanawalt's laboratory, from 489 total

Hanawalt PC "Use of Phosphorus-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)

Maaløe 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. coli*" *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, 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)
- Hanawalt** PC "Repair of Genetic Material in Living Cells" *Endeavor* 31:83-87 (1972)
- 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" *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) The issue of *Science* in which DNA Repair was selected as *Molecule of the Year*.
- 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-
- 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, Shiuian 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)
- Ford JM, Baron EL, **Hanawalt PC** "Human Fibroblasts expressing the human papillomavirus E6 gene are deficient in global genomic nucleotide excision repair and sensitive to UV-irradiation" *Cancer Research* 58:599-603 (1998)
-

- Crowley DJ, **Hanawalt** PC "Induction of the SOS response increases the efficiency of global nucleotide excision repair of cyclobutane pyrimidine dimer but not 6-4 photoproducts, in UV-irradiated *Escherichia coli*" *J. Bacteriol* 180:3345-3352 (1998)
- Hanawalt** PC, Spivak G "Transcription-Coupled DNA Repair: Which Lesions? Which Diseases?" in *Advances in DNA Damage and Repair* (Dizdaroglu M, M. Karakaya, eds.), pp 169-179, Academic/Plenum Pub., NY, NY (1999)
- Hwang BJ, Ford JM, **Hanawalt** PC, Chu G, "Expression of the p48 xeroderma pigmentosum gene is p53-dependent and involved in global genomic repair" *Proc. Natl. Acad. Sci USA* 96:424-428 (1999)
- Tornaletti S, **Hanawalt** PC, "Effect of DNA Lesions on Transcription Elongation" *Biochimie* 81:139-146 (1999)
- Courcelle J, Crowley DJ, **Hanawalt** PC, "Recovery of DNA replication in UV-irradiated *Escherichia coli* requires both excision repair and RecF protein function" *J. Bacteriol* 181:916-922 (1999)
- Ganesan AK, Hunt J, **Hanawalt** PC, "Expression and nucleotide excision repair of a UV irradiated reporter gene in unirradiated human cells" *Mut Res* 433:117-126 (1999)
- Tornaletti S, Reines D, **Hanawalt** PC, "Structural Characterization of RNA Polymerase II Complexes arrested by a Cyclobutane Pyrimidine Dimer in the Template DNA" *J Biol Chem* 274:24124-24130 (1999)
- Courcelle J, **Hanawalt** PC "RecQ and RecJ Process Blocked Replication Forks Prior to the Resumption of Replication in UV-Irradiated *Escherichia coli*" *Molecular Gen Genet* 262:543-551 (1999)
- Eisen J, **Hanawalt** PC, "A Phylogenomic study of DNA repair genes, proteins, and processes" *Mut Res:DNA Repair* 435:171-213 (1999)
