Milton Saier, Room 4254 (4155) Muir Biology Bldg., (858) 534-4084
Office hours: MWF, 1:50-3:00pm

ORGANIZATION:
Three lectures per week plus scheduled seminars and review sessions. Times and rooms for seminars will be announced, and those for review sessions will be decided democratically in class. Extra credit points for attending announced seminars, concerts, etc. will go towards your section and in-lecture quiz grades.

COURSE OUTLINE:

I.Organization of the Bacterial Chromosome

Genome vs. cell size: prokaryotes and eukaryotes
Compactation
Supercoiling
Gyrase (topoisomerase II)
Topoisomerase I
Permanent bends
DNA binding proteins
HU
IHF
Fis
DNA Structural Forms
A, B, C, D … Z
Cruciforms
Triple strands
Single and double stranded loops
GC content
Mutator genes
Recurrent Nucleotide Sequences
Chi
REP
DAM
Chromosomal Number
Copies per cell
Plasmid or chromosome?
Protoplast fusion
Chromosomal inactivation
Chromosomal Dynamics

Extra-intrachromosomal elements
Plasmids
Transposons
IS DNA
Phage
Long term rearrangements
rrn loci
tRNA loci
Alternative alleles
Deletions-Insertions
Amplification
M protein variation
sigma-K in Bacillus and nif in Anabaena
Phase and antigenic variation
hin, gin, pin, cin
fim
pil and opa
Direction of Transcription
DNA polymerase
oriC; DNA replication
Operon orientation and promoter strength
Consequences of polymerase collision
Completely Sequenced Genomes
Mycoplasm genitalium – the minimal genome
E. coli – the prototype
II. Transcription (Tx)

RNA Polymerase
Protein structure
Gene and operon structure
Accessory proteins
Steps of Transcription
Initiation
Elongation
Termination
Sigma FactorsD. Multiple Promoters
Functions
Structures and homologies
Recognition sequences
Criteria
Operons encoding sigma factors
DNA Binding ProteinsF. gal vs. lac

Promoter strength
Operon specific repressors and activators
Pleiotropic regulatory proteins
Antiterminators
Enhancers
Protein and DNA modification
trp and Amino Acid Biosynthesis
Carbon Catabolite Repression
SOS Regulon
Translational Regulation
III. Sensory Transmission and Protein Phosphorylation

Classical protein kinases
Novel protein kinases
PTS and the bgl operon
Sensor kinase – Response regulator systems
Osmoregulation (EnvZ-OmpR)
Virulence (VirA – VirG; ChvE)
Hexose phosphate transport (UhpA, B and C)
Nitrogen regulation
UT/UR and PII
NtrB and NtrC
sigma-54
Phosphate regulation
PhoR-PhoB, PhoU
PstSABC
IV. Genetics of Bacterial Differentiation

Sporulation in Bacillus
Initiation of sporulation
The sigma factor cascade
Control of cell division
Programmed bacterial cell death
Regulation of competence
Fruiting in Myxobacteria
Control of progression
C-signal
frz vs. che: differences in chemoresponse
Myxobacteria vs Dictyostelium
Heterocyst development in Cyanobacteria
Temporal control
Spatial control

Circadian rhythms
V. Symbiosis and Pathogenesis

Nitrogen Fixation and Nodulation
Agrobacterium – Plant Turmorigenesis
Salmonella – Cellular Invasion
Phase VariationPattern Formation during Bacterial Colonization
Flagellar phase variation in Salmonella
Mu: host range specificity determination
fim in E. coli
pil in Neisseria
opa in Neisseria