CLAIRE FRASER
ASM COLLOQUIUM
MARCH 19 - 21, 1999
NEW ORLEANS, LA

THURSDAY, MARCH 18

6:15 p.m. TIGR Van pick-up at home

US Airways 1519
7:26 p.m. Depart Washington/Reagan
9:17 p.m. Arrive New Orleans

Carey Sedan: Confirmation #: 99075260
Phone # in New Orleans: 504-523-6511
Will meet you at US Airways baggage claim;
Owen & Jonathan will meet you there also.

Jonathan Eisen & Owen White:

Northwest Flight 991
4:15 p.m. Depart BWI
5:56 p.m. Arrive Detroit
Northwest Flight 1475
7:10 p.m. Depart Detroit
8:50 p.m. Arrive New Orleans

Hotel: Bourbon Orleans
717 Orleans Street
Phone: 800-521-5338 or 504-523-2222

FRIDAY & SATURDAY, MARCH 19 & 20

Microbial Genome Sequencing: Current Status and Future Needs
See "Red" Logistics & Briefing Binder (agenda attached)

SUNDAY, MARCH 21

12:00 p.m. Adjourn

11:45 a.m. Carey Sedan pick-up at hotel
Confirmation #: 99075267

United 914
1:02 p.m. Depart New Orleans
4:18 p.m. Arrive Dulles

Jonathan Eisen & Owen White:

Northwest 1474
4:15 p.m. Depart New Orleans
7:46 p.m. Arrive Detroit
Northwest Flight 487
9:15 p.m. Depart Detroit
10:43 p.m. Arrive BWI

TIGR Van pick-up

From: McNult Peggy <pmcNult@asmusa.org>
To: "'meacho@tigr.org'" <meacho@tigr.org>
Subject: Microbial Genome Sequencing
Date: Mon, 15 Mar 1999 14:36:36 -0500
MIME-Version: 1.0

Hotel reservations have been made for Owen White and Jonathan Eisen at the Bourbon Orleans. All colloquium participants will be staying at the Bourbon Orleans and the colloquium will be held there as well. The address of the hotel is 717 Orleans Street and the telephone number is 1-800-521-5338. Their hotel reservation is under their last name and is part of the American Academy of Microbiology hotel block. Their room, tax, and incidentals will be billed directly the Academy's master account.

They can pick up their nametags and binders at breakfast on Friday morning.
If you have any additional questions, please feel free to contact me directly. Thank you, Peggy

Peggy McNult
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Memorandum

To: Participants, American Academy of Microbiology Colloquium: "Microbial Genome Sequencing: Current Status and Future Needs"

From: Carol Colgan, American Academy of Microbiology

Date: February 26, 1999

Subject: Colloquium Logistics and Briefing Binder

The American Academy of Microbiology colloquium, "Microbial Genome Sequencing: Current Status and Future Needs," will be held March 19-21, 1999, in New Orleans, Louisiana. This briefing binder contains the following information: agenda, roster of participants, biographical sketches of participants, working groups, issues for consideration, a document describing the colloquium, an ASM expense report form for submitting your expenses for reimbursement, a hotel brochure, and paper for notes.

In addition, listed below is additional colloquium information:

- **Attire**: Casual.

- **Ground Transportation**: The hotel is approximately 15 miles from the airport. You may take a taxi ($21) or the airport shuttle ($10). The airport shuttle company has a booth in the baggage claim area. Please keep your taxi or shuttle receipts for submission of reimbursement from the Academy. The Academy will not reimburse for car rental.

- **Hotel**: Hotel reservation, single sleeping rooms, have been made for you for the evenings of March 18, 19, and 20 at the Bourbon Orleans, unless you requested otherwise. If you have any special room requirements or have different arrival and departure dates and have not already communicated this to us, please contact Peggy McNult in writing immediately. Her fax number is (202) 942-9380; e-mail is pmcnult@asmusa.org. All hotel expenses—room, tax, and incidentals—will be billed directly to the American Academy of Microbiology. Our grants will only pay the expenses of the colloquium participants; you will be responsible for all expenses for guests. Telephone calls, laundry, liquor, in-room movies, and recreational activities may not be charged to our grants; you will be billed for these expenses after the colloquium or they will be deducted from your expense reimbursement form.

- **Meals:** Full breakfasts and lunches have been scheduled for the duration of the colloquium. Breakfast will be available at 7:30 a.m. each morning in Cafe Lafayette. There will be a group dinner on Friday night at 6:00 p.m. in the pool/patio area. If you would like to bring a guest to dinner on Friday night, please notify Peggy McNult in writing no later than March 15. You will be responsible for the cost of the dinner and beverages for any guests. If you have special dietary requirements, please also notify Peggy McNult by March 15. Since these meals (3 breakfasts, 2 lunches, 1 dinner) have already been paid for, you will not be reimbursed if you opt for private meals.

If you have any questions or concerns, please feel free to contact me or Peggy McNult. If look forward to seeing you in New Orleans.

AMERICAN
SOCIETY FOR
MICROBIOLOGY

MACMALL
1800-222-2808

Mrs Workman
1800-255-6337

American Academy of Microbiology

"Microbial Genome Sequencing: Current Status and Future Needs"

Agenda

Friday, March 19

7:30-8:30	Breakfast
8:30-9:00	Welcome (Rita Colwell, Chair, Board of Governors, American Academy of Microbiology)
	Charge to Colloquium Participants (David Relman and Craig Venter, Co-Chairs, Colloquium Steering Committee)
9:00-10:00	Round Table: Agency Initiatives
	• Marvin E. Frazier, Dept. of Energy
	• Michael Gottlieb, National Institutes of Health
	• Maryanna P. Henkart, National Science Foundation
	• R. Michael Roberts, U.S. Dept. of Agriculture
10:00-12:30	Working Groups
12:30-1:45	Group Lunch
1:45-5:00	Working Groups
6:00	Group Dinner

Saturday, March 20

7:30-8:30	Breakfast
8:30-12:30	Working Groups
12:30-1:45	Group Lunch
1:45-5:00	Working Groups
	Free for Dinner

Sunday, March 21

7:30-8:30	Breakfast
8:30-12:00	Group Reports and Discussion
12:00	Adjourn

American Academy of Microbiology

Microbial Genome Sequencing Roster

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American Academy of Microbiology

Participants

Joan W. Bennett. **Education:** Ph.D., Botany, Univ. of Chicago. **Present Position:** Prof., Dept. of Cell and Molecular Biology, Tulane Univ. **Honors, Awards, and Service:** Fellow, American Academy of Microbiology; Fellow, Society for Industrial Microbiology; Fellow, American Association for the Advancement of Science; President, American Society for Microbiology; Vice President, British Mycological Society; Editorial Board, *Biotechnology Letters, Annual Review of Microbiology, International Biodeterioration and Biodegradation, Mycological Research, Applied Microbiology and Biotechnology, Mycopathologia, Journal of Industrial Microbiology, Applied and Industrial Microbiology.* **Research Interests:** fungal genetics; aflatoxin biosynthesis, secondary metabolism; biodegradation; biotechnology; genomics.

