

Biology – prepared by Dr. Ariel Diaz, UPR-Cayey

The information contained in this webpage and the sites listed, target the needs of students in undergraduate biology course. High school students in advanced courses, may also benefit from this information. The resources are listed following the usual organization of a general biology course.

The links and pages provided are only a portion of the electronic material available to such students. In order to find and select the pages we conducted searches on general subjects, such as photosynthesis, chloroplast, etc., using well known search engines (Yahoo and Google), which occasionally produced tens of thousands of references to a single subject. Of those we selected the most appropriate in terms of contents, how current they were, and overall quality. It is possible that we missed many excellent resources and that some of the pages selected are now changed or updated.

Some of the pages included contain videos, movies, photographs, and animations that require the use of plug-ins for either Netscape Navigator or Microsoft Internet Explorer. We do not provide access to those programs, but most pages usually contain the appropriate link.

Section One: Defining Life

Part One

Characteristics of Living Organisms

Characteristics of Living Matter. Prepared and hosted by The Remarkable Ocean World. Page discusses fundamental characteristics separating living from non-living things. (In English. No illustrations. No revision date).

<http://www.oceansonline.com/lifeprops.htm>

The Search for Life's Origin. Prepared and hosted by the National Academy of Sciences. This excellent report deals with all aspects of the origin of life. Includes two important chapters on the origin of life and the evolution of cellular and multi-cellular life. (In English. Illustrated. Published in 1990).

<http://www.nas.edu/ssb/lifeoriginsmenu.htm>

Part Two

Chemistry of Life

Periodic Table of the Elements. Page hosted by Los Alamos National Laboratory Chemistry Division. Includes a periodic table with detailed descriptions and data on each element. (In English. Illustrated. Last revised September 5, 2001).

<http://pearl1.lanl.gov/periodic/default.htm>

Acid and Base pH Tutorial. Prepared by the Department of Chemistry at the University of British Columbia, Canada. The page includes a tutorial on pH consisting of a discussion session and a quiz on twenty topics related to pH. (In English. Illustrated. No revision date)

<http://www.science.ubc.ca/~chem/tutorials/pH/launch.html>

General Chemistry I. A Virtual Textbook. Prepared by Michael Blaber and hosted by Florida State University. The page covers all the topics in a general chemistry course, but includes important chapters,

such as those on chemical bonding and energy, that will be of use to biologists. (In English. Illustrated. No revision date).

<http://wine1.sb.fsu.edu/chm1045/chm1045.htm>

The Chemistry of Life. Page prepared by The Biology Project, University of Arizona. Page includes excellent discussion on a variety of topics such as pH, macromolecules, acids and bases, and energy. Links related to these and other topics in biology are provided. (In English. Illustrated. Last revised December 17, 2001).

<http://www.biology.arizona.edu/biochemistry/biochemistry.html>

The Medical Biochemistry Page. Prepared by Michael W. King, School of Medicine, Indiana State University. This award winning page contains extensive coverage to topics covered in a biochemistry course from a medical perspective. The page covers, among others, carbohydrates, nucleic acids, lipids, and proteins, as well as clinical issues related to these biomolecules.

<http://www.indstate.edu/thcme/mwking/home.html>

Biochemistry. Prepared by Michael Blaber, Florida State University. Michael Blaber's page is one of the most remarkable web pages designed for students registered in a biochemistry course. It provides detailed, in-depth description of all important biochemical processes, description of biological molecules, as well as an introduction to the role of chemistry and thermodynamics in the biological sciences. (In English. Illustrated. Last revised 2001).

<http://wine1.sb.fsu.edu/BCH4053/bch4053.htm>

Biomolecules. Prepared by J. Blair and S.R. Ford, Oklahoma State University. This page is prepared for a course on biomolecules. Covers all groups of biological important molecules, with contents presented in an outline form. Includes a glossary, collection of exams, and links to other sites. (In English. Illustrated. No revision date).

<http://opbs.okstate.edu/~Blair/Biomolec.htm>

A Structure for Deoxyribose Nucleic Acid. This page contains the classic 1953 paper by J. D. Watson and F. H. C. Crick on the structure of DNA. (In English. One illustration. Published in 1953).

<http://biocrs.biomed.brown.edu/Books/Chapters/Ch%208/DH-Paper.html>

Introduction to DNA Structure. Prepared by Richard B. Hallick and hosted by the University of Arizona. The page contains a series of computer generated graphics illustrating the molecular structure of purines, pyrimidines, nucleosides, nucleotides, and the DNA double helix. (In English. Illustrated. Prepared in 1995).

http://www.blc.arizona.edu/Molecular_Graphics/DNA_Structure/DNA_Tutorial.HTML

DNA Structure. Prepared by Eric Martz, and hosted by the San Diego Supercomputer Center. This page contains an excellent interactive tutorial on DNA structure. Also contains links to other DNA related material. Tutorials require Chime software. (In English with link to a Spanish version. Illustrations and animations. Last revised July 19, 2002).

<http://molvis.sdsc.edu/dna/index.htm>

Nucleic Acid Structure and Function and DNA Synthesis. Pages maintained by the Natural Toxins Research Center at Texas A&M University, Kingsville. The nucleic acid page contains detailed information on DNA and RNA, including structural formulas of nitrogenous bases, chemical bonds in nucleotides, and also provides a link to a video on the 3D structure of DNA. The DNA synthesis page focuses on DNA replication and covers major aspects such as the function of individual enzymes, effects

of temperature, and others. Also provides links to classical experiments that helped uncover nucleic acid chemistry. (In English. Illustrated. No revision date).

<http://ntri.tamuk.edu/cell/nucleic.html>

<http://ntri.tamuk.edu/cell/dna.html>

The Double Helix and DNA Replication. Prepared by John Kimball and based on the 6th edition of his general biology textbook. These pages include a detailed description of DNA structure and replication and covers topics such as speed and control of replication. Provides links to the Meselsohn-Stahl experiments and base pairing in DNA. (In English. Illustrated. Revised 2001-2002).

<http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/D/DoubleHelix.html>

<http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/D/DNAReplication.html>

Replication. Page is part of the Bio-Web, a collection of resources prepared by members of the University of Wisconsin System. The section on DNA replication provides very simple explanation of this process, but includes links to movies and animations illustrating this process. Included in the menu are buttons leading to discussions on DNA synthesis, transcription, and translation. (In English. With illustrations, animations and movies. No revision date)

<http://bioweb.uwlax.edu/GenWeb/Molecular/Theory/Replication/replication.htm>

Genetic Transmission. Pages are part of Ulrich Melcher's Molecular Genetics course at Oklahoma State University, Stillwater. Information of genetic transmission is presented in an outline form. Contains sections on the chromosome, replication, cell cycle, organelle DNA, and others. The user navigates through these topics by selecting keywords within the text. (In English. Illustrated. Last revised October 1999). <http://opbs.okstate.edu/~melcher/MG/MGW1/MG13.html>

Carbohydrate Structure. Pages maintained by the Natural Toxins Research Center at Texas A&M University, Kingsville. Page contains discussion of basic carbohydrates (mono-, di-, and polysaccharides) including their structural formulas. (In English. Illustrated. No revision date)

<http://ntri.tamuk.edu/cell/carbohydrates.html>

A Tutorial for Carbohydrate Structure and Function. Prepared for a pharmacology course by R. Kerns, Wayne State University. The tutorial covers all basic aspects of carbohydrate biology, including structure and synthesis of monosaccharides, formation of glycosidic bonds and glycosides, and glycoconjugates. Structural formulas for a variety of carbohydrates are presented. Each of the three sections includes quiz questions and answers. (In English. Illustrated. No revision date).