- Oh DH, **Hanawalt** PC, "Triple helix-forming oligonucleotides target psoralen adducts to specific chromosomal sequences in human cells" *Nucl Acids Res* 27:4734-4742 (1999)
- Svetlova M, Nikiforov A, Solovjeva L, Pleskach N, Tomilin N, **Hanawalt** PC "Reduced extractability of the XPA DNA repair protein in ultraviolet light irradiated mammalian cells" *FEBS Letters* 463:49-52 (1999).
- Schild LJ, Smith CA, **Hanawalt** PC, & Baird WM "DNA repair of Benzo{A}Pyrene diol epoxide- DNA adducts in the DHFR gene of a human embryonic kidney cell line" *Polycyclic Compounds* 16:131-139 (1999).
- Nouspikel T, **Hanawalt** PC, "Terminally differentiated human neurons repair transcribed genes but display attenuated global DNA repair and modulation of repair gene expression" *Molec Cell Biol* 20:1562-1570 (2000)
- Lloyd D, **Hanawalt** PC "p53-dependent Global Genomic Repair of Benzo[a]pyrene-7,8-diol-9,10-epoxide Adducts in human Cells" *Cancer Res* 60:517-521 (2000)
- Tang J, Huang BJ, Ford J, **Hanawalt** PC, Chu G, "Xeroderma pigmentosum p48 gene enhances global genomic repair and suppresses UV-induced mutagenesis" *Molec Cell* 5:737-744 (2000).
- Hanawalt** PC "DNA repair: The bases for Cockayne syndrome," News and Views, *Nature* 405:415-416 (2000)
- Bowman K., Sicard D, Ford J, and **Hanawalt** PC, "Reduced global genomic repair of UV light-induced cyclobutane pyrimidine dimers in Simian virus 40 transformed human cells" *Molec Carcinogenesis* 29: 17-24 (2000).
- Hanawalt** PC, Crowley DJ, Ford JM, Ganesan AK, Lloyd DR, Nouspikel T, Smith CA, Spivak G, and Tornaletti S "Regulation of nucleotide excision repair in bacteria and mammalian cells" In *Cold Spring Harbor Symposia on Quantitative Biology*, Vol 65: Biological responses to DNA damage pp 183-191 (2000).
- Hanawalt** PC "Controlling the Efficiency of Excision Repair" *Mut Res: DNA Repair* 485:3-13 (2001).
- Courcelle J, Khodursky A, Peter B, Brown PO, and **Hanawalt** PC "Comparative gene expression profiles following UV exposure in wild type and SOS deficient *Escherichia coli*" *Genetics* 158:41-64 (2001).
- Courcelle J, **Hanawalt** PC "Participation of recombination proteins in rescue of arrested replication forks in UV-irradiated *Escherichia coli* need not involve recombination" *Proc. Natl. Acad. Sci USA* 98:8196-8202 (2001).
- Crowley DF, **Hanawalt** PC "The SOS-dependent up-regulation of uvrD is not required for efficient nucleotide excision repair of ultraviolet light induced DNA photoproducts in *Escherichia coli*" *Mut. Res: DNA Repair* 485:319-329 (2001)
-