Alison M. Berry. **Education:** Ph.D., Botany, Univ. of Massachusetts. **Present Position:** Assoc. Prof., Dept. of Env. Horticulture, Univ. of California, Davis, and Program Director, Metabolic Biochemistry, Molecular and Cellular Biosciences, National Science Foundation. **Research Interests:** metabolic and regulatory aspects of biological nitrogene fixation by *Frankia* in root nodule symbiosis with woody angiosperms; assessment of the role and mechanism of nitrogen-fixing plants in N accretion in semiarid ecosystems.

Donald A. Bryant. **Education:** Ph.D., Molecular Biology, Univ. of California, Los Angeles (1977). **Present Position:** Ernest C. Pollard Prof. of Biotechnology and Prof. of Biochemistry and Molecular Biology, Pennsylvania State Univ. **Honors, Awards, and Service:** Fellow, American Academy of Microbiology; Chair, NIH-GMS Study Section, Microbiology Physiology; Editorial Board, *Photosynthesis Research, Archives of Microbiology, Journal of Bacteriology.* **Research Interests:** structure, function, and biogenesis of the photosynthetic apparatus in cyanobacteria and green sulfur bacteria.

Allan M. Campbell. **Education:** Ph.D., Univ. of Illinois. **Present Position:** Barbara Kimball Browning Prof. in the School of Humanities and Sciences and Prof. of Biological Sciences, Stanford Univ. **Honors, Awards, and Service:** Member, National Academy of Sciences; Fellow, American Academy of Microbiology; Fellow, American Association for the Advancement of Science; Council, American Academy of Arts and Sciences; Member, NIH Study Section, Genetics; Chair, Virology Div., American Society for Microbiology; Editorial Board, *Gene, The New Biologist, Evolution, Annual Review of Genetics, Journal of Virology, Journal of Bacteriology, Virology.* **Research**

Interests: Evolution of DNA recognition specificity in phage integrases; genetic structure of natural phage populations; genome-wide over- and underrepresentations of oligonucleotide sequences; regulation of vitamin biosynthesis.

Rita R. Colwell. **Education:** Ph.D., Univ. of Washington. **Present Position:** Director, National Science Foundation. **Honors, Awards, and Service:** Fellow, American Academy of Microbiology; Chair, Board of Governors, American Academy of Microbiology; President, Chair of the Board, American Society for Microbiology; President, American Association for the Advancement of Science; President, Sigma Xi; Fisher Biotechnology Research Award; Editorial Board, *Science, Asia-Pacific Journal of Molecular Biology and Biotechnology, International Journal of Biosciences and Law, Marine Molecular and Cellular Biology, Journal of Marine Biotechnology,* and *Applied and Environmental Microbiology.* **Research Interests:** marine biotechnology; marine and estuarine microbial ecology; survival of pathogens in the aquatic environment; ecology of *Vibrio cholerae* and related organisms; microbial systematics; microbial degradation.

Shiladitya DasSarma. **Education:** Ph.D., Biochemistry, Massachusetts Institute of Technology. **Present Position:** Prof. of Microbiology, Univ. of Massachusetts, Amherst. **Honors, Awards, and Service:** Editorial Board, *Journal of Bacteriology, Archaea, A Laboratory Manual.* **Research Interests:** extremophiles, especially halophilic archaea; mechanisms of adaptation to hypersaline environments; transposable elements; genomic plasticity; chromosome evolution.

Julian E. Davies. **Education:** Ph.D., Organic Chemistry, Univ. of Nottingham. **Present Position:** Chief Scientific Officer, TerraGen Diversity, Inc./Univ. of British Columbia, and Prof. Emeritus, Microbiology and Immunology, Univ. of British Columbia. **Honors, Awards, and Service:** President-Elect, American Society for Microbiology; Fellow, American Academy of Microbiology; Fellow, Royal Society of Canada; Fellow, Royal Society, London; Fellow, International Institute of Biotechnology; Hoechst-Roussel Award, ASM; Thom Award, Society for Industrial Microbiology; Microbial Chemistry Medal, Kitasato Institute; CSM, Boehringer-Mannheim Award; Editorial Board, *Journal of Molecular Biology, Journal of Antibiotics, Biofutur, Present Opinion in Biotechnology, Research in Microbiology.* **Research Interests:** function and regulation of resistance transfer factors; origin and evolution of antibiotic resistance genes; microbial diversity; gene transfer between distantly related microbes; evolution of RNA structures.

Robert E. Davis. **Education:** Ph.D., Cornell Univ. **Present Position:** Research Leader, Molecular Plant Pathology Laboratory, Agricultural Research Service, USDA. **Honors, Awards, and Service:** Fellow, American Phytopathological Society; 1998 USDA Silver Plow Award for Professional Excellence. **Research Interests:** molecular genetic diversity of pathogenic phytoplasmas; pathogen detection/identification/classification; etiology of unknown diseases; genomics.

Jody W. Deming. **Education:** Ph.D., Microbiology, Univ. of Maryland. **Present Position:** Prof. School of Oceanography, Univ. of Washington, and Director, Marine Bioremediation Program, Univ. of Washington. **Honors, Awards, and Service:** Fellow, American Academy of Microbiology; Nationally Elected Member-at-Large, AAAS; U.S. Coast Guard Arctic Service Medal; Editorial Board, *Journal of Aquatic Microbial Ecology, Journal of Water, Air, and Soil Pollution.* **Research Interests:** molecular cnzymatic basis for psychrophily in marine bacteria and relevance to biotechnology, bioremediation, and astrobiology; existence of subsurface biosphere; hydrostatic pressure as a factor in the evolution and ecology of marine bacteria.

W. Ford Doolittle. **Education:** Ph.D., Biological Sciences, Stanford Univ. **Present Position:** Director, Canadian Institute for Advanced Research Program in Evolutionary Biology, and Prof., Dept. of Biochemistry, Dalahousie Univ. **Honors, Awards, and Service:** Henry Friesen Award, Canadian Society for Clinical Investigation and the Royal College of Physicians and Surgeons of Canada; Award of Excellence, Genetics Society of Canada; Fellow, Royal Society of Canada; Fellow, American Association for the Advancement of Science; Council Member, Society for Molecular Biology and Evolution; Editorial Board, *Journal of Molecular Evolution, Molecular Biology and Evolution.* **Research Interests:** molecular changes that have occurred in the genomes of organisms during the course of evolution.