<http://wizard.pharm.wayne.edu/biochem/311chostrfxn.html>

Glúcidos. Page hosted by the Universidad de Murcia, Spain. Contains a tutorial on carbohydrates, covering topics such as monosaccharides, glycosidic bonds, di- and polysaccharides, glycoconjugates, and function of carbohydrates. Contains review questions and a test on carbohydrates. (In Spanish. Illustrated. No revision date)

<http://www.um.es/~molecula/gluci.htm>

Lipids. Written by Michael W. King, Indiana State University. Page contains description of the role of lipids, biochemistry of fatty acids, structure of fatty acids and simple and complex lipids, their physiological roles, and metabolic pathways. Topics are selected from a menu. Section on metabolism includes detailed description of lipid synthesis and its regulation, and covers clinical aspects of lipid metabolism. (In English. Illustrated. Last revised May 10, 2001).

<http://www.indstate.edu/thcme/mwking/lipids.html#role>

Lipids. Prepared by J. Blair and S.R. Ford, Oklahoma State University. This page presents and outline of the most important aspects of lipid chemistry. Covers 1. Structure and classification of lipids, 2. Fatty acids, waxes and oils, 3. Membrane lipids, and 4. Cholesterol and other steroids. (In English. Illustrated. No revision date).

<http://opbs.okstate.edu/~Blair/Bioch2344/Chapter12/Chapter12.htm>

Lípidos. Page hosted by the Universidad de Murcia, Spain. Tutorial contains discussion on structure and characteristics of simple and complex lipids, lipids on cell membranes, and function of lipids. Includes exercises and tests on the topic. (In Spanish. Illustrated. No revision date).

<http://www.um.es/~molecula/lipi.htm>

Introduction to Amino Acids. Prepared by Sami Raza and hosted by Birkbeck University of London. A tutorial on amino acids that uses computer generated graphics to depict their composition and structure. Page provides access to pictures and interactive images of all twenty amino acids. (In English. Illustrated. No revision date).

<http://www.cryst.bbk.ac.uk/PPS2/course/section2/AminoAcid/overview.html>

Principles of Protein Structure Using the Internet. Prepared by Clare Sansom and Jim Pitts of the Birkbeck University of London. A very useful page that includes a collection of internet resources covering most aspects of protein biochemistry. Links are divided into sections and include an introduction to proteins, protein structure, geometry, and synthesis and interactions. Links are also provided for pages on bioinformatics and protein science. Some of the links may require the use of plug-ins for Netscape Navigator or Internet Explorer. Some web addresses may have changed or sites may no longer be available. (In English. Illustrations, animations and movies. Main page updated July 26, 1996)

<http://www.cryst.bbk.ac.uk/PPS2/course/index.html>

Biomoléculas. Page prepared by J.L. Urdiales of the Universidad de Málaga, Spain. This work will eventually include descriptions and notes on the major classes of biologically important molecules. At present coverage is limited to the primary structure of the proteins. Requires Netscape Navigator and Chime plug-in for visualizations. (In Spanish. Illustrated. Last revised March 27, 2002).

http://www.nitrogeno.uma.es/AV/AV_BioMo/material.html

Proteins. Prepared by John W. Kimball and based on the 6th edition of his biology textbook. This page provides an introduction to basic aspects of protein biochemistry and function. Includes links to pages discussing protein structure. (In English. Illustrated. Last revised May 20, 2002).

<http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/P/Proteins.html>

Water and Organic Molecules. These pages, prepared by M.J.Farabee, are part of the Online Biology Book hosted by Estrella Mountain Community College in Avondale, Arizona. Page provides and introduction to the structure and characteristics of water and other organic molecules, including carbohydrates, proteins, lipids, and nucleic acids. Provides a set of review questions and links to related sites. (In English. Illustrated. Revised June 18, 2001)

<http://www.emc.maricopa.edu/faculty/farabee/BIOBK/BioBookCHEM2.html>

Biomoléculas. Page prepared by J. M. Gómez Mañas, of the Universidad del País Vasco, Spain. Covers carbohydrates, amino acids, peptides and proteins, and nucleic acids. Includes review tests, references, and links to related sites. Requires the Chime plug-in to view animations. (In Spanish. Illustrated. No revision date).

<http://www.ehu.es/biomoleculas/homepage.htm>

SECTION TWO: THE CELL

Part One

The Cell: The Fundamental Unit of Life

Cell Biology. This page is part of the University of Arizona's The Biology Project. Includes descriptions of prokaryotes, eukaryotes, and viruses, cell cycle and mitosis, and a timeline of major events in cell biology. (In English and Spanish. Various illustrations. Last revised August 9, 2001)

http://www.biology.arizona.edu/cell_bio/cell_bio.html

On-Line Biology Book. Prepared by Mark Dalton (Cray Inc.), this page covers in detail major aspects of cell structure and function, including cell organelles and cell types. Chapters on cell division and gene expression are listed but unavailable. (In English. Illustrated. No revision date)

<http://www.cbc.umn.edu/~mwd/cell.html>

Cell Biology Topics. This page was prepared by Gwen Childs (University of Arkansas) but is hosted by University of Texas Medical Branch. Includes detailed descriptions of cell organelles and their functions, which are accompanied by excellent illustrations and micrographs. The page also provides a good number of references of current research under some topics. (In English. Illustrated. Last revised July 19, 2001) <http://cellbio.utmb.edu/cellbio/>

The Virtual Cell Webpage. Originally developed by The Brown University Center for Computer Graphics and Scientific Visualization, this page now includes collaborations from many other institutions and schools. The page uses illustrations and animations to allow the user to explore the various cell components and major functions of cell organelles. (In English. Excellent illustrations and some animations. Last revised October 17, 1999.)

<http://personal.tmlp.com/Jimr57/textbook/chapter3/chapter3.htm>

Cellular Biology. Hosted by Cell-Biology.com, this page contains good descriptions of cell organelles and their functions. Unfortunately, the page lacks illustrations to complement the text. A detailed history of cell biology is presented. Also, access to related topics is provided. (In English. Not illustrated. No revision date) <http://www.cell-biology.com/#cytoplasm>

What is a Cell? This page was prepared by the NIH's Center for Biotechnology Information. It includes brief and accurate descriptions of cell types, cell organelles and functions, replication, mitosis, meiosis, and gene expression. Boxes provide additional information on some related key issues. (In English. Excellent illustrations. Last revised November 23, 2001).

http://www.ncbi.nlm.nih.gov/About/primer/genetics_cell.html

Cells 1: Origins and Cells 2: Cellular Organization. These pages, prepared by M.J.Farabee, are part of the Online Biology Book hosted by Estrella Mountain Community College in Avondale, Arizona. **Cells 1** includes information on the origins of life, cells, and multicellularity. **Cells 2** provides in-depth coverage of cellular organelles and their functions. (In English. Multiple illustrations and micrographs from several sources are provided. Last revised June 18, 2001).

