15/15/22
Liberal Arts and Sciences
Microbiology
Carl Woese Papers, 1911-2013

Biographical Note

Carl Woese (1928-2012), who revolutionized the science of microbiology, has been called "the Darwin of the 20th century." Darwin's theory of evolution dealt with multicellular organisms; Woese brought the single-celled bacteria into the evolutionary fold. The Syracuse-born Woese began his early career as a newly minted Yale Ph.D. studying viruses but he soon joined in the global effort to crack the genetic code. His 1967 book *The Genetic Code: The Molecular Basis for Genetic Expression* became a standard in the field. Woese hoped to discover the evolutionary relationships of microorganisms, and he believed that an RNA molecule located within the ribosome–the cell's protein factory–offered him a way to get at these connections. A few years after becoming a professor of microbiology at the University of Illinois in 1964, Woese launched an ambitious sequencing program that would ultimately catalog partial ribosomal RNA sequences of hundreds of microorganisms. Woese's work showed that bacteria evolve, and his perfected RNA "fingerprinting" technique provided the first definitive means of classifying bacteria. In 1976, in the course of this painstaking cataloging effort, Woese came across a ribosomal RNA "fingerprint" from a strange methane-producing organism that did not look like the bacterial sequences he knew so well. As it turned out, Woese had discovered a third form of life–a form of life distinct from the bacteria and from the eukaryotes (organisms, like humans, whose cells have nuclei); he christened these creatures "the archaebacteria" only to later rename them "the archaea" to better differentiate them from the bacteria. In 1980, four years after his discovery of the archaea, Woese unveiled the "Big Tree"–the first tree of life based entirely on ribosomal RNA data. Woese's tree attempted to trace the evolutionary relationships of the three forms of life going back to their divergence from a common ancestor over three billion years ago. Continuing to probe the origins of life for the rest of his career, Woese would help develop such seminal concepts as the RNA World and the progenote–a hypothetical communal state of life predating the first cell. In 1990 Woese proposed that all life be grouped into three domains: the Archaea, the Bacteria, and the Eucarya. This idea met a great deal of resistance from many of his fellow biologists but is now largely enshrined in the textbooks. Carl Woese died on December 30, 2012, in Urbana, Illinois.

Timeline

July 15, 1928	Born Syracuse, New York - son of Carl and Gertrude Woese
1942-46	Deerfield Academy, Deerfield, Massachusetts
1950 A.B.	Amherst College, Math and Physics
1953 Ph.D.	Yale University, Biophysics. Thesis: "Physical Studies on Animal Viruses"
1953	Married Gabriella Haws on August 20
1953-55	Medical School, University of Rochester
1955-60	Research Associate, Biophysics, Yale University
1960-63	Biophysicist, General Electric Research Laboratory, Schenectady, New

	York
1963	Biophysicist, Institute Pasteur
1964-2012	Professor of Microbiology, University of Illinois
1965	"On the Evolution of the Genetic Code" published
1967	*The Genetic Code: The Molecular Basis for Genetic Expression* published
1970	"Molecular Mechanics of Translation: A Reciprocating Ratchet Mechanism" published
1976	Discovered "third form of life" he christened "archaebacteria"
1977	Discovery announced in *Proceedings of the National Academy of Sciences* article "Phylogenetic Structure of the Prokaryotic Domain: The Primary Kingdoms"
1980	Tree of life–the "Big Tree"-- based on ribosomal RNA sequences published
1983	Received Bergey Award
1984	Received John D. and Catherine T. MacArthur Award
1987	Landmark paper "Bacterial Evolution" published
1988	Elected to the National Academy of Sciences
1989	Appointed to University of Illinois' Center for Advanced Study
1990	Proposed division of life into three domains: Archaea, Bacteria, and Eucarya
1992	Awarded the Leeuwenhoek Medal
1996	Selected as first Stanley O. Ikenberry Endowed Chair
1998	"The Universal Ancestor" published
2000	Received National Medal of Science
2003	Awarded the Crafoord Prize in Biosciences
2004	"A New Biology for a New Century" published
2007	Joined Institute for Genomic Biology, University of Illinois
2009	"How the Microbial World Saved Evolution from the Scylla of Molecular Biology and the Charybdis of the Modern Synthesis" published
Dec. 30, 2012	Died, Urbana, Illinois

Box 1:

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- Biographical File, 1953-2013
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CORRESPONDENCE (Includes incoming and outgoing correspondence.)
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1962

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"A Manifesto for Microbial Genomics," in *Current Biology*.
"Tetratrico-Peptide-Repeat Proteins in the Archaeon *Methanococcus jannaschii*," in *Trends in Biochemical Sciences*.
"*Polaribacter* gen. nov., with Three New Species, *P. irgensii* sp. nov., *P. franzmannii* sp. nov. and *P. filamentus* sp. nov., Gas Vacuolate Polar Marine Bacteria of the *Cytophaga-Flavobacterium-Bacteroides* Group and Reclassification of '*Flectobacillus glomeratus*' as *Polaribacter glomeratus* comb. nov.," in *International Journal of Systematic Bacteriology*.
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"Haloanaerobium kushneri sp. nov., an Obligately Halophilic, Anaerobic Bacterium from an Oil Brine," in *International Journal of Systematic Bacteriology*.
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"Reclassification of *Methanogenium tationis* and *Methanogenium liminatans* as *Methanofollis tationis* gen. nov., comb. nov. and *Methanofollis liminatans* comb. nov. and Description of a New Strain of *Methanofollis liminatans*," in *International Journal of Systematic Bacteriology*.
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"How the Microbial World Saved Evolution from the Scylla of Molecular Biology and the Charybdis of the Modern Synthesis," in *Microbiology and Molecular Biology Reviews*.

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REPRINTS–NON-WOESE (This file includes reprints of classic microbiology articles, reprints annotated by Woese, and reprints signed by the author.)