- Courcelle J, Ganesan A, **Hanawalt** PC "Therefore, what are recombination proteins there for?" *Bioessays* 23:463-470 (2001).
- Oh D, King BA, Boxer SG, **Hanawalt** PC "Spatially-specific and gene-specific targeting of photodynamic DNA damage" *Proc. Natl. Acad. Sci USA* 98:11271-11276 (2001).
- Hanawalt** PC "Revisiting the Rodent Repairadox" *Enviro. Molec. Mut.* 38:89-96 (2001).
- Hanawalt** PC, Ford JM "DNA Repair Defects and Human Hereditary Disease" for *Encyclopedia of Genetics* (eds. S. Brenner and J. Miller) Academic Press N.Y. pp. 564-571 (2001).
- Tornaletti S, Maeda L, Lloyd DR, Reines D, **Hanawalt** PC "Effect of thymine glycol on transcription elongation by T7 RNAP and mammalian RNAP II" *J. Biol Chem* 276:45367-45371 (2001)
- Tornaletti S, **Hanawalt** PC "Maintenance of Genetic Information" in *Frontiers of Life* (eds. R. Dulbecco, D. Baltimore, F. Jacob, R. Levi-Montalcini) Academic Press, CA. Volume I Part Two pp 403-412 (2001).
- Nouspikel T, **Hanawalt** PC "DNA repair in terminally differentiated cells" *DNA Repair* Vol.1: pp 59-75 (2002).
- Van Houten B, Eisen JA, **Hanawalt** PC "A Cut Above: Discovery of an alternative excision repair pathway in bacteria" Commentary in *Proc. Natl. Acad. Sci. USA* 99:2581-2583 (2002)
- Svetlova M, Solovjeva L, Pleskach N, Yartseva N, Yakovleva T, Tomilin N, **Hanawalt** PC "Clustered sites of DNA repair synthesis during early nucleotide excision repair in ultraviolet light-irradiated quiescent human fibroblasts" *Exptl. Cell Res* 276:284-295 (2002)
- Spivak G, Itoh T, Matsunaga T, Nikaido O, **Hanawalt** P, Yamaizumi M "Ultraviolet-sensitive syndrome cells are defective in transcription-coupled repair of cyclobutane pyrimidine dimers" *DNA Repair* 1:629-643 (2002)
- Lloyd D, **Hanawalt** PC "p53 controls global nucleotide excision repair of low levels of structurally diverse benzo(g)chrysene-DNA adducts in human fibroblasts" *Cancer Res.* 62:5288-5294 (2002)
- Hanawalt** PC "Subpathways of nucleotide excision repair and their regulation" *Oncogene* 21:8949-8956 (2002)
- Nouspikel T, and **Hanawalt** PC "When parsimony backfires: neglecting DNA repair may doom neurons in Alzheimer's disease" *Bioessays* 25:168-173 (2003)
- Kalogeraki V, Tornaletti S, **Hanawalt** PC "Transcription arrest at a lesion in the transcribed DNA strand in vitro is not affected by a nearby lesion in the opposite strand" *J. Biol Chem* 278:19558-19564 (2003)
- Cline SD, **Hanawalt** PC "Who's on first in the cellular response to DNA damage?" *Nature Reviews/Molec. Cell Biol.* 4:361-372 (2003)
- Tornaletti S, Patrick SM, Turchi JJ, **Hanawalt** PC "Behavior of T7 RNA polymerase and mammalian RNA polymerase II at site-specific cisplatin adducts in the template DNA" *J. Biol. Chem.* 278:25797-25797 (2003)
- Hanawalt** PC, Ford JM, Lloyd DR "Functional characterization of global genomic DNA repair and its implications for cancer" *Mutation Research* 544:107-114 (2003)
- Courcelle J, **Hanawalt** PC "RecA-dependent recovery of arrested DNA replication forks" *Annu. Reviews of Genetics* 37:611-646 (2003)
- Hanawalt** PC "Four decades of DNA repair; from early insights to current perspectives" *Biochimie* 85:1043-1052 (2003)
- Tornaletti S, Maeda LS, Kolodner RD, **Hanawalt** PC "Effect of 8-oxoguanine on transcription elongation by T7 RNA polymerase and mammalian RNA polymerase II" *DNA Repair* 3:483-494 (2004)
- Cline S, Riggins JN, Tornaletti S, Marnett LJ, **Hanawalt** PC "Malondialdehyde adducts in DNA arrest transcription by T7 RNA polymerase and mammalian RNA polymerase II" *Proc. Natl. Acad. Sci. USA* 101:7275-7280 (2004)
- Hanawalt**, PC "Density matters: the semiconservative replication of DNA "(Classics Perspective) (accompanying republication of 1958 Meselson/Stahl paper)" *Proc. Natl. Acad. Sci. USA* 101:17889-17894 (2004)
- Svetlova, S, Solovjeva L, Blasius M, Shevelev I, Hubscher U, **Hanawalt** P, Tomilin N "Differential incorporation of halogenated deoxyuridines during UV-induced DNA repair synthesis in human cells" *DNA Repair* 4: 359-366(2004)
- Kalogeraki V, Tornaletti S, Cooper PK, **Hanawalt** PC "Comparative TFIIS-mediated transcript cleavage by mammalian RNA polymerase II arrested at a lesion in different transcription systems" *DNA Repair* 4:1075-1087(2005)
-