<http://gened.emc.maricopa.edu/bio/bio181/BIOBK/BioBookCELL1.html>

<http://gened.emc.maricopa.edu/bio/bio181/BIOBK/BioBookCELL2.html>

Cell Biology: Structures of Cells and Viruses. Prepared by Michael W. Davidson and hosted by Florida State University. This is an excellent page containing detailed information on the structure and function of prokaryote and eukaryote (both plant and animal) cells as well as viruses. Includes detailed descriptions of organelles. (In English. Includes excellent illustrations and access to photo gallery and virtual microscope. Last revised December 11, 2001). <http://micro.magnet.fsu.edu/cells/index.html>

What is Life? Written by Diana Bentley and hosted by the Mira Mesa High School in San Diego, California. Includes description of plant cell and animal cell. Description of organelles and their functions are obtained by selecting individual organelles in figures. Includes discussion on origins of life and cells. (In English. Includes illustrations. Last revised January 1998).

<http://projects.edtech.sandi.net/miramesa/Organelles/life.html>

Inside the Cell. Prepared and hosted by the NIH's National Institute of General Medical Sciences. Page includes good non-technical descriptions of cell structure and function, including sections for the most important cell organelles. Discussion are presented within the context of medical sciences. Includes some historical references. (In English. Illustrated. No revision date).

http://www.nigms.nih.gov/news/science_ed/life.html

Kimball's Biology Pages. Prepared by John W. Kimball and based on the 6th edition of his biology textbook. This site gives the user access to all the information necessary to complete a general biology course. Navigation is either through a search engine, table of contents, or a list of links to individual pages. (In English. Illustrated. Continuously revised).

<http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/W/Welcome.html>

La Célula Animal. Prepared and hosted by Bio-Cl in Spain. Page presents a brief summary of the structure and function of a plant and animal cell. User can access description of organelles by selecting from a menu. (In Spanish. Illustrated. Last revised May 21, 2002).

<http://bio-cl.iespana.es/bio-cl/animcell.htm>

<http://bio-cl.iespana.es/bio-cl/plantcell.htm>

Las Células Procariota y Eucariota. Pages prepared by Pedro F. Mateos of the Universidad de Salamanca. Contains good descriptions of eucariotic and procariotic cells and their organelles, but lacks figures to complement the text. (In Spanish. Not illustrated. No revision date)

<http://edicion-micro.usal.es/web/educativo/micro2/tema03.html>

<http://edicion-micro.usal.es/web/educativo/micro2/tema04.html#anchor149053>

La Célula. Page prepared and hosted by the Instituto Químico Biológico in Spain. This page was prepared as part of a human physiology course. Includes description of the animal cell, its organelles, and their functions. (In Spanish. Illustrated. No revision date)

http://www.iqb.es/CBasicas/Fisio/Cap04/cap4_1.htm

Manual de Biología Celular. A manual of cell biology prepared and hosted by the Ministerio de Educación, Cultura y Deporte, in Spain. This is a menu driven manual covering basic aspects of cell biology and cell functioning. User navigates through the cell by selecting items from the main page menu. (In Spanish. Illustrated. No revision date).

<http://www.cnice.mecd.es/mem2001/biologia/ayuda/mapa.htm>

Biología. An online biology manual prepared by the biology faculty at the Universidad Nacional de La Plata, Argentina. The manual is intended for use in a general biology course. Contents may be printed or downloaded. (In Spanish. Illustrated. Prepared in March 2002).

<http://www.biol.unlp.edu.ar/biologia/>

Part Two

Cell Components: The Cell Membrane

Cellular Membrane. Prepared by Timothy Paustian and hosted by The University of Wisconsin-Madison. This page provides in depth coverage of the structure and function of cell membranes. Includes detailed description of transport functions. (In English. Includes illustrations. Last revised October 4, 2001) <http://www.bact.wisc.edu/MicrotextBook/BacterialStructure/MembraneGen.html>

Cell Membrane. Developed by Brannon Carter and Robin L. Carter and hosted by the University of Alabama – Huntsville. Includes a brief but clear description of the cell membrane. (In English. Illustrated. Last revised September 12, 2000).
<http://crystal.uah.edu/~carter/osmosis/membrane.htm>

Membranes. Published by Steve Downing and hosted by the University of Minnesota School of Medicine, Duluth. These lecture notes cover most aspects of membrane structure and function. The contents are presented in outline form, without much detail, but includes excellent illustrations to aid in interpreting key issues and links to a few animations are also provided. (In English. Illustrations and links to animations. Last revised April 23, 1997)
<http://www.d.umn.edu/~sdowning/Membranes/lecturenotes.html>

The Cell Membrane. Prepared by Gwen V. Childs and hosted by the Cytochemistry.Net. Includes description of cell membrane and summary of membrane functions, with cross references to key terms. A submenu guides the user to detailed information on membrane components and functions. Also includes review questions and links to other membrane related web pages. (In English. Good illustrations. Last revised July 10, 2001).
<http://www.cytochemistry.net/Cell-biology/membrane.htm>

La Membrana Celular. Page prepared by Lourdes Luengo, in Spain. Contains text and figures describing structure and function of the cell membrane, including transport across a cell membrane. (In Spanish. Illustrated. No revision date)
<http://www.arrakis.es/~lluengo/membrana.html>

Part Three

Cell Components: Cell Walls

The Cell Wall. Prepared by Timothy Paustian and hosted by The University of Wisconsin – Madison. This page is limited to the bacterial cell wall. Provides in-depth discussion of cell wall form and function, and text is accompanied by numerous illustrations and micrographs. (In English, with illustrations. Last revised February 20, 2002) <http://www.bact.wisc.edu/MicrotextBook/BacterialStructure/CellWall.html>

Plant Cell Wall. Prepared by Roger Hangarter and hosted by Indiana University. Includes detailed description of components of the plant cell wall, including chemical structure and characteristics of wall components. (In English. With illustrations. No revision date).
<http://sunflower.bio.indiana.edu/~rhangart/courses/b373/lecturenotes/cellwall/cellwall.html>

Prokaryotic Cell Wall. Published by Gary E. Kaiser. Provides a brief description of bacterial cell wall form and function. Also includes brief description of effects of antibiotics and antimicrobial agents. (In English. Illustrations. Last revised October 15, 2001)
<http://www.cat.cc.md.us/courses/bio141/lecguide/unit1/prostruct/cw.html>

The Cell Wall. Prepared by Peter v. Sengbusch, this page is part of Botany Online and is hosted by the University of Hamburg. This section includes detailed information on the plant cell wall, its form and functions. Detailed descriptions of cell wall components, including their structure, is provided. (In English. Illustrations. Last revised October 26, 2001).

<http://www.biologie.uni-hamburg.de/b-online/e26/26.htm>

La Pared Celular. Page prepared by Enrique Iáñez Pareja from the Universidad de Granada, Spain. Includes detailed description of the prokaryotic cell wall and its functions. Aimed at students enrolled in a microbiology course. (In Spanish. Not illustrated. Last revised August 17, 1998)

http://www.ugr.es/~eianez/Microbiologia/05_Micro.html

La Pared Celular. Page prepared by Ana María González from Universidad Nacional del Nordeste, Argentina. Includes description of the morphology and function of a plant cell wall, including growth, communication, and modifications. (In Spanish. Illustrated. No revision date).