Stanley Falkow. **Education:** Ph.D., Biology, Brown Univ. **Present Position:** Prof., Microbiology and Medicine, Stanford Univ. **Honors, Awards, and Service:** Member, National Academy of Sciences; Fellow, American Academy of Microbiology; Fellow, American Association for the Advancement of Medicine; Bristol-Myers Squibb Award for Distinguished Achievement in Infectious Disease Research; Becton Dickinson Award in Clinical Microbiology, American Society for Microbiology; President, American Society for Microbiology; Editorial Boards, *Infectious Agents and Disease, Infection and Immunity, Molecular Microbiology, Journal of Infectious Diseases, Journal of Bacteriology.* **Research Interests:** genetic and molecular basis of microbial pathogenicity; natural history of infectious diseases; molecular organization of genetic material of pathogens in endemic and epidemic settings.

Michael Fonstein. **Education:** Ph.D., All-Union Research Institute for Genetics and Selection of Industrial Microorganisms (ARIGSIM), Moscow, USSR. **Current Position:** Vice President for Research and Development, Integrated Genomics, Inc., and Director of the Sequencing Center, Univ. of Chicago. **Honors, Awards, and Service:** Member, Multi-User Instrumental Panel, NSF. **Research Interests:** developing comparative computational and "wet lab" approcahes aimed at functional reconstruction of microorganisms derived from their genome sequences.

Claire M. Fraser. **Education:** Ph.D., Pharmacology, State Univ. of New York at Buffalo. **Present Position:** President and Director, The Institute for Genomic Research. **Honors, Awards, and Service:** Member, Genome Research Review Committee, NIH; Editorial Board, *The Journal of Biological Chemistry, Microbial and Comparative*

Genomics. **Research Interests:** whole genome sequencing and analysis of microbial species; global analysis of gene expression; and evolution of microbial species.

Marvin E. Frazier. **Education:** Ph.D., Microbiology, Univ. of Montana. **Current Position:** Director, Life Sciences Div., Office of Biological and Environmental Research, Office of Science, U.S. Dept. of Energy. **Honors, Awards, and Service:** Member, Science and Technology Consultant Pool, Committee on International Radiation Research and Policy Coordination; Member, Human Risk Assessment Methods Working Group for the Strategic Environmental Research and Development Program. **Research Interests:** molecular and cellular mechanisms of oncogenesis; molecular biology of retroviruses; radiation biology; molecular and cellular bases of host-parasite interactions.

Thomas R. Gingeras. **Education:** Ph.D., Biology, New York Univ. **Present Position:** Vice President, Biological Sciences, Affymetrix, Inc. **Honors, Awards, and Service:** Study Section Panel Manager, USDA, Animal Molecular Biology; 11 patents. **Research Interests:** diagnosis and characterization of infectious agents and developing technologies which assist this goal; developing software tools and understanding how to utilize both the genotypic and phenotypic data collected from infected patients to better manage treatment of infectious disease conditions and guide therapeutic alternatives.

Harold S. Ginsberg. **Education:** M.D., Tulane Univ. School of Medicine. **Present Position:** Expert Scientist, National Institute of Allergy and Infectious Diseases, NIH, and Eugene Higgins Prof. of Medicine and Microbiology, Emeritus, College of Physicians and Surgeons of Columbia Univ. **Honors, Awards, and Service:** Member, National Academy of Sciences; Fellow, American Academy of Microbiology; Bristol-Myers Squibb Award for Distinguished Achievement in Infectious Disease Research; Academy Medal, New York Academy of Sciences; Honorary Fellow, American Association for the Advancement of Science; Senior U.S. Scientist Award, Humboldt Award; Chair, Board of Governors, American Academy of Microbiology; Member, National Board of Medical Examiners; President, Association of Medical School Microbiology Chairs; President, American Society of Virology; President, Harvey Society; Editorial Boards, *Journal of Virology, Intervirology, Journal of Infectious Diseases, Journal of Bacteriology, Journal of Immunology, Journal of Experimental Medicine, Proceedings of the Society for Experimental Biology and Medicine.* **Research Interests:** basic virology; viral genetics; molecular pathogenesis; infectious diseases.

Michael Gottlieb. **Education:** Ph.D., Biology, City University of New York. **Present Position:** Acting Chief and Program Officer, Parasitology and International Programs Branch, National Institute of Allergy and Infectious Diseases, National Institutes of Health. **Honors, Awards, and Service:** NIH Director's Award; Member, Board of Reviewers, *Journal of Eukaryotic Microbiology*; Councilor, American Society of Tropical Medicine and Hygiene. **Research Interests:** microbial physiology of trypanosomatid protozoa, including differential expression of surface membrame enzymes.

D. Jay Grimes. **Education:** Ph.D., Microbiology, Colorado State Univ. **Present Position:** Director, Institute of Marine Sciences, Univ. of Southern Mississippi. **Honors, Awards, and Service:** Fellow, American Academy of Microbiology; Chair, Public Communications Committee, American Society for Microbiology; Executive Board, U.S. Federation for Culture Collections; Editorial Board, *Applied and Environmental Microbiology, Estuaries*. **Research Interests:** microbiology of ocean and subsurface waste disposal; long-term survival of bacteria in aquatic habitats; bacterial genetics in natural environments; microbial ecology.

Radhey S. Gupta. **Education:** Ph.D., Molelcular Biology, Univ. of Bombay. **Present Position:** Prof., Dept. of Biochemistry, McMaster Univ. **Honors, Awards, and Service:** Executive Editor (North America), *Mutagenesis*; Member, Grant Review Panel, NCI Canada. **Research Interests:** evolutionary relationships among prokaryotes; origin of eukaryotic cells; cellular function of mitochrondria and heat shock proteins.

Maryanna P. Henkart. **Education:** Ph.D., Biology, Harvard Univ. **Present Position:** Director, Div. of Molecular and Cellular Biosciences, Biological Sciences Directorate, National Science Foundation. **Honors, Awards, and Service:** Chair, Biotechnology Research Working Group, National Science and Technology Council Submcommittee on Biotechnology. **Research Interests:** regulation of intracellular calcium and mechanisms of cellular cytotoxicity.

Richard E. Isaacson. **Education:** Ph.D., Microbiology, Univ. of Illinois. **Present Position:** Scientific Director, Center for Zoonosis Research and Infectious Diseases, Univ. of Illinois, and Prof. and Div. Head, Microbiology and Immunology, College of Veterinary Medicine, Univ. of Illinois. **Honors, Awards, and Service:** Fellow, American Academy of Microbiology; Pfizer Award for Research Excellence; Editorial Board, *Infection and Immunity, Animal Biotechnology, American Journal of Veterinary Research*. **Research Interests:** identification of *E. coli* genes expressed in vivo during disease; sequencing of *Salmonella enteritidis* genome.