1940-50
1951
1952
1953

Box 13:

1954-77
1981-88
1989-94
1995-99
2000-2003
2004-2007

REPRINT REQUESTS (The bulk of these reprint requests are for Woese's 1965 article "On the Evolution of the Genetic Code" and his 1973 article "Evolution of the Genetic Code.")

1966 (10 folders)
1966-67

Box 14:

1966-68 (6 folders)
1973
1973-74 (6 folders)
1973-75
1974-75
1975
1989-90

SUBJECT FILE (The subject file includes articles, computer printouts, correspondence, data

sheets, e-mails, exams, illustrations, manuscripts, newspaper clippings, notes, pamphlets, photographs, and slides.)

5S Ribosomal RNA Information, 1976-85 (2 folders)
5S Ribosomal RNA Sequences, undated
16S Ribosomal RNA Oligonucleotide Catalog Data Base, ca. 1981
16S Ribosomal RNA Sequences, undated
16S Ribosomal RNA Subunit Structure–Includes correspondence with George Fox and Harry Noller, 1976-82 (2 folders)

Box 15:

23S Ribosomal RNA, 1988-89
23S Ribosomal RNA–Archaea–Includes correspondence with A. Bock, 1984-90
Aging, undated
American Academy of Arts and Sciences, 1985
American Philosophical Society, 2004
Amherst College–Honorary Doctor of Science, 1984-5
Amherst College–Prizes, 1948-50
Amherst College Undergraduate Course Book, 1946-50
Amherst Magazine, 2002
Amino Acid Percentages in Bacteria, 1999
Appointment Book, 1989
Archae Families–Ribosomal RNA Sequences, undated
Archae History–Jan Sapp, 1972-2005
Archae History Project–Includes correspondence with W. Ford Doolittle, Tom Langworthy and John Oro, 1978, 2004-2005
"Archae Masters" (Miniature golf outing)–Invitations, 1981-84
Archae Twentieth Anniversary Party, 1997
Archaea Evolution Conference, 2007
Archaea: Molecular Cell Biology–Course Outline, undated
Archaea–Photographs, undated
Articles of Interest, 1977, 1980
Awards and Honors–Newspaper Articles, 1984-2006
Bacterioferritin–Paper, undated
Barbieri, Marcello–"The Ribotype Theory of Evolution," 1983 (3 folders)
Big Bacillus and Clostridia, 1979-87
Beckman Institute–Includes correspondence with William Greenough, 1985-86
Benjamin Franklin Medal in Life Science–Correspondence, 2006
Bergey Award–Certificate, 1983
Biohazard Information, 1979-81
Bohm, David–Remarks on Order–Includes annotations by Woese, 1980
Bohr, Niels, "Light and Life" and "Light and Life Revisited," 1933, 1963
Brown-Hazen Award Lectures, 1992
Brosius, Jurgen, 1980-2000

Budget Statements, 1981-82
Bulletin Board Items (Found on bulletin board outside Room 371, Morrill Hall, under heading "Space Is the Residue of Becoming")–Includes greeting cards, magazine articles, and newspaper clipping, 1982-2002
Burggraf, Siegfried–Dissertation, 1992
The Bushido Club–Request for Use of University Premises, 1968
Canadian Institute for Advanced Research–Program in Evolutionary Biology, 1986, 1991
Carolina Biology Readers–"The Origin of Life" by Carl Woese, 1979-84 (2 folders)
Cartoons, undated
Champaign County Humane Society–President's Circle Membership Certificate, 1988
"Charlie Rose Show" Transcript (Topic: "Charles Darwin," with guests James Watson and E. O. Wilson)–Includes annotations by Woese, 2005
Chemical Analyses, 1968-69
Chloroflexus and Planctomyces–Includes correspondence with R. C. Fuller, Otto Kandler, Jerome Perry, Erko Stackebrandt, and J. T. Staley, 1981-85

Box 16:

Chromosomes, undated
Code Papers, 1971, 1977
Codon Reassignment–Paper, undated
Computer Data Storage, ca. 1978
Condolence Letters, 2013
Course Lectures, 1971-73 (2 folders)
Crafoord Prize–Correspondence, Press Releases and Photos, 2003
Creationism–Includes correspondence with Thomas Jukes, 1975-86, 2008 (3 folders)
Crick, Francis–Talk (on DVD), 2003
Darwin, Charles–Includes correspondence with Robert Austin and Terry Hwa, 1911, 2005-2009
Darwin, Sir Charles, "How Scientific Discoveries Are Made," undated
Darwin, Erasmus, undated
Datta, Shoumen, "National Recognition of Excellence for K-12 Standards," 1998
Day, William, "How Life Began," 2002
Dissertation–Carl Woese ("Physical Studies on Animal Viruses"), 1953
Distinguished Lecturer Award, 1980
DNA Composition–Articles, 1953-66
Doolittle, W. Ford–Papers, 1986, 1999-2000
Eddington, Arthur, "The Domain of Physical Science," 1925
"Why I Believe in God," 1930
Enteric Bacteria–Articles and Notes, 1972
Eocyte Controversy–Includes correspondence with Joseph Felsenstein, Roger Garrett, George Harauz, Frank Harold, James Lake, Wen-Hsiung Li,, A. T. Matheson, Peter Newmark, Geoffrey North, David Penny, Georg Stoffler, Marina Stoffler-Meilicke, and Wolfram Zillig, 1984-89 (3 folders)

Ephemera (Found taped to cabinets and walls in Room 371, Morrill Hall)–Includes correspondence, postcards, and restaurant menus, 1970s-2004
Erasmus Biography
Evolution–Articles, 1954-2004 (2 folders)

Box 17:

Fourth Domain, 2011
Fractals–Images, undated
General Electric *Research Laboratory Bulletin*–Includes article on Woese, 1961
Genetic Code, 1969-82 (2 folders)
Genetic Code and Translation, 1940-2000
Genome/The Institute for Genomic Research (TIGR)–Includes correspondence with Daniel Drell, Lauren Goralski, and Ron Swanson, 1983-98 (2 folders)
GenProbe, 1987-88
Genta, 1990
Gest, Howard–Articles, 2003, 2008
Giaever, Ivar–1973 Nobel Lecture in Physics, 1974
Gonick, Larry–Cartoon "Science Classics: Archae," 1990
Gould, Stephen Jay–Article (With Woese annotations), 2001
Gram Positive Bacteria–Includes correspondence with Richard Devereux, John L. Johnson, Erko Stackebrandt, and Ralph Tanner, 1972-89
Grant Proposals, 1985-88
Greeting Cards, 2003, 2009
Gutell, Robin et. al., "A Compilation of Large-Subunit (23S-Like) Ribosomal RNA Sequences Presented in a Secondary Structure Format," 1991
Halobacterium volcanii Leader Sequence–Includes correspondence with A. Bock and Roger Garrett, 1977-87 (2 folders)
Hegel, Georg Wilhelm Friedrich–*Phenomenology of Mind*, undated
Holley , Robert, "The Nucleotide Sequence of a Nucleic Acid," *Scientific American*–Includes annotations by Woese, 1966
Honors and Awards, 1979-83
Hungate, Robert–Symposium, 1960
Stanley O. Ikenberry Endowed Chair–Correspondence and Clipping, 1996
Inside Illinois, 2007
Institute for Genomic Biology Fellows Symposium–Program (Woese comments on inside cover), 2012
The Institute for Genomic Research (TIGR)–Press Conference Photos, 1996
"Introducing French Wines," 1956
Jazz–Note on Charlie Parker, undated
Karl August Forster Lecture, 1982
Kitzmiller v. Dover Area School District Opinion ("Intelligent Design" Case)–Annotated by Woese, 2005
Korarchaeota Contigs–CD, 2006

Laboratory Procedures Manual–Written by Christine Hahn, 1983-84
Lactic Acid Bacteria–Includes correspondence with Otto Kandler, Jordan Konisky, R. G. E. Murray, and U. Weber, 1973-91
Langworthy, Tom, "Tom's Recollection of the Archaebacteria History," 2004
Larsen, Niels, undated
LAS Newsletter, 1983
Ledger Statements, 2006-2007
Leeuwenhoek Medal–Includes correspondence with W. R. Hugenholtz, Wil N. Konings, A. H. Stouthamer, K. Vrieze, Graham Walker, and I. Willems, 1992, 2003
Lwoff, A., "The Concept of a Virus," 1957
MacArthur at 25–MacArthur Foundation Annual Report, 2002
MacArthur Fellows Directory, 1991

Box 18:

Magazine Articles, 1985-2011
Manuscripts in Preparation, 1982
Mayr, Ernst–Article and Obituary, 1998, 2005
mcb: A Magazine–"Celebrating 30 Years on the Tree of Life," 2007
Memorial Service–Program, 2013
Metabolic Inhibitors and Psychedelics–Notebook, undated
Methanogens/Meyer Wolin–Includes correspondence with Piero Cammarano, Roger Garrett, T. Gold, Robin Gutell, Masahiro Kamekura, Jorgen Kjems, James McCloskey, Gary Olsen, Meyer Wolin, Wolfram Zillig, and Robert Zimmerman, 1987-90
Microbiology 330
    Exams and Lecture Materials, 1960-70
    Lecture Notes, ca. 1967-68
        1969
        1970 (Includes Woese's thoughts on state of society)
    Readings, 1969-70
    Test Questions, undated
Mitochondria–Includes correspondence with M. Edelman, 1977
Modified Ribosomal RNA Sequences–Data Sheets, 1979-83 (2 folders)
Molecular Evolution Seminar Series–Lecture Notice, undated
Multiple Mapping of DNA Fragments, 1990-91
Music Class–Notes, Papers, and Song Sheets, 1947
National Academy of Sciences–Membership, 1987-2004
NASA Exobiology Project, 2005
NASA Planetary Biology Meeting–Includes correspondence with Donald DeVincenzi, Hyman Hartman, and Richard Young, 1981
NASA Projects–Includes correspondence with Donald DeVincenzi, John Rummel, and Richard Young, 1977-92 (2 folders)

NBC Research Biochemicals–Catalog, 1966
National Medal of Science, 2000
New RNAs and Sequence Information–Includes correspondence with Charles Beard, Robert Gherna, James Hogan, Roar Irgens, Michael Madigan, Eric Miller, James Petzel, Frank Richards, K. H. Schleifer, Lawrence Shimkets, Erko Stackebrandt, Karl Stetter, Ralph Tanner, Will Whitenflugel, Fritz Widdel, T. Wilharm, Decheng Yang, and Robert Zimmerman, 1988-95 (2 folders)
Newspaper Articles, 1959-90
Nobel Committees for Physics and Chemistry–Includes correspondence with Astrid Graslund, 1999, 2005
Nobel Prize–Nomination, 1996
Noller, Harry–Article, 1992
Notebook–re: Methanobacteria, undated
Notes, undated
Notes on "Darwinism," 2009

Box 19:

Notes on "Darwinism," 2009
Obituaries, 2013
Olsen, Gary–Dissertation, 1983
Oparin, A. I., "The Origin of Life," 1924
Oriental Philosophies, 1985
Origin of Life–Includes articles, notes and correspondence with Derek Briggs, Sidney Fox, Thomas Gold, and Gunter Wachtershauser, 1957-95 (3 folders)
Pace, Norman, 1961, 1989-2003
"Into the Microbial World" Lecture–DVD, 2005
National Academy of Sciences Lecture Outline–CD, 2004
Passano Award–Nomination, 1994
Phi Beta Kappa (Beta Chapter of Amherst College)–Membership Certificate, 1949
Photographs–Includes photos of George Fox, Ramesh Gupta, Robin Gutell, Otto Kandler, Norman Pace, Gary Olsen, David Stahl, Charles Vosserinck, Will Weisburg, Carl Woese, and Ralph Wolfe , 1977-2004 (3 folders)
Phylogenetic Analysis Using Parsimony (PAUP) Manual, 1991
Procedures for Preparation of ATP and Plasmids, 1979
Promega Biotec–Confidential Disclosure Agreement and Correspondence, 1985
Pseudomonas-Streptococcus--Ribosomal RNA Sequences, 1974-75
Publications List–CDs, 2007-2008
Purple Bacteria–Includes correspondence with Frank Richards, 1987-90
Qi Gong, 1997
Quotations from Chairman Mencken or Poor Henry's Almanack, 1974
Radioactive Information, 1972-92
Radioisotope Laboratory Survey Documentation–Room 371, Morrill Hall, 1981-90
Rapid Evolution–Includes correspondence with Joe Felsenstein, W. M. Fitch, Ernst Mayr,