<http://fai.unne.edu.ar/morfo/tema7/7-2pared1.htm>

Part Four

Cell Components: Cytoskeleton

The Cytoskeleton. This page was written by John W. Kimball and is based on the 6th edition of his biology textbook. Page contains detailed information on components of the cell cytoskeleton and their function. Includes structure of cilia and flagella. (In English. Some illustrations. Last revised done November, 2001). <http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/C/Cytoskeleton.html>

Cytoskeleton Tutorial. This page is part of the Cell Biology section of The Biology Project hosted by the University of Arizona. Provides a tutorial on form and function of the cell cytoskeleton, including cell motility and internal cell movement. (In English. Illustrated. Last revised September 8, 1997).

http://www.biology.arizona.edu/cell_bio/tutorials/cytoskeleton/main.html

Cytoskeleton Filaments. This page is copyrighted by Garland Publishing. Excellent downloadable illustrations of cytoskeletal filaments with legends. (In English. Illustrated. No revision date).

<http://www.accessexcellence.org/AB/GG/cytoSkeleton.html>

Cytoskeleton in *Xenopus*. Published by Dave Gard at the University of Utah. The page provides a description of cytoskeleton form and function in *Xenopus*. Emphasis is placed in oogenesis. Key concepts are defined and the user can access detailed information and micrographs of cytoskeletal elements by selecting these key concepts. (In English. Good illustrations and micrographs. Last revised May 1999). <http://froglab.biology.utah.edu/Cytoskeleton/cytoskeleton.html>

Guía Sobre el Citoesqueleto. This page is part of the University of Arizona's The Biology Project. Page includes a tutorial on the morphology and function of the cell cytoskeleton, including cell motility and internal movement. (In Spanish. Illustrated. Last revised September 8, 1997)

<http://www.biologia.arizona.edu/cell/tutor/cyto/page1.html>

Part Five

Cell Components: Nucleus

The Cell Nucleus. Prepared by Gwen V. Childs. Discusses general aspects of the cell nucleus and its components, including the nuclear envelope, transport, and signaling. User accesses detailed information by navigating and selecting items in figures. (In English. Illustrations and micrographs. Last revised July 19, 2001)

<http://cellbio.utmb.edu/cellbio/nucleus.htm>

The Nucleus. This page was prepared by John Kimball and is based on the 6th edition of his biology textbook. Contains detailed information on the cell nucleus form and function. The user can navigate through terms and concepts by selecting items within the text. (In English. Illustrated. Last revised January 31, 2002).

<http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/N/Nucleus.html>

El Núcleo. Page prepared by Carlos Enrique Pelozo, Universidad Nacional de Formosa, Argentina. Contains brief description of the animal cell nucleus and its contents, with a section on chromosomes accessed through a link at the end of the document. (In Spanish. With illustrations. No revision date)

<http://www.unf.edu.ar/genetica/CELULA.html>

El Núcleo. Prepared and hosted by Bio-Cl in Spain. Page contains description of the nucleus, its contents, and functions. Well prepared and presented but lacks in technical content. (In Spanish. Illustrated. No revision date). <http://bio-cl.iespana.es/bio-cl/nucleo.htm>

Part Six

Cell Components: The Ribosome and Endoplasmic Reticulum

The Ribosome. Prepared by Gwen V. Childs. Discusses general aspects of the ribosome and ribosome-endoplasmic reticulum complex. Includes detailed descriptions of translation and protein processing in the endoplasmic reticulum.. User accesses detailed information by navigating and selecting items in figures. (In English. Illustrations and micrographs. Last revised July 19, 2001).

<http://cellbio.utmb.edu/cellbio/ribosome.htm>

<http://cellbio.utmb.edu/cellbio/rer2.htm>

Ribosome Structure and Function. Page maintained by the Natural Toxins Research Center at Texas A&M University, Kingsville. Contains detailed information on ribosome structure and function, including comparison of prokaryotic and eucaryotic ribosomes. (In English. Illustrations. No revision date).

<http://ntri.tamuk.edu/cell/ribosomes.html>

Tour of the Ribosome. Prepared by Wayne Decatur and hosted by the University of Massachusetts, Amherst. Page provides description of the ribosome and its functions, but requires the use of Netscape Navigator and additional plug-ins for complete access to visualizations. Provides references. (In English. Illustrated. No revision date)

<http://www.umass.edu/molvis/pipe/ribosome/tour/>

El Ribosoma. Prepared by and hosted by the Ministerio de Educación, Cultura y Deporte in Spain. Pages provide a description of the ribosome structure and function, including a very simple discussion on protein synthesis. (In Spanish. Illustrated. No revision date)

<http://www.cnice.mecd.es/mem2001/biologia/citoplasma/organelas2.htm>

<http://www.cnice.mecd.es/mem2001/biologia/citoplasma/organelas3.htm>

Part Seven

Cell Components: Golgi Complex

The Golgi Complex. Prepared by Gwen V. Childs. Discusses general aspects of the Golgi Complex form and function, including detailed descriptions of protein movement. User accesses detailed information by navigating and selecting items in figures. (In English. Illustrations and micrographs. Last revised August 10, 2000).

<http://cellbio.utmb.edu/cellbio/golgi.htm>

The Golgi Apparatus. This page was prepared by John Kimball and is based on the 6th edition of his biology textbook. Contains detailed information on the Golgi complex structure and function. Contains link to discussion of path of proteins after leaving the complex. The user can navigate through terms and concepts by selecting items within the text. (In English. Illustrated. Last revised May 3, 2002).

<http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/G/Golgi.html>

Part Eight

Cell Components: The Mitochondria

Mitochondria: Architecture Dictates Function. Page prepared by Gwen V. Childs and hosted by Cytochemistry.Net. Includes discussion on structure, organization, membrane characteristics and signaling as well as mitochondrial lifecycle. Mitochondrial functioning is discussed with the aid of simple but clear and appropriate figures. Includes a set of review questions. (In English. With illustrations and micrographs. Last revised August 10, 2001).

<http://www.cytochemistry.net/Cell-biology/mitoch1.htm>

Mitochondria and Chloroplasts. Prepared by Terry Frey and hosted by San Diego State University. This page contains a very detailed and technical description of mitochondrial processes. Access to Cell Biology course material is available by following links. (In English. Some illustrations. Prepared in 1998 with no revision date).

http://www.sci.sdsu.edu/TFrey/Biology356/Mitochondria_and_Chloropla.html

Electron Transport and ATP Synthesis in Mitochondria. Prepared by Thomas M. Terry and hosted by The University of Connecticut. This page contains a brief, non-technical description of the major aspects of mitochondrial functioning, and includes simple animations to illustrate electron transport and synthesis of ATP in the organelle. (In English. Animations. No revision date).

<http://www.sp.uconn.edu/~terry/images/anim/ETS.html>

<http://www.sp.uconn.edu/~terry/images/anim/ATPmito.html>

Mitochondria, Energy Converters in the Cell. Prepared and hosted by the NIH's National Institute of General Medical Sciences. Page includes a non-technical description of the mitochondria and its functions, and includes some historical references. Discussed from the viewpoint of medical sciences. (In English. Illustrated. No revision date) http://www.nigms.nih.gov/news/science_ed/mitochm.html

Animación de la Cadena de Transporte de Electrones. Prepared by J.S. Raisman and A.M. Gonzalez, and hosted by Universidad Nacional del Nordeste, Argentina. Page presents an animation of electron transport on the mitochondria. Menu provides access to other items such as glycolysis and Krebs cycle. (In Spanish. Illustrations and animations. No revision date).