H. Mark Johnston. **Education:** Ph.D., Molecular Biology, Univ. of California, Berkeley. **Present Position:** Prof. of Genetics, Washington Univ. School of Medicine **Honors, Awards, and Service:** Fellow, American Academy of Microbiology; Member, NIH Study Section, Microbial Physiology and Genetics; Editorial Board, *Molecular & Cellular Biology, Genetics*. **Research Interests:** yeast gene regulation; nutrient sensing and signaling.

A. Dale Kaiser. **Education:** Ph.D., Biology and Chemistry, California Institute of Technology. **Present Position:** Prof., Dept. of Biochemistry and Dept. of Developmental Biology, Stanford Univ. **Honors, Awards, and Service:** Member, National Academy of Sciences; Fellow, American Academy of Microbiology; Abbott-ASM Lifetime Achievement Award, American Society for Microbiology; Thomas Hunt Morgan Award, Genetics Society of America; Waterford Award in Biomedical Science; Lasker Medical Research Award; President, Genetics Society of America; Editorial

Board, *Journal of Bacteriology*. **Research Interests:** fruiting body development in *Myxococcus xanthus*.

Noel T. Keen. **Education:** Ph.D., Univ. of Wisconsin, Madison. **Present Position:** Distinguished Prof., Dept. of Plant Pathology, Univ. of California, Riverside. **Honors, Awards, and Service:** Member, National Academy of Sciences; Fellow, American Academy of Microbiology; Fellow, American Association for the Advancement of Science; Ruth Allen Award, American Phytopathological Society; Editorial Board, *Journal of Bacteriology, Journal of Phytopathology, Molecular Plant-Microbe Interactions, Phytopathology, Plant Physiology*. **Research Interests:** plant-microbe interactions; virulence mechanisms in bacterial plant pathogens; plant resistance mechanisms against pathogens.

Jeffrey H. Miller. **Education:** Ph.D., Biochemistry and Molecular Biology, Harvard Univ. **Present Position:** Prof., Dept. of Microbiology and Molecular Genetics, Univ. of California, Los Angeles. **Honors, Awards, and Service:** Friedrich Miescher Prize of the Swiss Biochemical Society; Editorial Board, *Journal of Molecular Biology*. **Research Interests:** mutagenesis and repair, in bacteria, higher cells, as well as Archea; genomics and proteomics.

F. Christopher Minion. **Education:** Ph.D., Molecular and Cellular Biology, Univ. of Alabama, Birmingham. **Present Position:** Assoc. Prof., Veterinary Medical Research Institute, Dept. of Microbiology, Immunology and Preventive Medicine, College of Veterinary Medicine, Iowa State Univ. **Honors, Awards, and Service:** SmithKline Beecham Award for Research Excellence; Louis Dienes Award in Mycoplasmology; Councilor, American Society for Microbiology. **Research Interests:** sequencing of *Mycoplasma hyopneumoniae* and *Mycoplasma gallisepticum* chromosomes; comparative genomics of mycoplasmas.

Kenneth H. Nealson. **Education:** Ph.D., Microbiology, Univ. of Chicago. **Present Position:** Sr. Scientist, Jet Propulsion Laboratory, and Faculty Associate, Geological and Planetary Sciences, California Institute of Technology. **Honors, Awards, and Service:** Fellow, American Academy of Microbiology; Member, Mars Science Working Group, NASA. **Research Interests:** bacteriology of oxic/anoxic interfaces; development of molecular methods for field ecology.

Eugene W. Nester. **Education:** Ph.D., Western Reserve Univ. **Present Position:** Prof., Dept. of Microbiology, Univ. of Washington, and Adj. Prof., Botany, Univ. of Washington. **Honors, Awards, and Service:** Member, National Academy of Sciences; Fellow, American Academy of Microbiology; Australia Prize (inaugural); Cetus Award in Biotechnology Research, American Society for Microbiology; Fellow, American Association for the Advancement of Science; Member, Board of Governors, American Academy of Microbiology; President, International Society for Molecular Plant-Microbe Interactions; Senior Editor, *Plant-Microbe Interactions*; Editorial Board, *Journal of Bacteriology, Plasmid, Molecular Plant Microbe Interactions, ASM News*. **Research Interests:** plant-microbe interactions; molecular basis of crown gall tumors.

David A. Relman. **Education:** M.D., Harvard Medical School. **Present Position:** Asst. Prof. of Medicine (Infectious Diseases and Geographic Medicine, and of Microbiology and Immunology, Stanford Univ. School of Medicine. **Professional Activities:** Young Investigator Award, VA Palo Alto HealthCare System; Baxter Diagnostics MicroScan Young Investigator Award, American Society for Microbiology; Upjohn Award for Excellence in Infectious Diseases Research, American Federation for Clinical Research, Western Section; Lucille P. Markey Scholar Award in Biomedical Science; Member, Advisory Panel, Emerging Infections Network, Infectious Diseases Society of America; Editorial Board, *Emerging Infectious Diseases*.

Monica M. Riley. **Education:** Ph.D., Comparative Biochemistry, Univ. of California. **Present Position:** Senior Scientist, Marine Biological Laboratory, Woods Hole, and Prof. of Biochemistry, Emeritus, State Univ. of New York, Stony Brook. **Professional Activities:** Editor, "The Bacterial Chromosome." **Research Interests:** function of all genes of the *E. coli* chromosome; database of metabolism of *E. coli*; mechanisms of evolution of prokaryotic genes and proteins.

Richard J. Roberts. **Education:** Ph.D., Organic Chemistry, Univ. of Sheffield, England. **Present Position:** Research Director, New England Biolabs. **Honors, Awards, and Service:** Fellow, American Academy of Microbiology; Nobel Prize for Physiology or Medicine; Fellow, American Academy of Arts and Sciences; Fellow, Royal Society; Golden Plate Award, American Academy of Achievement; Editorial Board, *Current Opinions in Chemical Biology, Bioinformatics, Journal of Biological Chemistry*; Executive Editor, *Nucleic Acids Research*. **Research Interests:** restriction endonucleases; DNA methylases, computational molecular biology.

R. Michael Roberts. **Education:** D.Phil., Plant Physiology/Biochemistry, Oxford University, England. **Present Position:** Prof. of Biochemistry and Animal Sciences, Univ. of Missouri-Columbia, and Chief Scientist, National Research Initiative, U.S. Dept. of Agriculture. **Honors, Awards, and Service:** Member, National Academy of Sciences; Member, NIH Reproductive Biology Study Section; Alexander von Humboldt Award for Agriculture; Milstein Award, International Society for Interferon and Cytokine Research. **Research Interests:** communication between the developing placenta, particularly of domestic animal species, and the mother during early pregnancy; control of gene expression at the time when the trophoblast first differentiates.