- Xu G, Spivak G, Mitchell DL, Mori T, McCarrey JR, McMahan CA, Walter RB, **Hanawalt PC**, Walter CA "Nucleotide excision repair activity varies among murine spermatogenic Cell Types" *Biology of Reproduction* 73: 123-130 (2005)
- Spivak G, **Hanawalt PC** "Host cell reactivation of plasmids containing oxidative DNA lesions is defective in Cockayne syndrome but normal in UV-sensitive syndrome fibroblasts" *DNA Repair* 5:13-22 (2006).
- Spivak G, Pfeifer GP, **Hanawalt PC** "In vivo assays for transcription-coupled repair" (eds. Judith L Campbell & Paul Modrich) *Methods in Enzymology: DNA Repair* 408:223-246 (2006)
- Wang Y, Sheppard TL, Tornaletti S, Maeda LS, **Hanawalt PC**. "Transcriptional inhibition by an oxidized abasic site in DNA". *Chemical Research in Toxicology* 19:234-241(2006)
- Tornaletti S, Maeda L, **Hanawalt PC**. "Transcription arrest at an abasic site in the transcribed strand of template DNA" *Chemical Research in Toxicology* 19:1215-1220(2006)
- Cline S, **Hanawalt PC**. "Topoisomerase deficiencies subtly enhance global genomic repair of ultraviolet-induced DNA damage in *Saccharomyces cerevisiae*" *DNA Repair* 5:611-617(2006).
- Morganroth P, **Hanawalt PC**. "Role of DNA Replication and Repair in Thymineless Death in *Escherichia Coli*" *J. Bacteriology* 188:5286-5288(2006)
- Nouspikel T, **Hanawalt PC**. "Impaired nucleotide excision repair upon macrophage differentiation is corrected by E1 ubiquitin-activating enzyme" *Proc.Natl.Acad.Sci.USA* 103:16188-16193(2006)
- Nouspikel T, Hyka-Nouspikel N, **Hanawalt PC**. "Transcription domain-associated repair in human cells. *Cell Molec. Biol.* 26:8722-8730(2006).
- Hanawalt PC**. Invited *Leading Edge Commentary*: "Research Collaborations: Trial, Trust, and Truth." *Cell* 126:823-825(2006)
- Hsu P, **Hanawalt PC**, Nouspikel T. "Nucleotide excision repair phenotype of human acute myeloid leukemia cell lines at various stages of differentiation" *Mutation Research* 614:3-15(2007)
- Ganesan AK, Savery N, Smith A, Zamos P, **Hanawalt PC**. Transcription coupled nucleotide excision repair in *Escherichia coli* can be affected by changing the arginine at position 529 of the beta subunit of RNA polymerase. *DNA Repair* 6:434-440(2007)
- Belotserkovskii BP, DeSilva E, Tornaletti S, Wang G, Vasquez KM, **Hanawalt PC**. A triplex-forming sequence from the human c-MYC promoter interferes with DNA transcription. *J. Biol. Chem.* 282:32433-32441(2007)
- Hanawalt PC**. Paradigms for the Three Rs: DNA Replication, Recombination and Repair. Invited Perspective *Molecular Cell* 28:702-707(2007).
- Tornaletti S, Park-Snyder S, **Hanawalt PC**. G4-forming sequences in the non transcribed DNA strand pose blocks to T7 RNA polymerase and mammalian RNA polymerase II. *J Biol Chem.* 283: 12756- 12762 (2008).
- Hanawalt PC**. Emerging links between premature aging and defective DNA repair. *Mechanisms of Aging and Development* 129: 503-505 (2008).
- Ditlevson J V, Tornaletti S, Belotserkovskii BP, Teijeiro V, Wang G, Vasquez KM, **Hanawalt PC**. Inhibitory Effect of a Short Z-DNA Forming Sequence on Transcription Elongation by T7 RNA Polymerase. *Nucleic Acids Research* 36: 3163-3170 (2008).
- Hanawalt PC**, Spivak G "Transcription-coupled DNA Repair: Two decades of progress and surprises" *Nature Reviews: Molecular Cell Biology* 9:958-970 (2008).
- Spivak G, Cox RA, **Hanawalt PC**. New applications of the Comet assay: Comet-FISH and transcription coupled DNA repair. *Mutat.Res.* 681: 44 – 50 (2009)
- Belotserkovskii BP, **Hanawalt PC**. Peptide nucleic acid (PNA) binding and its effect on *in vitro* transcription in Friedreich's ataxia triplet repeats. *Molec. Carcinogenesis* 48:299-308 (2009)
- Vasquez KM, **Hanawalt PC**. Intrinsic genomic instability from naturally occurring DNA structures: An introduction to Special Issue *Molec. Carcinogenesis* 48:271-272 (2009)
- .Nardo T, Oneda R, Spivak G, Vaz B, Mortier L, Thomas P, Orioli D, Laugel V, Stary A, **Hanawalt PC**, Sarasin A, Stefanini M. A UV-sensitive syndrome patient with a specific CSA mutation (2009)
- Hanawalt PC**, Spivak G. Foreword, for Medical Intelligence Unit: *Molecular Mechanisms of Cockayne Syndrome* (SI Ahmad, editor), Landes Bioscience, Austin TX {ISBN: 978-1-58-706-321-3} (2009)
- Sangurdekar DP, Hamann BL, Smirnov D, Srienc F, **Hanawalt PC**, Khodursky AB, "Thymineless death is associated with loss of essential genetic information from the replication origin." *Molecular Microbiology* 6:1455-1467 (2010)
-