Colin Patterson, and Robin Pellew, 1980-87 (3 folders)
Reviewers' Comments–Research Proposal ("Role of Horizontal Gene Transfer as a Control on the Coevolution of Ribosomal Proteins and the Genetic Code," 2005
Reviews, undated

Box 20:

Ribosomal Database Project
Correspondence, 1989-93
Grant, 1990-93
Literature, 1984-96
Ribosomal RNA/Ribosomes, 1977-86 (2 folders)
Ribosomal RNA Sequences
Archaebacteria, 1986-87 (2 folders)
Archaebacteria and Bacteria, 1984 1986-87 (4 folders)
Bacteria, undated
Gram Positive Eubacteria, 1986-87 (2 folders)
Purple Bacteria, 1986-87 (2 folders)
Ribosome–Articles, 1980-81
RNA Polymerase–Papers, 1987
Robb, Frank–Paper, 1993
The Royal Society–Correspondence and Newspaper Articles, 2006
Sapp, Jan–Papers (Includes Woese annotations), 2005-2007
Savant Instruments, Inc.–Blueprints, Correspondence, and Instruction Sheets, 1974-75
Seminars–Correspondence, 1979-81

Box 21:

Slides–Includes slides of the "eocyte problem," phylogenetic trees, and thermophiles, undated (2 folders)
Small Ribosomal Subunit RNA Sequences, 1990
The Society of the Sigma Xi (Amherst College Chapter)–Membership Certificate, 1950
The Society of the Sigma Xi (Yale University Chapter)–Membership Certificate, 1956
Sogin, Mitchell L. --Testimony, *Gen-Probe, Inc. v. Microprobe Corp.*, 1995
"Some of Our Finest Hours"–University of Illinois Brochure (with Woese annotations), undated
Spiegelman, Sol–Obituary, 1983
Sol Spiegelman Memorial Fund–Proposal in Support of, undated
Stanier, Roger–Includes articles (some annotated by Woese) and correspondence with Albert Balows and Germaine Stanier, 1936-2004 (2 folders)
Statement of Plans–Higher Order Structure of Ribosomal RNA, 1983
Stetter, Karl and Wolfram Zillig–Photographs, undated
"Symmetry and Symmetry Breaking"–Article, 2008

Thank You Cards (from schoolchildren), undated
The Three Billion Four Hundred Million, One Hundred and Sixth Archae Okie Open (Miniature golf outing)–Notice, 1985
Transcription Elongation Factors–Includes correspondence with Piero Cammarano, Michael Tomm, and Wolfram Zillig, 1991-94
Translation–Article, 1968
Translation Retrospect–Articles, 1958-2000
Transparencies (all undated unless indicated otherwise)
16S Ribosomal RNA Structure
Aminoacyl tRNA Synthetase Phylogenetic Trees
Charles Darwin Quotes
Erroneous Concepts in Microbiology
The Evolution of a Scientific Career
Genetic Code, 2004
History of Microbiology
History of Microbiology and Phylogenetics
Nobel Prize Winners
Phylogenetic Trees (2 folders)
Phylogenetic Tree and Genetic Signatures
Quotations of Noted Biologists, 2001 (2 folders)
John Tyndall's "Belfast Address"
J. Craig Venter

Box 22:

Tseng, Tsai-Tien–Lecture, 2002
The Universal Tree–Lecture Outline, undated
University of Illinois Board of Trustees Distinguished Service Medallion–Correspondence, 2009
University of Illinois Judo Club–Certificate of Merit, 1967
University Scholars Program, 1986
Unpublished Papers
"Binding of Transfer RNA by Aminoacyl-tRNA-Synthetase," 1968
"Concerning the Origin of Codon Assignments," 1969. Includes correspondence with Tracy M. Sonneborn.
"Concerning Primary Structure Homology between the 16S and 23S Ribosomal Ribonucleic Acids Isolated from *Escherichia Coli*," undated
"The Effect of Chloramphenicol on Germinating Cultures of *Bacillus Subtilis* Spores," 1958
"Evolution of Translation: Co-Evolutionary Development of Ribosomal Proteins and the Genetic Code," 2004
"The Fractionation of Soluble RNA on Methylated Albumin Columns," undated
"The Genetic Code in Eucaryotes and Procaryotes," 1969
"Interactions of Amino Acid Derivatives with Polynucleotides. I. N-

carboxyanhydrides vs. Polyadenylic and Polyuridylic Acids," 1964
"Is Translation a Pseudosymmetric Process," ca. 1972
"Light and the Origin of Life," ca. 1963
"A Method for Analysis of Operon Structure," 1967
"Molecular Signatures of the Past: Supporting Information," 2008
"Rapid Evolution, Mycoplasmas, and the Origin of the Mitochondrion," undated
"Tempo and Mode in Evolution: Molecular Perspectives," undated
Venter, J. Craig–Photos and Articles, 1996-99
Vetsigian, Kalin–Dissertation, 2005
Wachtershauser, Gunter–Includes articles and correspondence, 1974-97
Selman A. Waksman Award in Microbiology–Nomination, 1992
Who's Who in America, 1970
Wimmer, E.–Articles, 1967-68
Carl Woese Tribute, American Society of Microbiology–DVDs, 2009
Wolfe, Ralph–Includes articles and correspondence, 1982-2006
Yellowstone–Photographs, undated
Yu, Ming-Tsung, "Mapping of the Ribosomal RNA Cistrons in *Escherichia Coli* K-12," 1969

