

411-1 1/4/2009

Review bacterial chromosome and associated genetic elements

again, some of what I want to present, you've already encountered in earlier classes

I.

Here's a bacterium, here's its chromosome (single circle). Not to scale chromosome is long and folded- but draw as circle for clarity. How much longer than a single cell is a DNA molecule if stretched out (~1000X- 1mm vs 1 μ m)

How big is the *E. coli* chromosome
(in base pairs)? \rightarrow 4.6 Mbp
Largest? -10 Mbp
Smallest?- 0.6-Mbp

1100 bp/gene, therefore *E. coli* has about 4300 genes

Genome always one circle? Can be two- how to distinguish from large plasmid?
Live ohne? Can chromosome be linear like in eukaryotes? Yes but rare

II. The **entire** DNA sequences of >1000 bacteria, including 40 versions of *E. coli* have been determined

E. coli categories: 60% of genes assigned-in assigned genes, see a remarkable diversity of functions- ranging from crucial- like DNA replication (2.7%) to completely nonessential (phage, transposons and plasmids) - (2.03%)

-HO Table

Provides idea of genetic commitment of different processes. Best understood cell, but still almost 40% unknown functions.

III. That takes care of genome as such- but want to say more about three types of genetic elements- parasites in a sense- usually associated with genome- these are responsible for most natural genetic transfer between bacteria?

1. Viruses (phage)
2. transposons (insertion sequences or "IS" elements)

1. Phage- many bacterial phage have evolved the ability to insert themselves into the chromosome in an inactive form (lysogeny)- lambda phage most intensively studied

BOARD

original E. coli studied had lambda as lysogen- (draw)

Also- has seven other different defective phage (draw)- these are called "defective" because they can't grow. The reason they can't grow is because large numbers of genes have been deleted.

lambda- 49 Kb
defective phage- 14-27 Kb

Idea is that these phage were once complete, but were partially deleted in evolution

2. Insertion sequences (IS elements) (Transposons)- sequences 0.7-2.0 Kb that can insert approximately at random into DNA sequences. Occur naturally in large numbers in the chromosome

-E. coli has 10 types- 45 copies total (1-11 copies/type)

BOARD- draw a bunch of IS elements on chromosome

For identical IS elements, opportunity for intra-genomic homologous recombination and deletion or inversion of sequences

Draw deletion (usually don't survive unless small because of loss of essential genes if large). Draw inversion. Mention that inversions often seen bracketing terminus of replication.

3. Specific example: locations of IS and phage in K-12; ignore EcoK restriction sites at bottom

4. K-12 vs O157 H7 comparisons- O and K islands (Ec pathogens- diarrhea, urinary track infections, septic infections)

5. Genome ring

-GC skew- excess of G over C on first replicated (leading strand); all Gs on one strand=100%; no Gs=0%; leading strand has more Gs- repair differences

Kendall!

Review for quiz Wednesday (OHs/drawings for each)

1. DNA structure
 - a. nucleotide
 - b. bases identify
 - c. joining into polynucleotide
 - d. antiparallel- draw ds convention

e. base pairs

2. genetic code and use

3. lac operon

-names of gene and what products do

4. Substrates and products of homologous recombination

5. Know differences between F+, Hfr, F' states

6. Complementation

7. Sample questions