- Fonville N, Bates D, Hastings PJ, **Hanawalt PC**, Rosenberg SM, "Role of RecA and the SOS response in thymineless death in *Escherichia coli*." *PLoS Genetics* 6:e1000865 (2010)
- Belotserkovskii BP, Liu R, Tornaletti S, Krasilnikova MM, Mirkin SM, **Hanawalt PC**, "Mechanisms and implications of transcription blockage by guanine-rich DNA sequences" *Proc. Nat. Acad. Sci. USA*, 107: 12816 - 12821 (2010)
- Hanawalt PC**, "Growing up with DNA repair and joining the EMS." *Environmental and Molecular Mutagenesis* 51:890-896 (2010)
- Ganesan A and **Hanawalt PC**, "Transcription-coupled nucleotide excision repair of a gene transcribed by bacteriophage T7 RNA polymerase in *Escherichia coli*." *DNA Repair* 9:958-963 (2010)
- Kresge N, Simoni RD, Hill RL, "Discovery and characterization of DNA excision repair pathways: the work of Philip Courtland **Hanawalt**." *J. Biol. Chem.* 285: e9-11 (2010)
- Hanawalt PC**, Belotserkovskii B, Spivak, G, "Role of transcription in genomic stability or instability." in *DNA Repair and Human Cancers, Princess Takamatsu 40th International Symposium*. 40:123-126 (2010)
- Belotserkovskii B, **Hanawalt PC**, "Anchoring Nascent RNA to the DNA Template Could Interfere with Transcription." *Biophys. Journal* 100: 675-684 (2011)
- Salinas-Rios V, Belotserkovskii BP, **Hanawalt PC** "DNA slip-outs cause RNA polymerase II arrest in vitro: potential implications for genetic instability". *Nucl. Acids Res.* 39:7444-54 (2011).
- Hanawalt PC** and Ford JM, "DNA repair defects and human disease" for *Brenner's Encyclopedia of Genetics*, 2nd Edition, Elsevier (2012)
- Hanawalt PC**, "Lesions sensing and decision points in the DNA damage response." Chapter 3.4 in *The Cellular Response to the Genotoxic Insult: The Question of Threshold for Genotoxic Carcinogens*. (ed. by Helmut Greim and Richard J. Albertini. *The Royal Society of Chemistry* (2012)
- Ganesan A, Spivak G and **Hanawalt PC**, "Transcription-coupled DNA repair in prokaryotes." *Mol. Bio and Trans. Sci.* (CP. Doetsch, Ed.) Vol. 110: 25-40 (2012)
- Hanawalt PC**, "Repairing DNA for 80 years: The timeline of my life." *DNA Repair* 5: 452, e1-11 (2012)
- Falik-Zaccai TC, Erel-Segal R, Horev L, Bitterman-Deutsch O, Koka S, Chaim S, Keren Z, Kalfon L, Gross B, Segal Z, Orgal S, Shoval Y, Slor H, Spivak G and **Hanawalt PC**, "A novel XPD mutation in a compound heterozygote; the mutation in the second allele is present in three homozygous patients with mild sun sensitivity." *Enviro. Molecular Mutagenesis* 53:505-514 (2012)
- Neil AJ, Belotserkovskii BP and **Hanawalt PC**, "Transcription blockage by bulky end termini at single-strand breaks in the DNA template: Differential effects of 5' and 3' adducts." *Biochemistry* 44: 8964-8970 (2012)
- Belotserkovskii BP, Neil AJ, Saleh SS, Shin JH, Mirkin SM and **Hanawalt PC**, "Transcription blockage by homopurine DNA sequences: role of sequence composition and single-strand breaks." *Nucleic Acids Res.* 3: 1817-1828 (2013)
- Guo J, **Hanawalt PC** and Spivak G, "Comet-FISH with strand-specific probes reveals transcription-coupled repair of 8-oxoGuanine in human cells." *Nucleic Acids Res.* 41:1-13 (2013)
- Belotserkovskii BP, Mirkin SM and **Hanawalt PC**, "DNA sequences that interfere with transcription: Implications for genome function and stability" *Chemical Reviews*, thematic issue on "Gene Expression", 113:8620-8637 (2013)
- Hanawalt PC**, "The Awakening of DNA Repair at Yale." *Yale Journal of Biology and Medicine*, 86:517-523 (2013)
- Hanawalt PC**, Wilson SH, Preface for special issue on "Cutting Edge Perspectives in Genomic Maintenance" edited by **Hanawalt** (50th anniversary of discovery of excision repair of damaged DNA) *DNA Repair*, 19:1-2 (2014)
- Belotserkovskii BP, **Hanawalt PC**, "PNA binding to the non-template DNA strand interferes with transcription, suggesting a blockage mechanism mediated by R-loop formation" *Molecular Carcinogenesis*, Epub ahead of print (Aug 2014) 54: 1508-1512 (2015)
- Hanawalt PC**, "Role of transcription domain-associated DNA repair in mutational heterogeneity", Commentary in *Cell Reports Blog*, On Line (Nov 20, 2014)
- Spivak G, **Hanawalt PC**, "Photosensitive Human Syndromes" (Special Issue on DNA damage and Human Diseases) *Mutation Research*, 776: 24-30 (2015)
- Hanawalt PC**, "A balanced perspective on unbalanced growth and thymineless death" *Frontiers in Microbiology*, Open Access, doi:10.3389/fmicb.2015.00504 (2015)
-

