

Understandings:

1. Explain the chromosomes of prokaryotes.

- Most prokaryotes have 1 circular chromosome. Since prokaryotes are unicellular, the genes they have code basic needs for survival. In addition, their DNA does not have histones; hence we call them naked DNA.

Of course, when the prokaryote replicate, it copies its chromosome, but that is the only occasion when the prokaryote has two chromosomes.

2. Explain what plasmids are and where we can find it.

- Plasmids are small circular DNA molecules in prokaryotes. They are not essential for life, but these often are used as antibiotic resistance. Bacteria with plasmid containing resistance to penicillin will not be affected by it.

These plasmids are also transferrable between all cells. Yes, even those with different species. Thus these are great tools for scientists to transfer genes between species, but also bacteria to spread their resistance.

3. Explain the chromosomes of eukaryotes.

- Chromosomes in eukaryotes are linear and have histones.

4. State the difference of chromosomes in eukaryotes.

- First, in a molecular level, the length of chromosomes might be different. The location of centromere (intersection of the chromatids) can be different since it can be located practically anywhere.

The number of chromosome types is different. Humans have 23.

Different chromosomes contain different genes.

5. Explain what homologous chromosomes are.

- Homologous chromosomes are chromosomes with same general gene sequence. If they are identical, they have the same allele, but if they are different, they have different allele.

The existence of homologous chromosomes allows interbreeding since we have chromosome pairs.

6. Explain haploid nuclei.

- Haploid nuclei are nuclei that contain one chromosome of each type. Human haploids have 23 chromosomes; these are more commonly known as gametes.

7. Explain diploid nuclei.

- Diploid nuclei have a pair of chromosomes.

Most eukaryotes have it because we get one set of chromosomes from male gamete and the other set from female gamete.

One advantage is that a harmful recessive will be avoided when there is a robust dominant.

8. Explain the significance of chromosome numbers.

- Usually, different species will have different number of chromosomes. This is one of the things that do indeed make these different species, since they cannot interbreed! Well, some can interbreed, like lions and cats, but the offspring are not fertile.

To demonstrate, let's say a chimp and human breeds. Humans have 46 and chimps have 48. Their sex cells are going to have 23 and 24. These fuse together to produce 45 chromosomes. This means that we have a lone chromosome! This defies the laws of nature.

The number can however change during evolution, but it's rather rare.

9. Explain how sex is determined.

- We have two sex chromosomes. All others we call autosomes.

X and Y. X is a long and contain many of the essential genes for both females and males. Y chromosomes are short and mostly contain the essential genes that code for hormones like testosterone that initiate the growth of male features, a.k.a TDF or SRY.

Here is a Punnett square that is self-explanatory.

| | | Male gametes | |
|----------------|---|--------------|----------------|
| | | X | Y |
| Female gametes | X | XX | X ^Y |
| | X | XX | X ^Y |

10. Explain what karyogram is.

- How do we know how many chromosomes we and other organisms have? Simply, by karyograms! Karyograms are the ordering of chromosomes in descending length.

Dividing cells have been stained to give different patterns. The cells are burst and the chromosomes are extracted.

Nowadays these things are done digitally...

The results will be that most organisms have diploids, but there are exceptions such as Down syndrome and other diseases that might have too many or lack chromosomes.

Applications and skills:

1. Be able to measure the length of DNA using Cairns's technique.

- This is a method to determine the length and structure by autoradiography (a film that show dots when it hits emission from radioactive molecules).

What it basically does is that you let the target bacteria to grow in an environment with radioactive molecule (radioactive hydrogen for thymine in this case).

Then the cell walls had to be digested by lysosome.

Then after around 2 months, the decay of hydrogens that emit energized electrons will have left a mark on the film and these will indicate the position, the length of DNA and that it replicates in a semi-conservative way.

2. Compare the size of genomes.

- Different species have different size of genomes. It usually depends on the size and number of chromosomes. However, the complexity does not have to correspond with number of genes. This is because, one of many reasons, not all of the DNA are genes with function.

Humans have approx. 3000 Million bp.

Woodland plants have approx. 150,000 Million bp.

3. Compare diploid chromosome numbers.

- All eukaryotes have at least 2 different types of chromosomes.

And there is usually a correlation between length and size. Eukaryotes with short chromosomes tend to have many types, while long chromosomes tend to have few types.

Dogs have more chromosome numbers than us, but ours are longer.

4. Identify the sex and Down syndrome by looking at karyotypes.

- Sex is easily determined by the combination of XX or XY. Down syndrome can be determined by looking at chromosome number 21, which will have 3 chromosomes.

For the record, Down syndrome is also known as trisomy 21 because it has got three chromosomes in number 21. For all those affected with Down syndrome and their nearest and dearest, you have my deepest sympathies.

5. Use databases to identify the loci of a specific gene and its polypeptide product.

- Search OMIM.

Choose search gene map.

Enter a gene name that you wish to investigate.

The locus and other interesting information will appear.