<http://fai.unne.edu.ar/biologia/metabolismo/ets.htm>

El Aprovechamiento de los Alimentos. Prepared by Antonio Peña and Georges Dreyfus, and hosted by Instituto Latinoamericano de la Comunicación Educativa in Mexico. Page presents a description of energy-releasing pathways within the mitochondria, which are presented in the form of flowcharts. (In Spanish. Illustrated. No revision date).

http://lectura.ilce.edu.mx:3000/sites/ciencia/volumen2/ciencia3/092/htm/sec_7.htm

Mitocondrias y Respiración Celular. Page prepared by the biology faculty of Universidad Nacional de La Plata, Argentina. This page gives a complete description of the mitochondria and explains its major functions, including a description of cell respiration. (In Spanish. Illustrated. No revision date)

http://www.biol.unlp.edu.ar/biologia/modulo_9.html

Part Nine

Cell Components: The Chloroplast

Mitochondria and Chloroplasts. Prepared by Terry Frey and hosted by San Diego State University. This page contains a very detailed and technical description of processes within the chloroplast. Access to Cell Biology course material is available by following links. (In English. Some illustrations. Prepared in 1998 with no revision date).

http://www.sci.sdsu.edu/TFrey/Biology356/Mitochondria_and_Chloroplast.html

Chloroplasts. This page was prepared by John Kimball and is based on the 6th edition of his biology textbook. Contains detailed information on the chloroplast form and function, including detailed descriptions of light and dark reactions. The user can navigate through terms and concepts by selecting items within the text. (In English. Illustrated. Last revised January 31, 2002).

<http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/C/Chloroplasts.html>

Chloroplast Origin and Integration. This page includes the paper by Geoffrey I. McFadden on chloroplast origins. The paper summarizes outcomes of chloroplast research during the last 25 years. (In English. PDF file. No illustrations. Published in January 2001).

<http://dogwood.botany.uga.edu/courses/btmy8110/papers/McFadden%2001%20Chloroplast%20origin%20and%20integration.pdf>

SECTION THREE: ENERGY AND METABOLISM

Part One

Energy and the Laws of Thermodynamics

Bond Energy. Page prepared by J. W. Kimball and based on his general biology textbook. This section discusses the importance of chemical bond energy for biological processes. (In English. Not illustrated. Last revised September 5, 2001).

<http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/B/BondEnergy.html>

Thermodynamics and Entropy. Pages prepared by M. Breinig and hosted by the University of Tennessee. These pages are written for an introductory physics course. The first page contains explanation of the first and second laws of thermodynamics. The second page contains a discussion of entropy. (In English. Illustrated. Last revised in 1997). <http://electron4.phys.utk.edu/141/>

Cellular Energy: Laws of Thermodynamics. Prepared by June B. Steinberg at the National-Louis University. Page contains an explanation on the importance of the laws of thermodynamics for the biological sciences. Provides links to explanations on enzymes and ATP among others. (In English. Not illustrated. Prepared in 2000)

<http://faculty.nl.edu/jste/cell%20energy.htm>

Basic Energy Concepts. Page prepared by Timothy Paustian of the University of Wisconsin – Madison. This section explains the importance of the laws of thermodynamics in living systems using bacteria as a model. Also discusses free energy, oxidation-reduction reactions, and energy carrier molecules. A menu provides access to various topics on cell metabolism. (In English. With illustrations and animations. Last revised September 21, 2000).

<http://www.bact.wisc.edu/MicrotextBook/Metabolism/BasicEnergyConcepts.html>

Part Two

ATP

ATP (adenosine triphosphate). Page prepared by J. W. Kimball and based on his general biology textbook. Discusses the structure and roles of ATP in the cell, including its synthesis and consumption. Access to explanation of glycolysis, photosynthesis, cellular respiration, anabolic reactions, and others complete the coverage on the role of this molecule. (In English. Illustrated. Last revised November 4, 2001). <http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/A/ATP.html>

Biological Energy Conversion. Page prepared by Anthony Crofts, University of Illinois at Urbana-Champaign. This page includes a series of very detailed lectures on the most important mechanisms transforming energy in biological systems. Includes 27 lectures on topics like anaerobic and aerobic metabolism, electron transport chains, and ATP. Also provides links to various pages on related topics. May require the installation of plug-ins to view some material. (In English. With illustrations and animations. Prepared in 1996)

<http://www.life.uiuc.edu/crofts/bioph354/index.html>

ATP Structure/Cyclic Phosphorilation. Page created by Kneeland Nesius, Old Dominion University. This tutorial gives a description of the ATP molecules and the phosphorilation process. Also discusses the energy transfer through ATP in biological systems. (In English. Illustrated. Last revised October 29, 1997). <http://www.lions.odu.edu/~knesius/miniunits/epsilon/epsilon2.html>

ATP and Biological Energy. These pages, prepared by M.J.Farabee, are part of the Online Biology Book hosted by Estrella Mountain Community College in Avondale, Arizona. Includes a description of the ATP molecule with a structural formula. Also covers ATP synthesis and the role of ATP in energy transfers. Page provides review questions and links to related sites. (In English. Illustrated. Last revised June 10, 2001).

<http://www.emc.maricopa.edu/faculty/farabee/BIOBK/BioBookATP.html>

ATP synthase. Prepared by H. Wang and J. Oster, University of California, Berkeley. This page includes a collection of movies and animations dealing with the structure and function of the ATP synthase. Requires Windows Media Player or Quicktime. (In English. Animations and Movies. No revision date) http://www.cnr.berkeley.edu/~hongwang/Project/ATP_synthase/

ATP Synthesis. Page written by J. M. Moore, Taylor University. This page includes various resources explaining how ATP synthesis occurs. Includes a simple overview and a step by step presentation of ATP synthesis. Also provides links to sites related to the ATP synthase. (In English. Illustrated. No revision date).

http://www.tayloru.edu/upland/departments/biology/authorware/cell_respiration/atpsyn.html

Part Three

Enzymes as regulators

Introduction to Enzymes. Produced and maintained by Wothington Biochemical Corporation. Page includes and introduction to enzymes and sections that explain the basic aspects of the role of enzymes in life processes and enzyme kinetics, including factors that affect enzyme activity. Provides a list of references. (In English. Illustrated. No revision date).

<http://www.worthington-biochem.com/introBiochem/introEnzymes.html>

Reactions and Enzymes. These pages, prepared by M.J.Farabee, are part of the Online Biology Book hosted by Estrella Mountain Community College in Avondale, Arizona. Page explains endergonic and exergonic reactions, oxidation reduction, and catabolism and anabolism. Also explains the role of

enzymes in controlling metabolic reactions. Provides review questions and a list of links related to the topic. (In English. Illustrated. Last revised June 10, 2001).

<http://www.emc.maricopa.edu/faculty/farabee/BIOBK/BioBookEnzym.html>

Enzyme Inhibition and Regulation. Page prepared by K. McMichael for an organic chemistry course at Washington State University. Page uses a series of simple diagrams to explain the role of enzymes in biologic processes and the control of enzyme activities. (In English. Illustrated. Prepared March 1, 1996).