Pandey S, Ogloblina AM, Belotserkovskii BP, Dolinnaya NG, Yakubovskaya MG, Mirkin SM, **Hanawalt PC**, "Transcription blockage by stable H-DNA analogs in vitro", *Nucleic Acids Res.* (2015) doi:10.1093/nar/gkv622 Open Access

Tanasova M, Goeldi S, Meyer F, **Hanawalt PC**, Spivak G, Sturla SJ, "Altered minor-groove hydrogen bonds in DNA block transcription elongation by T7 RNA polymerase", *ChemBioChem*, (2015) doi:10.1002/cbic.201500077 Open Access

Khodursky A, Guzman EC, **Hanawalt PC**, "Thymineless death lives on: New insights into a classic phenomenon", *Annual Reviews of Microbiology* 69:247-263, (2015)

Hanawalt PC, Wilson SH, (special issue edited by **Hanawalt**)"Cutting-edge perspectives in genomic maintenance II : Preface", *DNA Repair*, 32: 1-2 (2015)

Hanawalt P, Grollman A, Mitra S, "A tribute in memory of Richard B. (Dick) Setlow (1921-2015)", *DNA Repair*, 33:111-114 (2015)

Ganesan A, **Hanawalt P**, "Photobiological origins of the field of genomic maintenance", (invited review) *Photochem.Photobiol.* In Press (2015)

Hanawalt P, "Historical perspective on the DNA damage response" (invited perspective), *DNA Repair*, In Press (2015)

Books and Monographs

Haynes RH and **Hanawalt PC**, **The Molecular Basis of Life: An Introduction to Molecular Biology**, (Readings from Scientific American, with introductions) WH Freeman & Co, San Francisco, (1968). Translations: Spanish (1971) as Selecciones de Scientific American, Editorial Blume, Madrid.

Smith KC and **Hanawalt PC**, **Molecular Photobiology: Inactivation and Recovery**, Academic Press, NY (1969). Translations: Japanese (1969), Russian (1972).