David Schlessinger. **Education:** Ph.D., Biochemistry, Harvard Univ. **Present Position:** Chief, Laboratory of Genetics, NIH, National Institute on Aging. **Honors, Awards, and Service:** Fellow, American Academy of Microbiology; Eli Lilly Award for Research, American Society for Microbiology; Member, National Board of Medical Examiners, Microbiology; President, American Society for Microbiology; Editorial Board, *Genomics, GENE, Microbiological Reviews*. **Research Interests:** applying genomic approaches to study of developmental processes and their relation to subsequent age-related conditions.

Karen Shaw. **Education:** Ph.D., Univ. of Connecticut. **Present Position:** Research Fellow, Chemotherapy and Molecular Genetics, Schering-Plough Research Institute. **Honors, Awards, and Service:** mentor for high school student, 1997 Westinghouse Talent Search finalist; scientific mentor for visiting international scientists. **Research Interests:** development of genomic approaches to discovery of novel antibacterial and antifungal agents.

Melvin I. Simon. **Education:** Ph.D., Biochemistry, Brandeis Univ. **Present Position:** Chair and Prof., Div. of Biology, California Institute of Technology. **Professional Activities:** Member, National Academy of Sciences; Fellow, American Academy of Microbiology; Selman A. Waksman Award in Microbiology, National Academy of Sciences; Max-Planck Forschungspreise; Member, Board of Governors, American Academy of Microbiology; Editorial Board, *Current Opinion in Microbiology, Molecular Microbiology, Molecular Biology of the Cell, Marine Molecular Biology.*

Hamilton O. Smith. **Education:** M.D., Johns Hopkins Univ. School of Medicine. **Present Position:** Prof. of Molecular Biology and Genetics, Johns Hopkins Univ. School of Medicine, and Director, DNA Resources, Celera Genomics Corp. **Honors, Awards, and Service:** Member, National Academy of Sciences; Fellow, American Academy of Microibology; Nobel Prize in Physiology or Medicine. **Research Interests:** comparative genomics.

Mitchell L. Sogin. **Education:** Ph.D., Microbiology and Molecular Biology, Univ. of Illinois. **Present Position:** Director, Program in Molecular Evolution, Marine Biological Laboratory, Woods Hole. **Honors, Awards, and Service:** Fellow, American Academy of Microbiology; Editorial Board, *Journal of Eukaryotic Microbiology, Molecular Phylogenetics and Evolution, Molecular Biology and Evolution, Journal of Molecular Evolution.* **Research Interests:** molecular evolution studies of eukaryotic ribosomal RNAs and coding regions for cytoskeletal proteins.

James T. Staley. **Education:** Ph.D., Univ. of California, Davis. **Present Position:** Prof., Dept. of Microbiology, Univ. of Washington. **Honors, Awards, and Service:** Fellow, American Academy of Microbiology; Alexander von Humboldt Senior Investigator Award; Editorial Board, *Geomicrobiology, Microbiological Reviews, International Journal of Systematic Bacteriology, Microbial Ecology, Applied and Environmental Microbiology, Bergey's Manual Trust.* **Research Interests:** phylogeny and taxonomy of bacteria; biodiversity and biogeography of bacteria; sea ice microbiology; bioremediation.

Karl O. Stetter. **Education:** Dr.rer.nat. (Ph.D., Microbiology), Technical Univ., Munich. **Present Position:** Head and Prof., Dept. of Microbiology, Univ. of Regensburg, Germany. **Honors, Awards, and Service:** 1994 Gold Medal Lecture, International Institute of Biotechnology, Royal Society; Member, Bergey's Manual Trust; Editorial Board, *Systematic and Applied Microbiology, Extremophiles.* **Research Interests:** exploration of the upper temperature border of microbial life; discovery and cultivation of novel groups of hyperthermophilic archaea and bacteria.

J. Craig Venter. **Education:** Ph.D., Physiology and Pharmacology. Univ. of California, San Diego. **Present Position:** Founder, President, and Chief Scientific Officer, Celera Genomics Corporation. **Honors, Awards, and Service:** Fellow, American Academy of Microbiology; Fellow, American Association for the Advancement of Science; Chiron Corporation Biotechnology Award, ASM; Beckman Award; Scientist of the Year, *R&D Magazine*; International Biotechnology Award, International Institute of Biotechnology; Editorial Board, *Metabolic Engineering, Sequence Journal, Proteins Journal, Journal of Pharmacology and Therapeutics*; Founder and Editor-in-Chief, *Microbial and Comparative Genomics*.

"Microbial Genome Sequencing: Current Status and Future Needs"

I. Introduction

A not-so-quiet revolution has occurred in the fields of microbiology and infectious diseases. It is a revolution involving the application of high-throughput sequencing technology to microbial genomes, with a resulting explosion of primary sequence information. It began in the early 1990s and forced its way into the public consciousness in 1994. In that year, Craig Venter and colleagues published the first complete genome sequence, *Haemophilus influenzae*—a bacterial agent of respiratory trace disease and meningitis.

In the subsequent four years, 12 complete genome sequences have been published, encompassing a total of more than 37 million base pairs (Mb) of sequence information. In addition, more than 49 microbial genome sequencing projects are underway, resulting in the release of tens of Mb of unedited sequence information into the Internet. Some of the microorganisms whose genomes have been sequenced and published are *Escherichia coli*, the most widely studied bacterium of modern times; *Burrelia burgdorferi*, the agent of Lyme disease; *Helicobacter pylori*, the major etiologic agent of gastric ulcers; and *Archaeoglobus fulgidus*, a sulfur-metabolizing, heat-loving, inhabitant of natural environments.

A substantial, and sometimes redundant, effort is taking place simultaneously within the private commercial sector. The sudden availability—and potential availability—of these data has spawned massive efforts to interpret, understand, and apply them for a wide variety of academic, public, and private commercial purposes.

Ten years ago, this revolution could not possibly have been anticipated nor incorporated into the research plans of microbiologists, commercial ventures, and public policy makers. Among a number of acute problems, we currently suffer from underdeveloped computational methods, relative ignorance in inferring structure and function from primary sequence, inadequate coordination of related scientific disciplines, conflicting and ill-defined priorities for selection of targeted microbial species and strains, and unclear policy for funding these activities. At this early, but precipitous, juncture, it is critical that these problems and issues be addressed formally by a multidisciplinary group of experts. A significant investment of resources and a greater potential return are at stake.

II. Purpose

The American Academy of Microbiology is convening an interdisciplinary colloquium of leading scientists to deliberate and develop a comprehensive, analytical report and action plan. The colloquium will focus on the following:

- Selection of microbial genomes, prioritization, logistics and technical aspects.
- Inference of function from full genome sequences.
- Data and technology management, access, funding, and public policy.
- Role for professional societies, such as the American Society for Microbiology.

It is our intention to develop an in-depth analysis of the scientific issues and recommendations for a future plan of action and to widely disseminate this report—to the scientific community, to federal agencies, to industry, and to the public.

