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Student Exploration: Water Cycle

- Primary cycle:** condensation, precipitation, runoff, evaporation, transpiration
- Secondary cycle:** infiltration, percolation, groundwater, evaporation, transpiration
- Evaporation:** Atoms/energy/molecules of water rise and collect near the surface water.
- Condensation:** changes from a gas to a liquid.
- Precipitation:** change from a liquid to a gas or temperature below freezing.
- Freezing:** changing from a liquid to a solid.
- Runoff:** a large, steady-moving body of water on the land.
- Soaking:** changing from a liquid to a solid.
- Phase change:** A change from one state of matter to another.
- Transpiration:** water that infiltrates the soil.
- Evaporation:** is designed to as the sun's energy, which is used to evaporate the water.
- Runoff:** water that moves across the surface of land into streams or rivers.
- Transpiration:** The release of water vapor from the leaves of plants.
- Water cycle:** The continuous movement of water from Earth's surface to the atmosphere and back again.
- Four knowledge questions for the 8th/9th science class:**
- The water that comes from your house comes from the ocean. How do you get it?**
- How do you get it from the ocean? Through the water cycle.**

Water Cycle

Water on Earth is always moving. Transpiration, evaporation, condensation, precipitation, runoff, infiltration, and percolation are all part of the water cycle. The water cycle is a continuous process that moves water around the Earth.