<http://www.chem.wsu.edu/Chem102/102-EnzInhibReg.html#zymogen>

Enzymes, The Biological Catalysts. Page prepared and maintained by T. Paustian at The University of Wisconsin – Madison. Page explains the basic aspects of enzyme structure and function. Requires Macromedia Shockwave Player to view animations. (In English. With illustrations and animations. Last revised September 21, 2000).

<http://www.bact.wisc.edu/MicrotextBook/Metabolism/Enzymes.html>

Enzymes: Kinetics and Catalysis. Page prepared for the pharmaceutical biochemistry course of Patrick M. Woster, Wayne State University. This page gives an extensive and technically detailed function, nomenclature, and the control of enzymatic activity. Also covers enzyme defects and the use of enzyme in clinical diagnostics. (In English. Illustrated. No revision date).

<http://wizard.pharm.wayne.edu/biochem/enz.html>

Enzimas. Page prepared by J. M. Gómez Mañas, of the Universidad del Pais Vasco, Spain. Explains enzyme structure, function, and nomenclature. Also covers regulation of enzymatic activity. The page includes a series of tests and references and provides links to other pages related to the topic. Requires the Chime plug-in to view animations. (In Spanish, with illustrations and animations. No revision date).

<http://www.ehu.es/biomoleculas/ENZ/ENZ.htm>

Part Four

Photosynthesis

The Photosynthetic Process. This page hosted by The University of Illinois at Urbana-Champaign reproduces the 1999 paper written by John Whitmarsh and Govindjee. The paper covers the basics of the photosynthetic process as well as historic and current aspects of photosynthesis research. It includes, among other topics, a history of photosynthesis research, a classification of photosynthetic organisms, photosynthetic energy transformation, oxygenic and anoxygenic photosynthesis, and global photosynthesis and the atmosphere. (In English, with figures. Published in 1999).

<http://www.life.uiuc.edu/govindjee/paper/gov.html>

Milestones in Photosynthesis Research. This page reproduces the 2000 paper written by Govindjee (The University of Illinois at Urbana-Champaign). The paper reviews the most important events in photosynthesis research, from the discovery of the chlorophylls to contemporary findings in photophosphorylation. (In English. With figures. Published in 2000).

<http://www.life.uiuc.edu/govindjee/papers/milestones.html>

Photosynthesis and the Web: 2002. This page was written by Larry Orr and Govindjee and is hosted by The University of Illinois at Urbana-Champaign. Contains a collection of sites dealing with the process of photosynthesis. Sites are grouped in the following categories: 1) large group sites, 2) comprehensive overview sites, 3) specific subject sites, 4) individual researcher sites, 5) kindergarten (K)-12 educational sites, 6) books and journals, and, 7) other useful sites. (In English. Not illustrated. Published in 2002).

<http://www.life.uiuc.edu/govindjee/photoweb/>

Photosynthetic Pigments. This site is maintained by the University of California – Berkeley. This site gives a basic description of the photosynthetic pigments of plants algae and bacteria. (In English. Illustrated. o revision date. <http://www.ucmp.berkeley.edu/glossary/gloss3/pigments.html>)

Molecular Evolution of Photosynthesis. Written by Carl Bauer at Indiana University. This page discusses relevant aspects of the evolution of photosynthetic systems, including aspects of the authors current research. Includes phylogenetic trees for evolution of photosynthesis among bacteria. (In English. Illustrated. No revision date).<http://sunflower.bio.indiana.edu/~cbauer/bauerlab/research/evolution.html>

Fotosíntesis. Page written by Rubén Hernández Gil, Universidad de los Andes, Venezuela. Site contains all explanations of all topics relevant to photosynthesis. Includes sections on the nature of light, chloroplast structure, light and dark phases of photosynthesis. Also includes discussions on the carbon cycle. (In Spanish. Illustrated. Revised in 2002).
<http://liscano.forest.ula.ve/%7Erubenhg/fotosintesis/#introducción>

Photosynthesis. Page hosted by the Botany Online site at the University of Hamburg. This page provides the most extensive and detailed pages on the photosynthetic process. Includes explanation of the light (phosphorylation, cyclic phosphorilation and the two photosystems) and dark (Calvin cycle) reactions, with a description of the experiments leading to their discovery. Also covers C3, C4 and CAM regulation of photosynthesis and the role of the photosynthetic membrane. A list of relevant literature is provided. (In English with illustrations and animations. Last revised March 7, 2002).
<http://www.biologie.uni-hamburg.de/b-online/e24/24.htm>

Bacterial Photosynthesis. Page created and hosted by Carl Bauer of Indiana University. Page includes a brief explanation of the photosynthetic process in bacteria. Includes links to important articles on the topic. (In English. Illustrated. No revision date)
<http://sunflower.bio.indiana.edu/~cbauer/bauerlab/research/photosystem.html>

Evolution of Earth's Early Biosphere and Atmosphere. This page reproduces the paper by David J. Des Marais published in 1999 on which he discusses important aspects of the earth's early atmosphere and the changes brought about by the evolution of photosynthetic organisms. (In English. Not illustrated. Published in 1999).
<http://astrobiology.arc.nasa.gov/palebluedot/abstracts/ddm.html>

Anoxygenic and Oxygenic Photosynthesis. Pages prepared for a microbiology course at Cornell University. These pages uses movies to show, in a simplified manner, how light excites electrons and how these are used to harvest energy under both systems. Movies on other topics may also be accessed from this page. Requires Macromedia Shockwave. (In English. Movie. No revision date)
<http://instruct1.cit.cornell.edu/courses/biomi290/index.html>

Part Five

Respiration

Cellular Respiration. Pages prepared by June B. Steinberg, National Louis University. Pages include explanations of glycolysis, conversion of pyruvate into acetyl CoA, the citric acid cycle, electron transport chains, and fermentation. (In English. Illustrated. No revision date)
http://faculty.nl.edu/jste/cellular_respiration.htm#Glycolysis.

Cellular Respiration. Pages prepared by Gary E. Kaiser and hosted by the Community College of Baltimore County. This tutorial guides the user through the important events in cellular respiration, including glycolysis, the citric acid cycle, and electron transport chains. Also covers anaerobic

respiration and fermentation. Contains list of objectives and short tests. (In English. Illustrated. Last revised June 26, 2001).

http://student.ccbc.cc.md.us/biotutorials/cellresp/cellresp_index.html

Respiration. Page prepared for a microbiology course at Cornell University. This page uses a movie to show how electrons are transported across the electron transport chain in order to produce ATP, but user must know the key elements involved. Requires Macromedia Shockwave. (In English. Movie. No revision date) <http://instruct1.cit.cornell.edu/courses/biomi290/MOVIES/RESPIRATION.HTML>

Aerobic Respiration. Pages prepared and maintained by the Natural Toxins Research Center at Texas A&M University. Describe the important steps in aerobic respiration (glycolysis, formation of acetyl CoA, citric acid cycle, and the electron transport chain. (In English, with illustrations and animations. No revision date). <http://ntri.tamuk.edu/cell/mitochondrion/glycol.html>

Glycolysis. This page is part of the Biotech Resources Web Page at Indiana University. It explains the fundamentals of glycolysis by presenting the reactions involved and the full model for glycolysis. Review questions and an exam are provided. (In English. Illustrated. Last revised July 18, 1998).