DISSERTATIONS (produced by Woese students)
1967, Norman Bernard Hecht
1967, Masatoshi Kondo
1968, Judith Ann Oldham Williams
1969, Michael Alan Bleyman
1969, Pamela Dee McNamara
1969, William Carl Saxinger

Box 23:

1970, Stephen Jules Sogin
1972, Mitchell Loyd Sogin
1974, Cynthia Ann Cowgill
1976, Lawrence Barry Zablen
1977, Bobby Joe Lewis

Box 24:

1978, David Allan Stahl
1981, Ramesh Gupta
1982, JoAnn Lai Wah Kop
1986, William Greene Weisburg (2 copies, including one with Woese annotations)

Box 25:

1986, De-Cheng Yang
1988, Laurie Achenbach-Richter

LABORATORY NOTES
Paper Chromotography Experiments, 1966

NOTES (These notes were written on yellow legal pads.)
"Bacterial Evolution," ca. 1987
Bacteria Signature and Universals, undated
Course Lectures, 1994-2004
"Darwinism," 2009-2011
Genetic Code, undated
"A Phylogenetic Definition of the Gram Negative Bacteria," undated
Phylogenetic Trees, undated

Box 26:

ARTIFACTS
"Archae Ale"--Bottle
Archae Buttons, 1980s
Audiotapes
"Coleopterissimo"–Beatles Songs
"Death of an Archaesalesman"
"Round Midnight–the Archae Orchestras"–Jazz Recordings
Campbell's "Primordial" Soup Can
Carlsberg Carl's Special Beer--Bottle, 1997
Confucius Family Liquor--Bottle
Document Cases (2)
Eyeglasses–Two Pairs (One Broken)
Framed Photo of Giant Tube Worm–Signed by Norman Pace, Dave Lane, Gary Olsen, and Dave Stahl
Gaming Tokens–One Dollar
Binion's Horseshoe
Rio, 2002

Box 27:

G. H. Mumm & Co. Champagne--Bottle (commemorating Woese's election to the National Academy of Sciences)–Inscribed, 1988
Japanese Headband (Hachimaki)
Metal Cube
Prokaryote Small Subunit Trees (4), 1994
Rotary File
Rubber Stamp

Silk Necktie
Stamps (5 Envelopes)
Tie Clip
Tie Pin
Wooden Printing Blocks (4)

Box 28:

Awards and Honors--Certificates
Crafoord Prize, 2003
MacArthur Fellow, 1984
Royal Swedish Academy of Sciences Membership, 1997
Syracuse University
Honorary Doctorate, 1994
Citation Accompanying Honorary Doctorate, 1994
Selman A. Waksman Award in Microbiology, 1997
Bronze Miniatures–Alma Mater
Crafoord Prize, 2003
Ikenberry Chair, 1996
Commemorative Pieces
Abbott-ASM Lifetime Achievement Award, 2009
Center for Advanced Study Professor, 1989
IGB: Conversation with Carl, 2010
Glass Globe
Illinois License Plate–ARCHAE

Box 29:

Medals
Abbott Laboratories Pharmaceutical Products Division Honors, 2009
Stanley O. Ikenberry Chair, 1996
National Medal of Science, 2000
University of Illinois Board of Trustees Distinguished Service Medallion, 2010
Neckties
The Royal Swedish Academy of Sciences
Uppsala University
Plaques
The Brown-Hazen Award, 1992
Storer Lecturer, 1979
University Scholar, undated

Box 30: OVERSIZE Box I

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American Academy of Microbiology Fellow, 1994
American Society for Microbiology Honorary Member, undated
German Academy of Sciences Leopoldina Membership, 1983
The German Society for Hygiene and Microbiology–Membership, 1981
Illinois House of Representatives Certificate of Recognition, undated
National Medal of Science, 2000

Computer Printouts

16S-Like Primers, 1986
Database of 16S rRNA Catalogs, undated
Eubacterial Complete and Reverse Transcriptase Summary Sequences, 1986
Evolutionary Distance Tables, 1981-82
Phylogenetic Trees, 1984
Ribosomal RNA Oligonucleotide Catalogs, 1981-84
Sequence Shuffle Program, 1982

Box 31: OVERSIZE Box II

Illustrations for Articles, Books, and Talks

16S Ribosomal RNA Secondary Structure, undated
16S and 18S Ribosomal RNA Secondary Structure, undated
23S Ribosomal RNA Secondary Structure, undated
Archaea Ribosomal RNA Structure and Phylogenetic Tree, undated
"Bacterial Evolution," 1987
Drawings for Tahoe Meeting, undated
The Genetic Code: The Molecular Basis for Genetic Expression , 1967
"Higher Order Interactions in 23S rRNA," undated
"Molecular Mechanics of Translation: A Reciprocating Ratchet Mechanism," 1970
Mycoplasma 5S Ribosomal RNA Tree, undated
Phylogenetic Trees–Archaebacteria and Eubacteria, undated
Bacteria, undated
Methanogens and Purple Bacteria, undated
"Phylogeny of Procaryotes," 1980
Two-Dimensional Electrophoretogram, undated
Universal Ancestor, undated

Box 32: OVERSIZE Box III

Awards and Honors–Certificates

The Explorers Club Membership, 1978
External Scientific Member of the Max Planck Institute for Biochemistry, 1987

Newspaper Article re: Honorary Degree from Syracuse University, 1994

Photo–Framed

Institute for Genomic Biology Archaea Evolution Conference, 2007

Poster

"Whither Microbiology"–Woese Lecture at Uppsala University, 1995

Box 33: OVERSIZE Box IV

Scrapbooks re:
Discovery of Archaea, 1977-81
MacArthur Foundation Grant, 1984

Box 34:

RECORD BOOKS (These green notebooks list 16S ribosomal RNA oligonucleotide sequences of various bacteria and some eukaryotes. All of the notebooks are undated.)

