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For Bimm122:

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
Mycoplasma 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 Factors
D. Multiple Promoters
Functions
Structures and homologies
Recognition sequences
Criteria
Operons encoding sigma factors
DNA Binding Proteins
F. 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 Tumorigenesis

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