Microbial Genome Assignment - 50 points.

CHAPTERS 15 and 18 required for this assignment. You will also need to perform part of this assignment on-line with printer access. Some general question below are fair game on final.

Part One: Whole Microbial Genome Assignment – 25 points.

Each person will choose ONE DIFFERENT microbe/genome below (a sign-up sheet will be on my door and points will be docked if you choose an already-claimed organism/genome). The final page of this document contains an abbreviated option list. After making your selection, locate/download original research paper that describes genome, and summarize article using the following questions. Then, proceed to on-line exercise using this same organism.

Please organize your paper into the following CLEARLY LABELED sections:

5 pts. THE MICROBE: Using this paper's introduction, describe your microbe's lifestyle and discuss what this suggests to YOU about its genome content (size, kinds of genes…).

5 pts. THE GENOME: How many predicted genes and proteins were encoded in your genome. How many genes did not appear to be similar to anything known?

5 pts. RESULTS/SURPRISES: Describe 4 ways this paper presented "textbook" concepts about microbial genomes (e.g. size, no/little junk, repeats, introns, transposons, etc.) and 2 ways it did not (i.e. what surprised the authors?).

5 pts. SUPPORT/SIGNIFICANCE: Summarize who did the work, where they were from, who funded the work, and - in your mind - justify the significance or applicability of the work.

5 pts. ORIGINAL PAPER: Make certain that you attach your essay to a COMPLETE copy of the paper you researched. This paper MUST show all figures and tables in full.

Part Two: On-Line Genome Assignment (60-90 minutes) - 15 points.

For this portion of the assignment, you will need a computer with both internet and printing access. You will be using the microbe chosen above and visiting the NCBI website, actively cruising the microbial genome database. Follow directions carefully!

General Procedures

Go to the NCBI website: http://www.ncbi.nlm.nih.gov/
On the left side of the screen, select “Genomic Biology”
On the right side (Genome Resources), select “Microbial” under the projects section
Scroll down the list to locate the genome/organism that matches your paper above
Note that there are THREE or FOUR links for each microbial genome, all very technical:

- Organism Link: taxonomic information
- GenBank Link: the entire sequence in a form called a flatfile (HUGE file – watch out)
- RefSeq Link: summary data and schematic links to genome (what you will use most)
- Center: link to source of data, if available

Specific Procedures Once Clicked Into RefSeq Link Above

PRINT this entire page and TURN IN – CIRCLE information about GC, % Coding, Topology
Below the table, note the Gene Classification/COG link – be prepared to consult this link…
Below the COG link and to the right is a colorful circle – the entire genome in a graphic form
This image is clickable and linked with the adjacent linear representation of specific genes
Overall goal: click on THREE different locations and describe THREE different kinds of genes

Some Helpful Tips:
Practice clicking the circle and making sure you see the screen update accordingly
Review COG link to find THREE kinds/colors of genes that interest you (NO GRAY!)
Once you find genome region with that color, record location (base pair # above circle)
Now - note that you can hold your arrow over the linear gene blow-up and…
An information pop-up box appears; RECORD gene name
Now, actively click on linear gene blow-up and a new link box will come up…
Click TOP link; a flatfile for only this gene product will appear – PRINT PAGE, TURN IN
By the end, you should have THREE print-outs for three different colored genes!

The lower "gene" link is very technical, but does contain BLAST-derived relatives.

Additional Tasks/Questions: (to be turned in with all print-outs above)
(1) Make a table that looks something like this and complete for your final report.

	Gene Kind 1	Gene Kind 2	Gene Kind 3
COG Color			
COG Category Name			
Location in Genome			
Specific Gene Name			

(2) The flatfile is the workhorse of the entire GenBank database system because it requires that all researchers provide specific information about a given gene segment, all of which is searchable. Using any flatfile for any gene above, name and describe FIVE specific data annotations that you understand which are present in a flatfile.

(3) Why were gray COG's banned from this assignment?

Part Three: Metagenomics Assignment - 10 points.
Use your textbook to determine what metagenomics is. Next, locate an original research paper that uses this method. The American Society for Microbiology (ASM) provides 1 good/mostly free on-line journal: Applied and Environmental Microbiology. The only other sources I can recommend are Science or Nature articles (available at the library). For this assignment, enter the search term "metagenomics" in abstract or title search box (NOT "anywhere" in the paper) and peruse titles. For this assignment, you only need to print the first page of the article. However, you do need to record reference information and read enough to answer questions below.

Please organize your paper into the following CLEARLY LABELED sections:
4 pts. DEFINED: What kind of DNA is being analyzed using this approach? How is it different from the genome paper you read? How is it different from Woese's approach?