The bulk of the colloquium time will be spent in small working groups. This format has previously been proven successful by the American Academy of Microbiology for development of reports that are thoughtful, insightful, and practical. In order to facilitate the free and open exchange of viewpoints on controversial and complex issues, the colloquium is not open to the public. Webster has defined a colloquium as a "discussion meeting," and that is what these 2½ days will be: a discussion. Each working group will prepare a "mini-report" which will then be used by the steering committee to develop a draft report.

On the last day of the colloquium, participants will come together to share the working group reports and to discuss any issues raised during this final session. Following the meeting, a draft report will be circulated to all colloquium participants for review and comment prior to final publication. The report will be published by the American Academy of Microbiology in both print and electronic format and will be announced to the Fellows of the American Academy of Microbiology, the membership of the American Society for Microbiology, and the larger scientific and lay communities via a vigorous public communications program. The report will be posted on the web site of the American Society for Microbiology.

The report will be broadly announced and made available through a variety of media, including:

- A session, convened by David A. Relman and J. Craig Venter, at the 1999 General Meeting of the American Society for Microbiology
- A press release to appropriate publications
- A summary article in *ASM News*, the monthly magazine of the American Society for Microbiology (circulation ca. 42,000)
- On-line via the home page of the American Society for Microbiology

The American Academy of Microbiology is composed of leading scientists in all subspecialties of microbiology who have been elected to membership based on their

contributions to the science. The American Academy of Microbiology has over 180 members of the National Academy of Sciences among its 1,600 members. The Academy has conducted many prior colloquia with the sponsorship of the U.S. Department of Energy, the U.S. Environmental Protection Agency, the National Institutes of Health, the National Science Foundation, the U.S. Department of Agriculture, the Food and Drug Administration, the National Oceanic and Atmospheric Administration, the National Aeronautics and Space Administration, the World Health Organization, and the corporate sector.

Development of a practical plan of action from a multidisciplinary perspective is a difficult undertaking. It requires the interaction of scientists from many specialties. However, this approach has been used successfully by the American Academy of Microbiology in previous critical issues colloquia. We intend to utilize the previously developed methods to plan and conduct the proposed colloquium, as well as to develop the report and action plan.

III. Significance of Issues

Complete microbial genome sequences hold the promise of profound new insights into microbial pathogenesis, evolution, diagnostics, and therapeutics. From these insights will come a new foundation for understanding the evolution of single-celled life, as well as the evolution of more complex life forms. We stand to learn an enormous amount of valuable information about the diversity of metabolic pathways, physiological processes, and environmental adaptation. For example, genome sequences will reveal new biological products and processes that can be used to remediate (clean up) toxic environments contaminated by human society.

New targets for detection of microorganisms will be revealed, as well as novel potential strategies for antimicrobial therapy and prophylaxis. Many of these insights may be gleaned directly from the analysis of the sequences. Additional insights will require integration of genetic methods, protein expression and analytic approaches, experimental models of disease, and careful consideration of clinical data. All of this can only be efficiently achieved with a comprehensive and wide-ranging discussion of the attendant issues.

A coordinated plan will allow the most effective use of limited resources and will greatly facilitate education of the broader scientific community, policy makers, and the lay public. The failure to pursue such a plan would slow progress and effectively allow duplication of efforts to continue. We cannot afford to continue as we have, without forethought and a consensus plan.

Working Groups

Group I – main room front
Joan Bennett, Chair
Robert E. Davis
Jody W. Deming
W. Ford Doolittle, Rapporteur
Michael Fonstein
Richard E. Isaacson
A. Dale Kaiser
David Schlessinger
Melvin I. Simon
Mitchell L. Sogin

Group II – board room
Donald A. Bryant
Stanley Falkow
Claire M. Fraser
D. Jay Grimes, Rapporteur
Radhey S. Gupta
Maryanna P. Henkart
Kenneth H. Nealson
Eugene W. Nester, Chair
Karl O. Stetter

Group III – main room - back
Alison Berry
Allan M. Campbell
Shiladitya DasSarma
Harold S. Ginsberg
Michael Gottlieb
H. Mark Johnston, Chair
F. Christopher Minion, Rapporteur
Monica M. Riley
Karen Shaw
Hamilton O. Smith

Group IV – suite 422
Rita R. Colwell
Julian E. Davies
Marvin E. Frazier
Thomas R. Gingeras
Noel T. Keen
Jeffrey H. Miller
Richard J. Roberts, Chair
R. Michael Roberts
James T. Staley, Rapporteur

Questions for Working Groups

Many colloquium participants do not know one another. Please begin your deliberations by having each member of the group introduce himself or herself. This should facilitate discussion. Each introduction should take 2-3 minutes and include relevant background.

The following questions should be discussed and an attempt made to come to consensus. The information generated by your group will form the foundation for a report published and disseminated by the American Academy of Microbiology. The report will include a succinct description of the issues, graphical representations where appropriate, and recommendations for future action. Please keep in mind that the report is not a journal article; it will be disseminated to policy makers, the press, and the public, as well as to the scientific community.

To focus discussion, please address the following questions. The rapporteur is responsible for your group's report. Please make sure your group addresses each issue. You are not limited to the questions below, but these questions must be discussed in order for the colloquium co-chairs to prepare the final report.

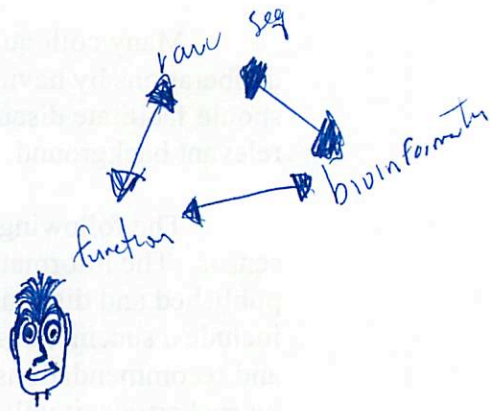
("WFD" is a self-effacing Stephen Jay Gould)

Selection of microbial genomes, prioritization, logistics, and technical aspects

- What is currently being done? by whom?
- What have we learned from previous genome sequencing projects that might facilitate future projects?
- What should be the critical features of a newly-selected strain for full genome sequencing? genetics, evol diversity
- How should we sort out competing priorities, e.g., microbial diversity vs. usefulness of closely-related strains or importance of low-passage (clinically relevant) fresh isolates vs. importance of well-characterized strains?
- How do we target differences between closely-related strains for sequencing, rather than duplicating existing data?
- What is the role for partial sequences? ← why not? - no linkage - errors - 90% → what size + confidence? →
- How can we coordinate sequencing efforts between different investigators and organizations to avoid duplication of effort? ASM hot list
- Should anyone be encouraged to embark on a full genome sequencing project? Can there be too many such projects? … slow speed of projects prevent others →

lc/large …

I think we have a dite on our hands.