Hanawalt PC and Haynes RH, **The Chemical Basis of Life: An Introduction to Molecular and Cell Biology** (Readings from Scientific American, with introductions) WH Freeman, San Francisco (1973)

Hanawalt PC, **Cell Growth and Proliferation**, Biocore Monograph, McGraw-Hill (1974)

Hanawalt PC and Setlow RB, Editors, **Molecular Mechanisms for the Repair of DNA**, Based upon first international workshop on molecular mechanisms for repair of DNA, organized by Hanawalt at Squaw Valley, Feb 25 – Mar 1, 1974, Basic Life Science Series (A. Hollaender, General Editor) Volume 5, Parts A & B, Plenum Press, New York (1975)

Goulian M, **Hanawalt PC**, Fox, CF, Editors, **DNA synthesis and its regulation**, Proceedings of 1975 ICN-UCLA Symposium on Molecular and Cellular Biology Vol III, W.A. Benjamin, Inc. Menlo Park, CA (1975)

Hanawalt PC, Friedberg EC, and Fox CF, Editors, **DNA Repair Mechanisms**, Proceedings of 1978 ICN-UCLA Symposium on Molecular and Cellular Biology Vol IX, Academic Press (1978)

Hanawalt PC, **Molecules to Living Cells**, (Selections from Scientific American with introductions) WH Freeman Co., San Francisco (1980)

Friedberg EC and **Hanawalt PC**, Editors, **DNA Repair: A Laboratory Manual of Research Procedures**, Marcel Dekker Inc, Vol I (Parts A and B), (1981)

Friedberg EC and **Hanawalt PC**, Editors, **DNA Repair: A Laboratory Manual of Research Procedures**, Marcel Dekker Inc, Vol II, (1983)

Friedberg EC and **Hanawalt PC**, Editors, **DNA Repair: A Laboratory Manual of Research Procedures**, Marcel Dekker Inc, Vol III, (1988)

Friedberg EC and **Hanawalt PC**, Editors, **Mechanisms and Consequences of DNA Damage Processing**, UCLA Symposia on Molecular and Cellular Biology, New Series, Vol. 83, Alan R. Liss, Inc. New York (1988)

XI. Invited Lectures (2004 – present)

February 2004 Keynote Lecture: 4th Intl. Conf. On Unstable Microsatellites and Human Disease, Banff Centre, Alberta, Canada

April 2004 Seminar: UCLA, Molecular Toxicology, Los Angeles, CA

May 2004 Seminars: Texas A&M Univ., MD Anderson Cancer Ctr., Houston; and Science Park

May 2004 Speaker: Conf. on Cockayne syndrome and related disorders, Natl. Conf. Ctr, VA

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-Wellcome 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
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: "DNA Repair and Genomic Maintenance", Montevideo, Uruguay
October 2006 Lectures in an Alexander Hollaender Course on Environmental 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, Int. workshop on Cockayne syndrome, Boston, MA
Speaker, Special symposium in honor of R.B. Setlow, Brookhaven Nat. Labs, NY
October 2009 Short course lectures on Genomic Maintenance, Deep Springs College, CA
Plenary speaker, and Symposium Chair/speaker, EMS Annual Meeting, St. Louis, Mo.
November 2009 Speaker, 40th Int. Symp. of the Princess Takamatsu Cancer Research Fund, Tokyo
January 2010 Seminar, University of California, Berkeley
February 2010 Seminar, University of Florida, Gainesville
March 2010 Seminar, Eppley Institute for Cancer Research, Univ. Nebraska, Omaha
April 2010 Seminar, National Cancer Institute, NIH, Bethesda
May 2010 Plenary Lecture, Banbury Center Workshop on "Mutagenesis: What it means and how it has changed.", Cold Spring Harbor, NY

July 2010 Keynote Lecture, Russian-Swiss Workshop on “Regulation of genome stability by DNA replication and repair”, Saint Petersburg, Russia

September 2010 Speaker, Plenary session on “Oxidative stress, DNA damage, repair and biological consequences”, 9th Int. Soc. for Study of Xenobiotics Meeting, Istanbul, Turkey

September 2010 Speaker on “Causes and consequences of arrested transcription”, Annual Cell/Molecular Biology Retreat, Stanford University, CA

October 2010 Plenary Speaker, ALAMCTA Meeting, Santiago, Chile
Symposium Co-Chair, EMS Annual Meeting, Fort Worth, TX

November 2010 Keynote Lecture, Mexican Soc. Biochemistry, Puxtia Gutierrez, Chiapas, Mexico