16S RNA Book III
Arthrobacter/Micrococcus
Bacillus group
Bacteroides
Blue-Green Bacteria and Chloroplasts
Clostridium II
Desulfovibrio and Bdellovibrio
Eucaryotes
Gram-Positive Bacteria
Green Bacteria
Lactobacillus/Streptococcus
Mycoplasma
Mycoplasma/Clostridia
Pseudomonas/Rhodospirillum III
Rhodospirillum I
Rhodospirillum II
Rhodospirillum III
Rhodospirillum Group
Spirochete

Oversize in Map Case 3-6, Room 106F, ARC

Diagram Showing 16S Ribosomal RNA Secondary Structure between Positions 230 and 440 for *E. coli*, *V. necatrix*, and *S. cerevisiae*
Illustrations by Stanley Jones for Woese article, "Molecular Mechanics of Translation: A Reciprocating Ratchet Mechanism," 1970
Posters
"Hidden Before Our Eyes: 30 Years of Molecular Phylogeny," Institute for Genomic Biology Conference, 2007
Miles Davis
Moe Howard as Mao Zedong
Marshall Nirenberg: Genes and the Future of Man–Includes Woese annotation

National Medal of Science 2000

Oversize in Room 201, ARC

Framed Drawings of 16S Ribosomal RNA Structure (4)

Oversize in Room 121, ARC

Electrophoresis Chamber

X-RAY FILMS

Beginning about 1970, Carl Woese and his students began to partially sequence the ribosomal RNA of numerous microorganisms with the ultimate hope of shedding light on the early evolutionary development of the cell. "Therefore, what I want to do is to determine primary structures for a number of genes in a very diverse group of organisms, on the hope that by deducing rather ancient ancestor sequences for these genes, one will eventually be in the position of being able to see features of the cell's evolution," Woese explained in a 1969 letter to Francis Crick, co-discoverer of the DNA double helix. Woese employed an expensive, complex and time-consuming process known as polyacrylamide gel electrophoresis to separate the RNA fragments. The end result of this process was a so-called Sanger pattern on an X-ray film showing the organism's partial ribosomal RNA sequences. These sequences appeared on the film as hazy spots or "blobs"; the "blobs" were the "fingerprints" that allowed Woese and his students to identify the organism. In 1976 Woese noticed that the Sanger pattern of an organism called *Methanobacterium thermoautotrophicum* (nicknamed "delta H" for short) didn't have the tell-tale spots of a bacterial species, and this observation led to Woese's discovery of the Archaea–the third form of life. Documenting some twenty years of Woese's work on the cutting edge of microbiology research, the X-ray films contain Sanger patterns of the ribosomal RNA of hundreds of microorganisms and are organized alphabetically by organism.

Note: "S" stands for Svedberg unit–a measure of the rate at which a molecule turns to sediment in an ultracentrifuge; 16S refers to the ribosomal RNA of the smaller of the two subunits that make up the ribosome; 23S and 5S are the ribosomal RNA of the larger of the two subunits.

Box 35:

Acetobacterium woodii 16S, 1976-77

Box 36:

Acetogen 16S, 1980

Box 37:

Acholeplasma laidlawii 16S, 1975-76

Box 38:

Acholeplasma laidlawii 16S, 1975-76

Box 39:

Acholeplasma laidlawii 16S, 1975-76

Box 40:

Acholeplasma laidlawii 16S, 1975-76

Box 41:

Acinetobacter 16S, 1974

Box 42:

Acinetobacter 16S, 1974

Box 43:

Acinetobacter calcoaceticus 16S, 1974

Box 44:

Acinetobacter calcoaceticus 16S, 1979

Box 45:

Actinomyces bovis 16S/*Actinomyces viscosus* 16S, 1978

Box 46:

Aerobacter, 1971

Box 47:

Aerobacter 5S, undated

Box 48:

Aerobacter aerogenes 16S, 1972

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Aerobacter aerogenes 16S, 1972

Box 50:

Aerobacter aerogenes 16S, 1972

Box 51:

Aeromonas liquifaciens 5S, 1973

Box 52:

Aeromonas liquifaciens 16S, 1973

Box 53:

Agrobacterium tumefaciens 23S, 1984-85

Box 54:

Agrobacterium tumefaciens 23S, 1984-85

Box 55:

Alcaligenes aestus 5S, 1976

Box 56:

Alcaligenes aestus 16S, 1976

Box 57:

Alcaligenes eutrophus 16S /*Pseudomonas diminuta* 16S, 1980

Box 58:

Alcaligenes faecalis 16S, 1974

Box 59:

Alcaligenes faecalis 16S, 1974

Box 60:

Alcaligenes faecalis 16S, 1974

Box 61:

Alcaligenes faecalis 16S, 1974

Box 62:

Alcaligenes faecalis 16S, 1983

Box 63:

Amino Acid Experiments, undated

Box 64:

Anacystis nidulans 16S, 1972

Box 65:

Aphanocapsa 4S and 16S, 1976

Box 66:

Aquaspirillum aquaticum 16S/*Aquaspirillum dispar* 16S, 1981-82

Box 67:

Aquaspirillum bengal 16S, 1982

Box 68:

Aquaspirillum gracile 16S/*Aquaspirillum serpens* 16S, 1979-80

Box 69:

Aquaspirillum itersonii 16S/*Rhodospirillum rubrum* 16S, 1976-78

Box 70:

Archaeoglobus 7S, undated

Box 71:

Archaeoglobus fulgidis 5S, undated

Box 72:

Archaeviruses-Photographs, 1982

Box 73:

Arthrobacter atrocyaneus 16S/*Arthrobacter variabilis* 16S, 1978

Box 74:

Arthrobacter globiformis, undated

Box 75:

Arthrobacter globiformis 16S/*Arthrobacter oxydans* 16S/*Arthrobacter simplex* 16S, 1978

Box 76:

Azotobacter vinelandii, 1978

Box 77:

Bacillus acidocaldarius 5S/*Methanobacterium* M-1 5S/*Acholeplasma* 5S, 1976

Box 78:

Bacillus acidocaldarius 16S, 1976

Box 79:

Bacillus alvei 16S, 1976

Box 80:

Bacillus badius 16s/*Bacillus coagulans* 16S, 1976

Box 81:

Bacillus brevis 5S, 1974

Box 82:

Bacillus brevis 16S, 1974

Box 83:

Bacillus brevis 16S/*Escherichia coli* 16S, 1974-75

Box 84:

Bacillus brevis 16S, 1976

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Bacillus brevis 16S, 1976

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Bacillus brevis 16S, 1977

Box 87:

Bacillus brevis 16S, 1978

Box 88:

Bacillus brevis 16S, 1978

Box 89:

Bacillus brevis 16S, 1978-79

Box 90:

Bacillus brevis 16S, 1979

Box 91:

Bacillus brevis 16S, 1979

Box 92:

Bacillus brevis 16S, 1979

Box 93:

Bacillus brevis 16S, 1979

Box 94:

Bacillus brevis 16S, 1979

Box 95:

Bacillus brevis 16S, 1979

Box 96:

Bacillus brevis 16S, 1979

Box 97:

Bacillus brevis 16S, 1979

Box 98:

Bacillus brevis 16S, 1979

Box 99:

Bacillus brevis 16S, 1979

Box 100:

Bacillus brevis 16S, 1979

Box 101:

Bacillus brevis 16S, 1979

Box 102:

Bacillus brevis 16S, 1979

Box 103:

Bacillus brevis 23S, 1974

Box 104:

Bacillus brevis 23S, 1974

Box 105:

Bacillus brevis 30S, 1974

Box 106:

Bacillus brevis 30S, 1976

Box 107:

Bacillus brevis 953 16S/*Bacillus brevis* 1028 16S, 1976

Box 108:

Bacillus brevis 1028 5S/*Bacillus brevis* 12991 5S/*Bacillus polymyxa* 5S, 1976

Box 109:

Bacillus brevis 8185 5S, 1976

Box 110:

Bacillus brevis 8185 5S, 1976-77

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Bacillus brevis 8185 5S, 1977

Box 112:

Bacillus brevis 8185 5S, 1977

Box 113:

Bacillus brevis 8185 5S, 1977

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Bacillus brevis 8185 5S, 1977

Box 115:

Bacillus brevis 8185 5S, 1977

Box 116:

Bacillus brevis 8185 16S, 1973-74, 1976

Box 117:

Bacillus brevis 8185 23S, 1977

Box 118:

Bacillus brevis 8185 50S, 1976

Box 119:

Bacillus brevis 8185 50S, 1976

Box 120:

Bacillus brevis 12991 16S, 1976

Box 121:

Bacillus cereus 5S, 1974

Box 122:

Bacillus cereus 16S, 1974

Box 123:

Bacillus cereus 16S, 1974

Box 124:

Bacillus fastidiosus 16S, 1977

Box 125:

Bacillus firmus 5S, 1976

Box 126:

Bacillus firmus 16S, 1976

Box 127:

Bacillus insolitus 16S, 1976

Box 128:

Bacillus megaterium 5S, 1971

Box 129:

Bacillus megaterium 5S, 1974

Box 130:

Bacillus megaterium 5S, 1974

Box 131:

Bacillus megaterium 5S/*Bacillus subtilis* 5S, 1974

Box 132:

Bacillus megaterium 16S, 1972

Box 133:

Bacillus megaterium/Escherichia coli 16S, 1973

Box 134:

Bacillus megaterium 16S, undated

Box 135:

Bacillus megaterium 23S, 1974

Box 136:

Bacillus pasteurii 5S/*Sporosarcina ureae* 5S, 1974

Box 137:

Bacillus pasteurii 16S, 1973

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Box 139:

Bacillus polymyxa 16S, 1976

Box 140:

Bacillus pumilus 16S, 1974

Box 141:

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Box 142:

Bacillus psychrophilus 16S, 1976

Box 143:

Bacillus sphaericus 5S/*Aphanocapsa* 6714 5S/*Rhodomicrobium* 5S, 1976

Box 144:

Bacillus sphaericus 16S, 1976

Box 145:

Bacillus stearothermophilus 16S, 1973

Box 146:

Bacillus stearothermophilus 16S, 1973

Box 147:

Bacillus stearothermophilus 16S, 1981

Box 148:

Bacillus stearothermophilus 23S, 1981

Box 149:

Bacillus subtilis 16S, 1975

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Bacillus subtilis 16S, 1975

Box 151:

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Box 152:

Bacillus subtilis 16S, 1979

Box 153:

Bacteroides amylophilus 16S, 1981-82

Box 154:

Bacteroides asaccharolyticus 16S, 1983

Box 155:

Bacteroides asaccharovorum 16S, 1983

Box 156:

Bacteroides "Bruce contaminant," 1982

Box 157:

Bacteroides distasonis 16S/*Bacteroides vulgatus* 16S, 1982

Box 158:

Bacteroides fragilis 16S/*Bacteroides thetaiotaomicron* 16S, 1982

Box 159:

Bacteroides gingivalis 16S, 1983

Box 160:

Bacteroides melaninogenicus 16S/*Bacteroides ovatus* 16S, 1982

Box 161:

Bacteroides ruminicola 16S, 1983

Box 162:

"Bacteroides" succinogenes 16S, 1981-82

Box 163:

Bacteroides uniformis 16S/*Bacteroides ruminicola* 5S, 1982

Box 164:

Bacteroides vulgatus 5S/16S, 1983 (2 folders)

Box 165:

Bacteroides vulgatus 5S/*Sulfolobus solfataricus* 5S, 1983

Box 166:

Bacteroides vulgatus 5S/*Thermoplasma* 5S/*Sulfolobus solfataricus* 5S, 1983

Box 167:

Bdellovibrio 16S, 1977

Box 168:

Bdellovibrio stolpii 16S/*Bdellovibrio* BM4 16S, 1980, 1983

Box 169:

Beggiatoa leptomitiformis 16S, 1982

Box 170:

Bifidobacterium/Propionibacterium/Micrococcus/Arthrobacter sp., 1988

Box 171:

Bifidobacterium bifidum 16S/*Bifidobacterium breve 16S*, 1978

Box 172:

Blastocladiella, 1977

Box 173:

Brevibacterium linens 16S/*Brevibacterium ketoglutamicum* 16S, 1978

Box 174:

Butyrivibrio fibrosolvens 16S, 1982

Box 175:

Caulobacter crescentus, 1985

Box 176:

Cellulomonas flavigena 16S/*Cellulomonas cartalyticum* 16S, 1978

Box 177:

Chloroacetaldehyde Experiments, 1974

Box 178:

Chlorobium pharovibrio forme 16S, 1982

Box 179:

Chlorobium limicola 16S, 1982

Box 180:

Chlorobium vibrioforma 16S/*Chloroherpeton* 16S, 1976, 1982

Box 181:

Chloroflexus 16S, 1976-77

Box 182:

Chloroflexus aurantiacus, 1985

Box 183:

Chloroplast 16S, 1974

Box 184:

Chromatium 5S, 1976

Box 185:

Chromatium 16S, 1976

Box 186:

Chromatium tepidum 16S, 1985

Box 187:

Chromobacterium violaceum 16S/*Chromobacterium lividum* 16S, 1979-80

Box 188:

Clostridium aceticum 16S/*Clostridium formicoaceticum* 16S, 1980

Box 189:

Clostridium acidurici 16S, 1977

Box 190:

Clostridium aminovalericum 5S/*Clostridium cochlearum/Clostridium innocuum* 5S, 1978

Box 191:

Clostridium aminovalericum 16S/*Clostridium oroticum* 16S, 1977-78

Box 192:

Clostridium barkeri 16S, 1977

Box 193:

Clostridium barkeri 16S, 1986

Box 194:

Clostridium barkeri/Sporomusa/Methanococcus, 1986

Box 195:

Clostridium butyricum 16S/*Clostridium scatologenes* 16S, 1978

Box 196:

Clostridium cylindrosporum 16S, 1981-82

Box 197:

Clostridium indolis 16S/*Clostridium sphenoides* 16S, 1978

Box 198:

Clostridium innocuum, undated

Box 199:

Clostridium innocuum 16S/*Clostridium ramosum* 16S, 1977

Box 200:

Clostridium lituseburense 16S/*Eubacterium tenue* 16S, 1977

Box 201:

Clostridium pasteurianum 5S, 1974

Box 202:

Clostridium pasteurianum 16S, 1974

Box 203:

Clostridium perfringens 16S, 1971

Box 204:

Clostridium perfringens 16S, 1978

Box 205:

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Box 206:

Clostridium purinolyticum 16S, 1981-82

Box 207:

Clostridium spp., 1986

Box 208:

Clostridium stricklandii, 1978

Box 209:

Clostridium thermoaceticum 16S, 1978

Box 210:

Clostridium thermosaccharolyticum 5S, 1977

Box 211:

Clostridium thermosaccharolyticum 16S, 1977

Box 212:

Clostridium thermosaccharolyticum 23S, 1972

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Box 215:

Comamonas terrigena 16S, 1979

Box 216:

Corynebacterium diphtheriae 16S, 1975

Box 217:

Corynebacterium fascians/Clostridium perfringens, 1978

Box 218:

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Box 219:

Corynebacterium mediolanum 16S, 1978

Box 220:

Dactylosporangium aurantiacum 16S, 1978

Box 221:

Deinococcus erythromyxa 16S, 1982

Box 222:

Desulfomaculum 16S/*Desulfovibrio* 16S, 1978

Box 223:

Desulfovibrio desulfuricans, 1979

Box 224:

Desulfovibrio desulfuricans 23S/*Heliobacterium* 23S, 1987

Box 225:

Desulfuromonas aeroxidans 16S, 1983

Box 226:

Dictyostelium 17S, 1977

Box 227:

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Box 228:

Escherichia coli 16S, 1974-75

Box 229:

Escherichia coli 16S, 1975

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Escherichia coli 16S, 1975

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Escherichia coli 16S, 1975-76

Box 234:

Escherichia coli 16S, 1976

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Box 236:

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Box 237:

Escherichia coli 16S and 30S, 1974-75

Box 238:

Escherichia coli 16S and 30S, 1975

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Escherichia coli 23S, 1972

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Box 241:

Escherichia coli 30S, ca. 1970

Box 242:

Escherichia coli 30S and 50S, ca. 1970

Box 243:

Escherichia coli 50S, 1970 (2 folders)

Box 244:

Escherichia coli 50S/*Bacillus brevis* 16S, 1976

Box 245:

Escherichia coli B236 16S, 1975

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Escherichia coli B236 23S, 1975

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Escherichia coli B236 50S, 1975

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Escherichia coli B236 50S, 1975

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Escherichia coli B236 50S, 1975

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Escherichia coli B236 50S, 1975

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Escherichia coli B236 50S, 1977

Box 259:

Escherichia coli B236 50S, 1977

Box 260:

Escherichia coli EB-30 16S, 1973

Box 261:

Eubacterium limosum 16S, 1977

Box 262:

Euglena--Chloroplast, 1974

Box 263:

Euglena-Cytoplasm and Chloroplast, 1974

Box 264:

Euglena-Mitochondrion and Chloroplast, 1974

Box 265:

Euglena 18S, 1977

Box 266:

Flavobacterium aquatile 16S/*Flavobacterium heparinum* 16S, 1980, 1982

Box 267:

Flavobacterium capsulatum 16S/*Thiocapsa/Pseudomona*s 29357, 1979

Box 268:

Flavobacterium ferrugineum 16S/*Flavobacterium uliginosum* 16S, 1983

Box 269:

Flavobacterium halmephilum 16S, 1982

Box 270:

Flavobacterium heparinum 16S, 1985

Box 271:

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