<http://biotech.icmb.utexas.edu/glycolysis/glycohome.html>

Glycolysis I and II. Prepared by Michael Blaber, Florida State University. Michael Blaber's page is one of the most remarkable web pages designed for students registered in a biochemistry course. These two pages on glycolysis include a detailed explanation of this important process. Includes chemical equations, energetics, and remarks for each of the reactions. This is a frames page, and the user must select the Glycolysis topic from the right hand menu. <http://wine1.sb.fsu.edu/BCH4053/bch4053.htm>

Step by Step Krebs Cycle. Page prepared by A. Sanamontre, University of Leeds, UK. The page presents, on a step by step fashion, all the reactions on the citric acid cycle. For each step in the cycle there is a fact sheet, written reactions, and an animation. Requires Realmedia Playlet to view animations. (In English. With illustrations and animations. No revision date).

<http://www.jonmaber.demon.co.uk/tcasteps/>

The Citric Acid (Krebs, TCA) Cycle. Prepared by Michael Blaber at Florida State University. This page presents the citric acid cycle on a step by step fashion. For each step the authors provide comments, a chemical equation, and its free energy. Page also includes a summary of catabolism of glucose and the yield of ATP. (In English. Illustrated. No revision date).

<http://wine1.sb.fsu.edu/krebs/krebs.htm>

Interactive Krebs Cycle. Prepared by C. Early, Kent State University. This interactive module presents a diagram of the Krebs cycle. Selecting items in the diagram brings on a description of that particular item. For example, selecting arrows provides information on the reaction such as, type of reaction, reactants, and catalyst.

<http://www.stark.kent.edu/~cearly/pchem/Krebs/Krebsrxn.htm>

Chemiosmosis. Page prepared by J.B. Steinberg, National-Louis University. This page provides a simplified explanation of the electron transport chain and chemiosmosis, focusing on the characteristics of the membranes. (In English. With Illustrations and animations. No revision date)

<http://faculty.nl.edu/jste/chemiosmosis.htm>

Electron Transport Chain. Page prepared by E. Neeno-Eckwall, Hamline University. This page explains the structure and function of the mitochondrial electron transport chain, including details of the most important reactions. (In English. Illustrated. No revision date)

<http://138.192.68.68/bio/Courses/biochem2/ETC/ETC1.html>

Oxydative Phosphorylation. Page prepared by Michael W. King, Indiana University. This page describes the electron transport chain and the process of oxydative phosphorylation. Discusses the complexes of the electron transport chain as well as regulation and inhibition of oxidative phosphorylation. (In English. Illustrated. Last revised May 10, 2001).
<http://www.indstate.edu/thcme/mwking/oxidative-phosphorylation.html>

Anaerobic Respiration and Fermentation. Pages prepared by T. Paustian, University of Wisconsin, Madison. Explains the role and importance of anaerobic respiration, covering nitrate reduction, denitrification, sulfate reduction, and carbonate reduction. Also explains in detail the process of fermentation, including fermentation processes of importance to humans. (In English. Illustrated. Last revised September 21, 2000). <http://www.bact.wisc.edu/MicrotextBook/Metabolism/RespAnaer.html>
<http://www.bact.wisc.edu/MicrotextBook/Metabolism/Fermentation.html>
<http://www.bact.wisc.edu/MicrotextBook/Metabolism/FermFoods.html>

Anaerobic Respiration – Fermentation. Page prepared by K. Nesius at Old Dominion University. Presents a summary of the fermentation process and compares it, in terms of its chemistry and energy yields, to aerobic respiration. Includes a short test on the material. (In English. Illustrated. Last revised October 29, 1997). <http://www.lions.odu.edu/~knesius/miniunits/epsilon/epsilon5.html>

SECTION FOUR: GENETICS, REPRODUCTION AND DEVELOPMENT

Part One

Genes and Chromosomes

DNA From The Beginning. Prepared by the Dolan DNA Learning Center, Cold Spring Harbor Laboratory. This award winning page contains an introduction to the basic concepts of genetics. Requires Flash Player or Real Player plug-ins. (In English. Animations. No revision date)
<http://www.dnafb.org/dnafb/>

Chromosomes. Page prepared by Gwen V. Childs and hosted by the cytochemistry net. Explains the basics of DNA organization in the chromosome, covering topics such as heterochromatin, euchromatin, and histones. (In English. Illustrated. Last revised June 4, 2001).
<http://www.cytochemistry.net/Cell-biology/nucleus2.htm#Chromosome>

Eukaryotic Chromosome Structure. Prepared by Phillip McLean, North Dakota State University. This pages provide a summary of the organization of chromosomes. Includes explanation of components of a chromosome, telomere replication, analysis of DNA sequences, and others. Page also includes study questions, a presentation, and links to other pages. (In English. Illustrated. Prepared in 1997.)
<http://www.ndsu.nodak.edu/instruct/mcclean/plsc431/eukarychrom/eukaryo3.htm>

Genes and Mutations. Prepared by Phillip McLean, North Dakota State University. Includes explanation of germinal, somatic, spontaneous and induced mutations. Page also includes study questions, a presentation, and links to other pages. (In English. Illustrated. Prepared in 1997.)
<http://www.ndsu.nodak.edu/instruct/mcclean/plsc431/mutation/index.htm>

Central Dogma. Prepared by Hong Li, Florida State University. These lecture notes provide an explanation of the central dogma of molecular genetics. It includes detailed explanations of transcription and translation, and their control. (In English. Illustrated. Last revised
<http://www.sb.fsu.edu/~hongli/BCH5425/note6.html>

Part Two

Mitosis and Meiosis

Mitosis. Page prepared by Stephen M. Wolniak at the University of Maryland. This excellent page makes a simple but effective presentation of the steps in mitosis using a plant stem cell as a model. Very concise and accurate explanations are aided by excellent micrographs. Includes technical details. (In English. Illustrated. No revision date).

<http://www.life.umd.edu/cbm/faculty/wolniak/wolniakmitosis.html#anchor2267645>

Mitosis Animation. Page prepared by Jeff Bell, California State University, Chico. A simple but well design animation showing events in mitosis. A brief description is provided for each step. (In English. Animation. Last revision April 8, 1998.) <http://www.csuchico.edu/~jbell/Biol207/animations/mitosis.html>

Mitosis Mastery Test. Hosted by North Carolina State University. Online test on the basics of mitosis. (English. Not illustrated. No revision date.) http://www.cals.ncsu.edu/bio_sci/mastery_tests/mitosis.html

Guia Sobre Mitosis y Meiosis. Pages prepared by The Biology Project at the University of Arizona. Includes explanations of mitosis and meiosis, and animations on these processes. (In Spanish. With illustrations and animation. Last revised October 1998.)

<http://www.biologia.arizona.edu/cell/tutor/mitosis/mitosis.html>

<http://www.biologia.arizona.edu/cell/tutor/meiosis/meiosis.html>

Meiosis Tutorial. Created by Brian Chorley, North Carolina State University. This tutorial includes a brief explanation and a picture for each of the meiotic stages. (In English. Illustrated. No revision date.)