4 pts. PAPER: What habitat was being sampled in this paper? Briefly describe 1 novel finding the authors highlighted in the abstract.

2 pts. ORIGINAL PAPER: Make certain you attach the first page of the metagenomics paper. If reference citations are not obvious on this page, hand-write this information on the printout.

Microbial Genome List - CHOOSE ONE AND SIGN UP
This list was compiled in Fall 2004 - there may be new information.
Go to the NCBI Microbial Genome website for a complete list.

Only Available In Hard-Copy Form at WOU Library
From Science or Nature – which mean that these topics were considered sexier than journals below.

Agrobacterium tumefaciens - Science 294 (5550), 2323-2328 (2001)
Aquifex aeolicus - Nature 392 (6674), 353-358 (1998)
Archaeoglobus fulgidus - Nature 390 (6658), 364-370 (1997)
Bacillus anthracis - Nature 423 (6935), 81-86 (2003)
Bdellovibrio bacteriovorus - Science 303 (5658), 689-692 (2004)
Borrelia burgdorferi - Nature 390 (6660), 580-586 (1997)
Campylobacter jejuni - Nature 403 (6770), 665-668 (2000)
Chlamydia trachomatis - Science 282 (5389), 754-759 (1998)
Deinococcus radiodurans - Science 286 (5444), 1571-1577 (1999)
Neisseria meningitidis - Science 287 (5459), 1809-1815 (2000)
Prochlorococcus - Nature 424 (6952), 1042-1047 (2003)
Rickettsia prowazekii - Nature 396 (6707), 133-140 (1998)
Streptomyces coelicolor - Nature 417 (6885), 141-147 (2002)
Treponema pallidum - Science 281 (5375), 375-388 (1998)
Vibrio cholerae - Nature 406 (6795), 477-483 (2000)
Yersinia pestis - Nature 413 (6855), 523-527 (2001)

Available as Free PDFs for Downloading off the Internet
Only PDFs accepted – points will be docked for non-PDF print-outs.

Chlamydia pneumoniae - Nucleic Acids Res. 28 (6), 1397-1406 (2000)
http://nar.oupjournals.org/cgi/reprint/28/6/1397

Chlorobium tepidum - Proc. Natl. Acad. Sci. U.S.A. 99 (14), 9509-9514 (2002)
http://www.pnas.org/cgi/reprint/99/14/9509.pdf

Clostridium perfringens - Proc. Natl. Acad. Sci. U.S.A. 99 (2), 996-1001 (2002)
http://www.pnas.org/cgi/reprint/99/2/996.pdf

Clostridium tetani - Proc. Natl. Acad. Sci. U.S.A. 100 (3), 1316-1321 (2003)
http://www.pnas.org/cgi/reprint/100/3/1316.pdf

Helicobacter hepaticus - Proc. Natl. Acad. Sci. U.S.A. 100 (13), 7901-7906 (2003)
http://www.pnas.org/cgi/reprint/100/13/7901.pdf

Methanopyrus kandleri - Proc. Natl. Acad. Sci. U.S.A. 99 (7), 4644-4649 (2002)
http://www.pnas.org/cgi/reprint/99/7/4644.pdf

Mycoplasma pneumoniae - Nucleic Acids Res. 24 (22), 4420-4449 (1996)
http://www.pnas.org/cgi/reprint/92/25/11829.pdf

Pseudomonas syringae - Proc. Natl. Acad. Sci. U.S.A. 100 (18), 10181-10186 (2003)
http://www.pnas.org/cgi/reprint/100/18/10181.pdf

Streptococcus - Proc. Natl. Acad. Sci. U.S.A. 99 (15), 10078-10083 (2002)
http://www.pnas.org/cgi/reprint/99/15/10078.pdf

Streptococcus mutans - Proc. Natl. Acad. Sci. U.S.A. 99 (22), 14434-14439 (2002)
http://www.pnas.org/cgi/reprint/99/22/14434.pdf

Streptomyces avermitilis - Proc. Natl. Acad. Sci. U.S.A. 98 (21), 12215-12220 (2001)
http://www.pnas.org/cgi/reprint/98/21/12215.pdf

Sulfolobus solfataricus - Proc. Natl. Acad. Sci. U.S.A. 98 (14), 7835-7840 (2001)
http://www.pnas.org/cgi/reprint/98/14/7835.pdf

Thermoplasma volcanium - Proc. Natl. Acad. Sci. U.S.A. 97 (26), 14257-14262 (2000)
http://www.pnas.org/cgi/reprint/97/26/14257.pdf