Since the CGS does not provide any functional or biological information directly we encourage the development of

Databases that summarize particular aspects of genom

Inference of function from full genome sequences

- What are optimal strategies and goals for the use of full genome sequences with respect to the following applications:
  - microbial evolution? - databases of gene families, +/-, etc
  - pathogenesis?
  - diagnostics?
  - therapeutics?
  - manufacturing?
- How can we facilitate the integration of "genomic" and "genetic" approaches for the above applications?
- What is the appropriate use of "host/gene expression" profiles for the study of pathogenesis, diagnostics, therapy, and manufacturing?

databases

pathways

Data and technology management, access, funding, and public policy

- How do full genome sequencing data differ from other forms of scientific data? How can quality control standards be applied?
- How should data be released? What are the roles for peer review and peer-reviewed journals? At what point in a genome sequencing project should the sequence be released? to whom?
- How can we make the latest technology more widely available? What kinds of technology should be given the highest priority?
- Who should fund full genome sequencing projects? How should costs be distributed?
- Should funding be restricted to a limited number of groups? What should the criteria be for funding?

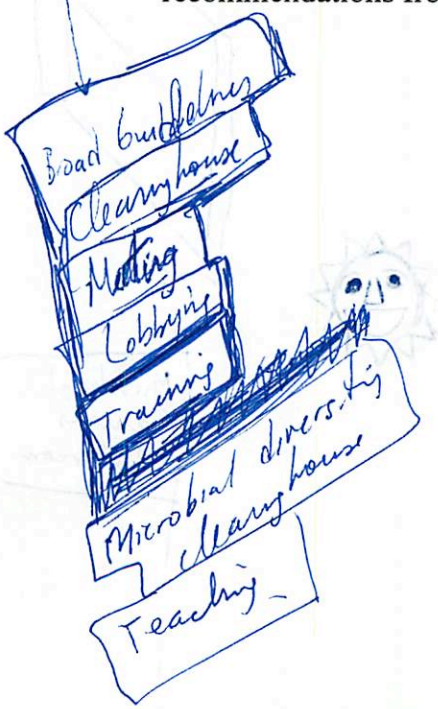
-QC
-accuracy
gaps
-fine
-quality
-rights

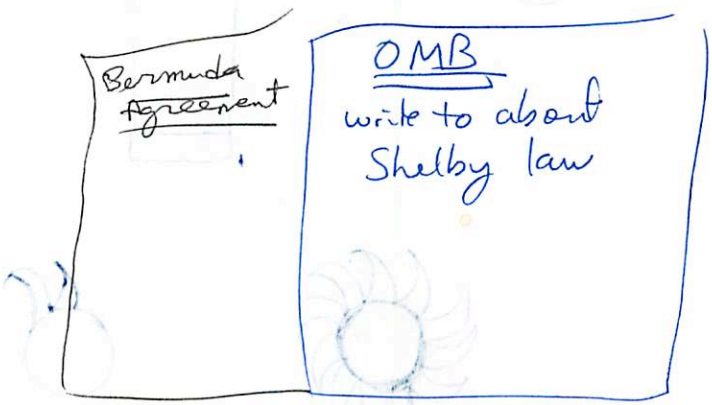
Bioinformatics at external sites.

Structure

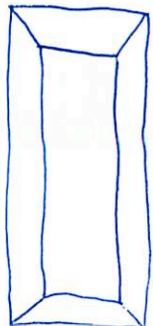
Role for professional societies, such as the American Society for Microbiology

- What should the appropriate role be?
- How can the American Academy of Microbiology best publicize the conclusions and recommendations from this colloquium?

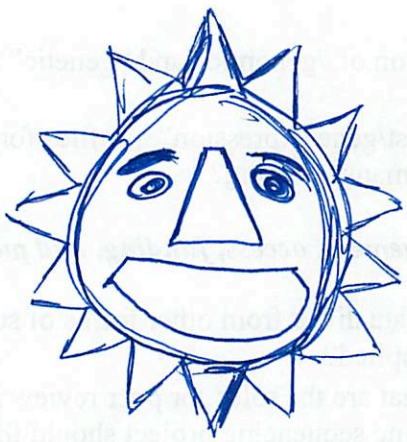




Nomenclature

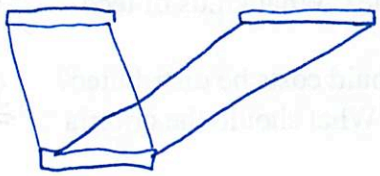


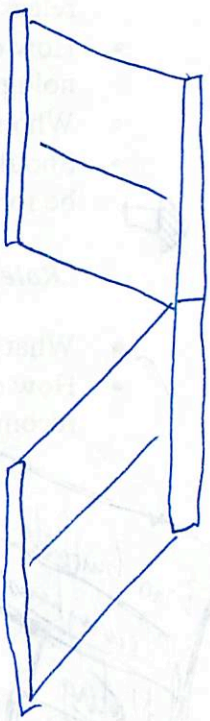
Gene family nomenclature

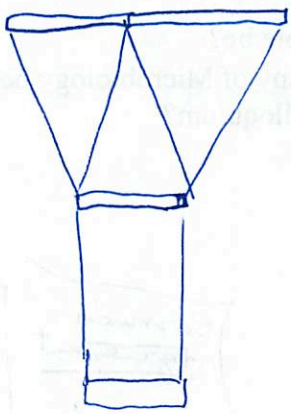


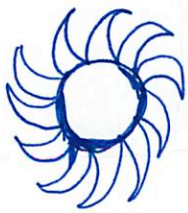
TIGR
vs.
Grad student

TIGR
course in Bioinformatics









BD

1. Diagnostic utility

2. Antigen variation

3. Molecular mimics

4. DNA structural elements

5. Ab resistance

6. Pathogen specific genes

Duplications
- recent
- recent w/ some category
-

Antigens

7. Species unique genes

8. Unusual seq. patterns

How scan our data

① using known genes of interest

② what role categories

③ composition

What genomes?
- Neisseria

What or for?
- genetics
- evolution
- ecology
- intensify pathways
- human
- difference from other species

- Specs - specs
- Browser

TO DO

Plot species on rRNA tree

Major initiatives

1. Biocomplexity
2. Information technology
3. Microbial observatories - (sys. sampling of National Parks)
4. Plant/rhizosphere associated microorganisms

Implications outside of expanded

- proteomics
- vaccinomics

Things to build on

① symbionts
② gene family databases
③ extremophiles
④ closely related species
⑤ genetics

Marvin Frasier - DOE

- DOE
- OFFICE OF SCIENCE
- OBER
- LIFE SCIENCES

Why

biosensors, monitoring; biomass, remediation, fuels

Claims DOE is largest funder of non medical microbiology

DOE Microbial Genomes

- still funding lags 1% of non-pathogens

WHICH BUGS?