April 2011 AACR – Princess Takamatsu Lectureship, Orlando, FL

October 2011 Symposium speaker on “Transcription blockage by lesions and unusual DNA structures” Annual Mtg of the EMS, Montreal, Quebec, Canada

January 2012 Seminar, “Benchmarks in the History of DNA Repair”, University of California, Riverside, CA

June 2012 1st Session Chair and Speaker, 7th Int. Conf. on Unstable Satellites and Human Disease, Mont St. Odile, Strasbourg, France

June 2012 Seminar, Centre de Recherche en Cancerologie, Marseille, France

June 2012 Keynote Speaker, 3rd Erling Seeberg Symposium on DNA Repair, Trondheim, Norway

July 2012 Seminar, Universiti Tunku Abdul Rahman, Kampar, Malaysia

October 2012 Honors Program Seminar, NYU School of Medicine, New York

October 2012 Seminar, Center in Molecular Toxicology, Vanderbilt University, Nashville, TN

November 2012 Seminar, University of Buenos Aires, Argentina

November 2012 Plenary Lecture, XV Congreso Latinoamericano de Genetica, Rosario, Argentina

May 2013 Speaker, Symposium on “50 years of DNA Repair at Yale”, New Haven, CT

November 2013 Plenary Lecture, 11th Int. Conf. on Environmental Mutagens, Iguassu, Brazil

September 2014, Keynote Lecture in Opening Session, 16th International Congress on Photobiology, Cordoba, Argentina

January 2015, Keynote Lecture, Gordon Research Seminar on Mammalian DNA Repair, Ventura

May 2015 First Biennial Smerdon/Reeves Chromatin-DNA Repair Lecture, Washington State University, Pullman WA

June 2015 Lecture, The Tomas Lindahl Conference on DNA Repair, Holmenkollen, Norway

XII Current Research Support

2R01-CA77712 Hanawalt (PI) 04/01/09 – 07/31/17

Role of Transcription in Genomic Stability

We are characterizing unique features of transcription complexes encountering different impediments; non-canonical DNA structures, guanine-rich sequences, strand breaks and other lesions, to reveal signals for initiating TCR and possible “gratuitous” repair. These studies will hopefully provide clues for innovative approaches in chemotherapy for cancer, including the generation of stable R-loops in unique active genes in tumor cells to render the very act of transcription “toxic” in those cells.

Completed Research Support

1R01-ES018834 Hanawalt (PI) 04/01/10 – 09/30/15

Oxidative DNA damage processing; role in human pathology and aging

We developed novel techniques for elucidating effects of oxidative DNA lesions on transcription, and for repair analysis at physiologically relevant levels in transcriptionally active and silent genomic domains. This included an ultrasensitive comet-FISH approach with strand-specific probes to reveal transcription-coupled repair of 8-oxo-guanine in human cells.

R01 CA77712 Hanawalt (PI) 04/01/03-03/31/09.

Role of RNA Polymerase II in DNA Repair

Characterization of translocating RNA polymerases at site-specific DNA lesions *in vitro*; Effects of transcription factors (eg. TFIIS); comparative analysis with TCR *in vivo*.

R01 CA90915 Hanawalt (PI) 01/28/02-12/31/08

Transcription-coupled DNA Repair and Human Disease

Comparative studies of TCR in cells from Cockayne syndrome and UV-sensitive syndrome with respect to different genotoxic exposures, including reactive oxygen species. Genetic analyses of these diseases.

RO1 CA91456 Hanawalt (PI) 01/28/02-12/31/08

Transcription-coupled DNA Repair in *E. coli*

Role of RNA polymerase in TCR, including TCR with T7 RNA polymerase. Studies on thymineless death and roles of RecA, RecQ and other enzymes in processing arrested replication forks.

AG-SS-0550-00 Hanawalt (PI) 01/01/01-12/31/04

***Ellison Medical Foundation Sr. Scholar Award* : DNA Repair in Human Neurons**

5R 35 CA44349 Hanawalt (PI) 06/01/87-11/30/01

***Outstanding Investigator Grant* : Cellular Processing of Damaged DNA; Role in Oncogenesis**

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