Human karyotypes for teaching This site is a cooperative venture between ZooWeb and the Wisconsin State Laboratory of Hygiene. These karyotypes are intended for use in teaching, to help students study human chromosomes. Copyright for these images remains with the State Laboratory of Hygiene, apply to them for permission for any other use than non-profit teaching. Each karyotype is available in one of three forms: The original unmodified smear. These may have extra material, and often have some chromosomes crossed, which makes them less useful for a class exercise in which students cut apart and arrange the individual chromosomes. A copy of the original, with extraneous materials removed, crossed chromosomes separated, and all chromosomes separated slightly to facilitate cutting apart of the chromosomes in a printed copy. This form is intended for student use in an general biology class. A "key", with the chromosomes arranged in standard order. This page is still to a degree, under construction. There are keys missing for some karyotypes. I hope to include more information on each type soon. Please let me know if you find any errors. For some hints on using these karyotypes in teaching, click here. So far, the following karyotypes are available. We hope to continue adding more kinds as they become available. 45, XX, normal female 46, XY, normal male 45, X, Monosomy-X, Turner's syndrome 47, XY, +21, Trisomy-21, Down's syndrome 47, XX, +10, Trisomy-10 47, XY, +10, Trisomy-10 47, XX, +13, Trisomy-13 47, XY, +15, Trisomy-15 47, XY, +16, Trisomy-16 47, XY, +18, Trisomy-18 47, XXY 47, XYY 46, XX, der(4)t(4;8)(q24.11)46, XX, t(1;20)(q32.1;q11.2) For technical information on the methodology by which these smears were created click here. This site was last modified on 28 September 2003. Do you have suggestions for this page? Please email Larry Phelps (lphelps@uw.edu) © 1998 The Board of Regents of the University of Wisconsin System. Click here to email comments regarding BioWeb or its links. In order to continue enjoying our site, we ask that you confirm your identity as a human. Thank you very much for your cooperation. Learning Objectives Describe a normal human karyotype and discuss the various abnormalities that can be detected using this technique The isolation and microscopic observation of chromosomes forms the basis of cytogenetics and is the primary method by which clinicians detect chromosomal abnormalities in humans. A karyotype is the number and appearance of chromosomes. To obtain a view of an individual's karyotype, cytologists photograph the chromosomes and then cut and paste each chromosome into a chart, or karyogram, also known as an ideogram. In a given species, chromosomes can be identified by their number, size, centromere position, and banding pattern. In a human karyotype, autosomes or "body chromosomes" (all of the non-sex chromosomes) are generally organized in approximate order of size from largest (chromosome 1) to smallest (chromosome 22). However, chromosome 21 is actually shorter than chromosome 22. This was discovered after the naming of Down syndrome as trisomy 21, reflecting how this disease results from possessing one extra chromosome 21 (three total). Not wanting to change the name of this important disease, chromosome 21 retained its numbering, despite describing the shortest set of chromosomes. The X and Y chromosomes are not autosomes and are referred to as the sex chromosomes. The chromosome "arms" projecting from either end of the centromere may be designated as short or long, depending on their relative lengths. The short arm is abbreviated p (for "petite"), whereas the long arm is abbreviated q (because it follows "p" alphabetically). Each arm is further subdivided and denoted by a number. Using this naming system, locations on chromosomes can be described consistently in the scientific literature. Although Mendel is referred to as the "father of modern genetics," he performed his experiments with none of the tools that the geneticists of today routinely employ. One such powerful cytological technique is karyotyping, a method in which traits characterized by chromosomal abnormalities can be identified from a single cell. To observe an individual's karyotype, a person's cells (like white blood cells) are first collected from a blood sample or other tissue. In the laboratory, the isolated cells are stimulated to begin actively dividing. A chemical called colchicine is then applied to cells to arrest condensed chromosomes in metaphase. Cells are then made to swell using a hypotonic solution so the chromosomes spread apart. Finally, the sample is preserved in a fixative and applied to a slide. The geneticist then stains chromosomes with one of several dyes to better visualize the distinct and reproducible banding patterns of each chromosome pair. Following staining, the chromosomes are viewed using bright-field microscopy. A common stain choice is the Giemsa stain. Giemsa staining results in approximately 400-800 bands (of tightly coiled DNA and condensed proteins) arranged along all of the 23 chromosome pairs. An experienced geneticist can identify each chromosome based on its characteristic banding pattern. In addition to the banding patterns, chromosomes are further identified on the basis of size and centromere location. To obtain the classic depiction of the karyotype in which homologous pairs of chromosomes are aligned in numerical order from longest to shortest, the geneticist obtains a digital image, identifies each chromosome, and manually arranges the chromosomes into this pattern. Figure {{PageIndex|1}}: A human karyotype. This karyotype is of a male human. Notice that homologous chromosomes are the same size, and have the same centromere positions and banding patterns. A human female would have an XX chromosome pair instead of the XY pair shown. At its most basic, the karyotype may reveal genetic abnormalities in which an individual has too many or too few chromosomes per cell. Examples of this are Down Syndrome, which is identified by a third copy of chromosome 21, and Turner Syndrome, which is characterized by the presence of only one X chromosome in women instead of the normal two. Geneticists can also identify large deletions or insertions of DNA. For instance, Jacobsen Syndrome, which involves distinctive facial features as well as heart and bleeding defects, is identified by a deletion on chromosome 11. Finally, the karyotype can pinpoint translocations, which occur when a segment of genetic material breaks from one chromosome and reattaches to another chromosome or to a different part of the same chromosome. Translocations are implicated in certain cancers, including chronic myelogenous leukemia. During Mendel's lifetime, inheritance was an abstract concept that could only be inferred by performing crosses and observing the traits expressed by offspring. By observing a karyotype, today's geneticists can actually visualize the chromosomal composition of an individual to confirm or predict genetic abnormalities in offspring, even before birth. hemizygous. Provided by: Wiktionary. Located at: . License: CC BY-SA: Attribution-ShareAlike OpenStax College, Biology, October 16, 2013. Provided by: OpenStax CNX. Located at: . License: CC BY: Attribution Robert Bear and David Rintoul, Extensions of the Laws of Inheritance, October 31, 2013. Provided by: OpenStax CNX. Located at: . License: CC BY: Attribution Structural Biochemistry/Chromosomes. Provided by: Wikibooks. Located at: en.wikibooks.org/wiki/Structu...ry/Chromosomes. License: CC BY-SA: Attribution-ShareAlike autosome. 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Karyotyping Activity Introduction This exercise is a simulation of human karyotyping using digital images of chromosomes from actual human genetic studies. You will be arranging chromosomes into a completed karyotype, and interpreting your findings just as if you were working in a genetic analysis program at a hospital or clinic. Karyotype ...

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