Key points

- genes of unknown f(x)
- unique ORFs

In progress

?? { Geobacter Sulfurreducers
Caldanaerocellum thermus ethanogens

Future

Leverage sequencing
Uncultivable
Comp genomics
Diversity
F(x) biology
Euk. microbes
Engineered activities

What resources are being devoted to engineering studies?

What is being done regarding release of engineered microbes.

What else?

symbiosis
commensalism.

Repository
Release of clones

- ~1/4 from computer progress
- ~70 million dollars in 2001 for plants

NSF

Basic studies on microorganism
Microbial observatories
Life in extrem environments
Biocomplexity - 113 preproposals

Sequencing

A. thaliana

1997 - Neurospora ESTs
Halophile plasmid
Ecol genomic variation

1998 - Ecoli variation in nature

1999 - Halophile genome
ESTs
synechococcus clocks

Curated Gene Family Databases

Agriculture

Large genomes = more unusual genes

Mechanisms for generation of antigenic variation

Chloroplast Mitochondria
↓
Useful to study microbes

Training

Whitman et al Microbes of the world

objective measures of evol. diversity

Training programs

USDA

~1.2 billion research

~~Extramural~~

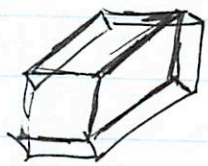
↓ Intramural

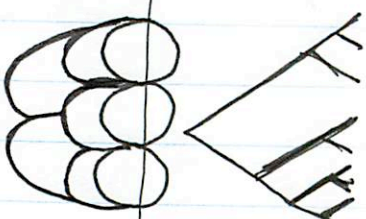
½ extra

much is pork

some real extramural
↓ NRI
~120 mil/yr

- part of interagency AT
- part of rice project
- attemp to establish animal project

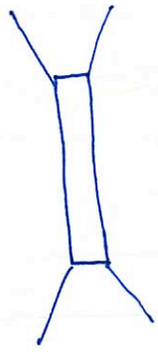




Terragen

What are the questions?

Strategies



Generalists have higher GC

- Ps. syringae
- Erwinia chrysanthymoidi

Sequence
- enough people

small genome → accum of AT

- communities
- Microarrays
- aspartic proteinases
- annotation vs. experiment
- small genes ignored
- what genes are useful for evolution
- unculturable
- hibernation
- new cloning methods
- how seq uncultivable

Annotation
- cofunding projects w/ foundations + industry
- university-industry liason groups are very difficult to work with

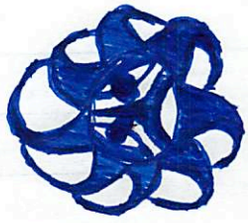
Why do it!
- right way to do biology
- completeness important
-

- well developed studies
- # of people
- what are categories
  - genetics
  - extreme/new environments
  - economics
  - unusual environments
  - evolution
  - pathogens - not just human
  - ecological significance

Completion is important

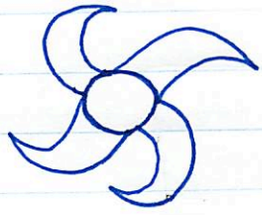
- Guidelines for which species
- Clearinghouse

What have we learned from previous
① better inform



GENETICS?

MICROBES ROCK



Objects of Controversy

① who does sequencing?

② data release

③ fresh vs. characterized

④ ignore private projects

⑤ leveraging? partial sequence?

⑥ peer review? study sections?

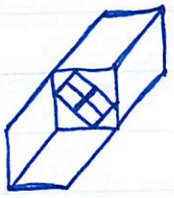
Genome
Analysis
Operating
System

NIH Review
① significance
② innovation
③ approach
④ investigator
⑤ facilities

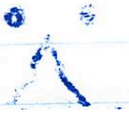
DNA
↓
CLONE
↓

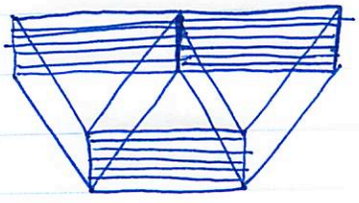
- orthology group is bad choice

scientifically bad



evolutionary process





APOLOGIES FOR A RIDICULOUSLY DELAYED FLIGHT

150
↓
flight delayed
↓
went
↓
board
↓
sat on plane ~ 100 feet out
↓
no information... then pilot say a spoiler problem + need mechanics to clear us but can't tell if its a problem or if its already been fixed

↓
but says that will deliver a safe product + we appreciate your patience

↓
also says crew + maint. crew did what they thought was right

- then comes on again + says - mechanics want us to leave them alone until 4

- so to gate... got off... waited

- then finally they loaded us on again and we sat around

- 2nd problem - with generator
- waited
- then pilot said w/ rain in Baltimore didn't feel safe w/ this plane so back in & said might get new plane.

Kept saying "will not leave if not fixed"

"your boy will make it"

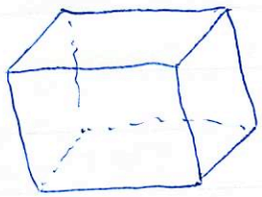
- so to gate... told us as we were getting off... that another plane.

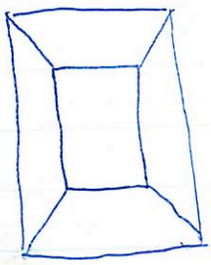
So.. to gate F3 -- when toronto flight delayed
- and they sent them to C and made us sit around.

Then we sat around more - told earlier 6:50 start would be
- came back and already almost done

- then onto plane

- pilot came on and said still waiting for all the paperwork

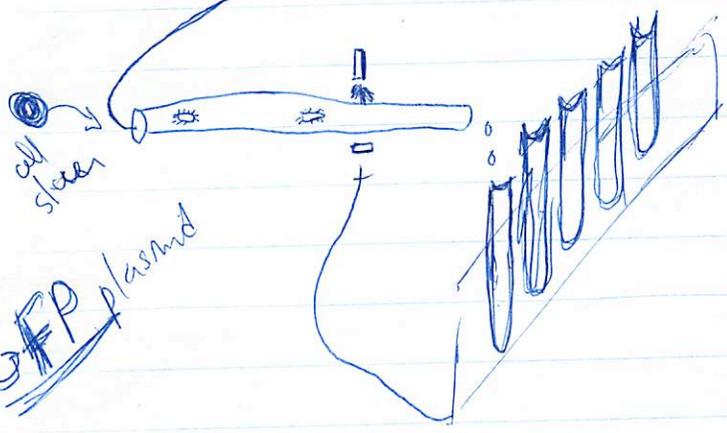




- in salts so no grow

serial dilute → or just put into tubes → and discard empties (ELISA)

0
1
2+



- low reduce
- two colonies

this move just after detected

10^8