3. Genetics – 3.2 Chromosomes Name:

**Understandings, Applications and Skills** (This is what you maybe assessed on)

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|  | **Statement** | **Guidance** |
| 3.2.U1 | Prokaryotes have one chromosome consisting of a circular DNA molecule. |  |
| 3.2.U2 | Some prokaryotes also have plasmids but eukaryotes do not. |  |
| 3.2.U3 | Eukaryote chromosomes are linear DNA molecules associated with histone proteins. |  |
| 3.2.U4 | In a eukaryote species there are different chromosomes that carry different genes. |  |
| 3.2.U5 | Homolgous chromosomes carry the same sequence of genes but not necessarily the same alleles of those genes. |  |
| 3.2.U6 | Diploid nuclei have pairs of homologous chromosomes. |  |
| 3.2.U7 | Haploid nuclei have one chromosome of each pair. |  |
| 3.2.U8 | The number of chromosomes is a characteristic of feature of members of species. |  |
| 3.2.U9 | A karyogram shows the chromosomes of an organism in homologous pairs of decreasing length. |  |
| 3.2.U10 | Sex is determined by sex chromosomes and autosomes are chromosomes that do not determine sex. |  |
| 3.2.A1 | Cairns’ technique for measuring the length of DNA molecules by autoradiography. |  |
| 3.2.A2 | Comparison of genome size in T2 phage. *Escherichia coli, Drosophila melanogaster, Homo sapiens* and *Paris japonica.* |  |
| 3.2.A3 | Use of karyotypes to deduce sex and diagnose Down syndrome in humans. |  |
| 3.2.S1 | Use of online database to identify the locus of a human gene and its protein product. |  |

**Recommended resources:**

<http://bioknowledgy.weebly.com/29-photosynthesis.html>

Allott, Andrew. *Biology: Course Companion.* S.l.: Oxford UP, 2014. Print.

3.2 U1 Prokaryotes have one chromosome consisting of a circular DNA molecule.

1. Prokaryotic DNA is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and is not associated with any \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_proteins.
   1. There is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ copy of each gene except when the cell and its DNA are replicating Bacterial \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

3.2 U.2 Some prokaryotes also have plasmids but eukaryotes do not.

1. Plasmids are small \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(usually \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_) DNA molecules located in some prokaryotic cells
   1. Plasmids are also \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (not associated with proteins) and are not needed for daily life processes in the cell.
   2. The genes in plasmids are often associated with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and can be transferred from one bacterial cell to another.
   3. Plasmids are readily used by scientists to artificially \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from one species to another (ie. Gene for human insulin)
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: consist of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ histones.
   1. They help create \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of chromatin, which creates a chromosome during cell replication
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ chromosomes are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and are made up of DNA and histone proteins.
   1. Histones are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ protein in which the DNA is wrapped around.
   2. DNA wrapped around 8 histone proteins is called a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
   3. The DNA wraps \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ around the histone protein core.
   4. Another histone protein is attached to the outside of the DNA strand. This helps maintain the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ structure of the nucleosome.
4. DNA, because of its \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ charge is attracted to the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ charge on the amino acids of the histone proteins.

3.2 U4 In a eukaryote species there are different chromosomes that carry different genes.

1. Chromosomes are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, varying in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the centromere that holds the sister chromatids together.
   1. In humans there are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ types of chromosomes. Each chromosome carries a specific sequence of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_along the linear DNA molecule.
   2. The position where the gene is located is called the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

3.2 U.5 Homologous chromosomes carry the same sequence of genes but not necessarily the same alleles of those genes.

1. Homologous chromosomes are chromosomes within each cell that carry the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
2. One chromosome came from an individual’s \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and one from the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
3. They have the same \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
4. These chromosomes \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ up during meiosis.
5. Even though these chromosomes carry the same genes, they could have different \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (different versions of the same gene)

3.2 U6 Diploid nuclei have pairs of homologous chromosomes.

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ nuclei have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ copies of each type of chromosome.
   1. One chromosome comes from the mother and one from the father.
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (sperm and egg) fuse during sexual reproduction which produces \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ with a diploid nucleus.
   1. This cell will then divides by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to produce numerous cells, all with a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ nucleus.
3. Each nucleus has \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ copies of each gene, accept the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ chromosomes.

3.2 U.7 Haploid nuclei have one chromosome of each pair. [The two DNA molecules formed by DNA replication prior to cell division are considered to be sister chromatids until the splitting of the centromere at the start of anaphase. After this, they are individual chromosomes.]

1. Haploid nuclei have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ copy of each chromosome or one full set of the chromosomes in that particular species eg. Human \_\_\_\_\_\_\_\_\_\_\_\_\_\_ chromosomes
   1. These are called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, which are sperm and egg
   2. Human sperm and eggs each contain 23 chromosomes.
2. Chromosomes \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ at the centromere.
   1. This occurs during \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
   2. The chromatids move to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ poles of the cell to become chromosomes in a newly created cell.
3. Chromosome with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ chromatids become \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

3.2 U.8 The number of chromosomes is a characteristic feature of members of a species.

1. The chromosome \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a characteristic feature of that species.
2. A chromosome number does not indicate how \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ an organism might be.
3. Organisms with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ numbers of chromosomes would unlikely be able to interbreed.
4. Chromosome number tends to remain \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ over millions of years of evolution; however, sometimes through evolution chromosomes can \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ together or split to change the number of chromosomes an organism contains.

3.2 U.9 A karyogram shows the chromosomes of an organism in homologous pairs of decreasing length. [The terms karyotype and karyogram have different meanings. Karyotype is a property of a cell— the number and type of chromosomes present in the nucleus, not a photograph or diagram of them.]

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_:
   1. A karyotype is a picture of an organism's \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in which the chromosomes of a cell have been \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ so that the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ pattern of the chromosomes appear.
   2. Cells in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are stained to show distinct parts of the chromosomes.
   3. The cells are then photographed through a microscope and enlarged.
   4. The chromosomes are cut from the photograph and arranged according to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

3.2 U.10 Sex is determined by sex chromosomes and autosomes are chromosomes that do not determine sex.

1. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ chromosome determine the sex of an individual.
2. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ chromosome contains over \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ genes in comparison to the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ chromosome has less than \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ genes.
3. If an individual has \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ X chromosomes they will be a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and if they have an X and a Y chromosome they will be a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
4. All other chromosomes are called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and do not affect the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of an individual.
5. The X chromosome has many genes located on it essential to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, while the Y chromosome has a small number of genes (some of these are shared with the X chromosome).
6. The rest of the genes on the Y chromosome are only necessary for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

3.2 A.1 Cairns’ technique for measuring the length of DNA molecules by autoradiography.

1. Using the technique of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Cairns first supplied the cells with suitable \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (replaces normal hydrogen in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_).
2. Used to selectively label only \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and will not label RNA.
3. Intact \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are placed on slides.
   1. These slides are then covered by photographic \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and stored in dark.
   2. During this storage the particles are emitted, exposing the film.
   3. The photographs show the regions of labelled \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
   4. The results demonstrated \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ mode of replication.