<http://www4.ncsu.edu/unity/users/b/bnchorle/www/>

Meiosis Mastery Test. Hosted by North Carolina State University. An online test on the basics of meiosis. (In English. Not illustrated. No revision date.)

http://www.cals.ncsu.edu/bio_sci/mastery_tests/meiosis.html

Meiosis Tutorial. Prepared by Rolf E. Christoffersen and Debbie Kaska, University of California, Santa Barbara. Contains a step by step explanation of meiosis, and an animation. Requires Macromedia Shockwave for animations. (In English. Illustrations and animations. No revision date.)

<http://tutor.lscf.ucsb.edu/course/fall/mcddb1a/genetics/meiosis/>

Part Three

Genetics

Landmarks in the History of Genetics. Page prepared by Francis F. Steen, University of California, Los Angeles. List milestones in the history of genetics. Includes list of references, some of which provide links to original papers, and other sites and resources. In English, not illustrated. Last revised February 7, 2002). http://cogweb.ucla.edu/EP/DNA_history.html#McGinnis

Basic Principles of Genetics. Pages prepared by Dennis O'Neal at Palomar College. A very good page that provides a simple introduction to concepts in basic genetics. Divided in three sections: 1. Mendel's Genetics, 2. Probability of Inheritance, and 3. Exceptions to Simple Genetics. Includes links and a glossary of terms. (In English. Illustrated. Last revised August 8, 2002).

<http://anthro.palomar.edu/mendel/Default.htm>

Primer on Molecular Genetics. Prepared by Denise Casey, DOE Human Genome Project. This primer includes explanations of DNA, genes and chromosomes, and a wealth of information on molecular genetics and the human genome project. (In English. Illustrated. Published in 1992.)

<http://www.ornl.gov/hgmis/publicat/primer/toc.html>

A Genetics Tutorial. Developed by William Sofer and Mary Gribbin, Rutgers University. This tutorial covers basic principles of genetics divided on the following units: Genes and Chromosomes, Alleles and Mutations, Probability, Linked Genes, Recombination, and Chromosomes and Sex Determination. Requires Chime plug-in to view molecular structures. (In English. Illustrations and animations. Last revised March 2000.)

<http://morgan.rutgers.edu/MorganWebFrames/htmldocs/contents.html>

The Molecular Basis of Inheritance. Pages prepared by Mike Satterwhite, Louis and Clark State College. Explains the events leading to the discovery of DNA and its structure and its establishment as the carrier of genetic information. Includes a detailed explanation of replication and DNA repair. (In English. Illustrated. o revision date.) <http://mickey.lcsc.edu/~msatterw/BI201/DNA.htm>

Introduction to Genetics. Part of the Biology hypertextbook prepared by Michael Farabee, Estrella Mountain Community College, Arizona. Includes sections on historical perspectives of heredity, Gregor Mendel's findings, crosses, mutations, as well as a list of genetics terms and list of links. (In English. Illustrated. Last revised in 2001.)

<http://www.emc.maricopa.edu/faculty/farabee/BIOBK/BioBookgenintro.html>

Intermediate Genetics. Pages prepared by Phillip McLean, North Dakota State University. This excellent resource was written for a course on intermediate genetics and covers most relevant topics on that science. (In English. Illustrated. Prepared in 1997.)

<http://www.ndsu.nodak.edu/instruct/mcclean/plsc431/431g.htm>

Mendel Web. Prepared by Roger B. Blumberg. Pages provide access to translations of Mendel's signal papers as well as to commentaries on his work by other researchers. Also includes a timeline of his work, and tools that allow the user to work with numerical data. Includes links to relevant sites. (In English. Illustrated. Last revised February 1997.)

<http://www.netspace.org/MendelWeb/>

Part Four

Gene Expression and Regulation

The Dolan DNA Learning Center. This site is prepared by the staff at Cold Spring Harbor Laboratories. The site contains an extensive collection of educational and research resources related to the study of DNA. Also provides an excellent list of links. Includes a biology animation library covering topics such as PCR and DNA fingerprinting. Requires Macromedia Shockwave plug-in to view animations. (In English. Continuously updated). <http://www.dnalc.org/>

Beginners Guide to Molecular Biology. Maintained by Nathalie Castells-Brooke and part of the Molecular Biology Notebook. These pages contain a wealth of information on molecular biology, covering topics such as the chromosomes, mitosis and meiosis, DNA structure, gene expression, and protein synthesis. Includes links under each topic. (In English. Illustrated. Last revised April 2002.)

<http://www.iacr.bbsrc.ac.uk/notebook/courses/guide/>

Control of Gene Expression, DNA Metabolism, RNA Metabolism, and Protein Synthesis. Prepared by Michael W. King, Indiana University School of Medicine. These pages cover the details of gene expression and regulation in prokaryotes (*lac* and *trp* operons) and eukaryotes, replication, translation and protein synthesis. Provide links to related pages. (In English. Illustrated. Last revised May 2001.)

<http://www.indstate.edu/thcme/mwking/gene-regulation.html#motifs>

<http://www.indstate.edu/thcme/mwking/dna.html>

<http://www.indstate.edu/theme/mwking/rna.html>
<http://www.indstate.edu/theme/mwking/protein-synthesis.html>

Control of Gene Expression. These pages, prepared by M.J.Farabee, are part of the Online Biology Book hosted by Estrella Mountain Community College in Avondale, Arizona. Covers the following topics: 1. The chromosome of *E. coli*, 2. the operon model, 3. viruses, 4. plasmids, 5. the eukaryotic chromosome, 6. replication of the eukaryotic chromosome, 7. regulation of eukaryotic gene expression, 8. types of chromatin, 9. the eukaryotic genome, 10. transcription and processing of mRNA, 11. antibody-coding genes, 12. viruses and eukaryotes, 13. eukaryotic transposons, 14. genes, viruses, and cancer, and a links section. The user should also revise the sections on DNA and molecular genetics and on protein synthesis, by following the second and third links below, to obtain a complete picture of gene expression and regulation. (In English. Illustrated. Last revised 2001.)

<http://www.emc.maricopa.edu/faculty/farabee/BIOBK/BioBookGENCTRL.html>
<http://www.emc.maricopa.edu/faculty/farabee/BIOBK/BioBookDNAMOLGEN.html>
<http://www.emc.maricopa.edu/faculty/farabee/BIOBK/BioBookPROTSYn.html>

Control of Gene Expression in Eukaryotes. Prepared by Phillip McLean, North Dakota State University. A comprehensive discussion of gene regulation in eukaryotes. Includes the following topics: 1. introduction, 2. the transcription complex, 3. basic cis-acting sequences, 4. enhancers and silencers, 5. methylation, 6. trans-acting factors, 7. signaling control of transcription, 8. hormonal control of gene expression, and 9. signal transduction pathways. Also includes a list of links and review questions. (In English. Illustrated. Prepared in 1997.)

<http://www.ndsu.nodak.edu/instruct/mcclean/plsc431/geneexpress/eukaryex1.htm>

Part Five

Human Genetics

Genomics and its Impact on Medicine and Society: A 2001 Primer. Published by the DOE Human Genome Project. Includes among others, sections on basic genomics, history of the human genome project, and discussion on the benefits of genomic research and societal concerns. Also includes a glossary of genetic terms. (In English. Illustrated. Published in 2001.)

<http://www.ornl.gov/hgmis/publicat/primer2001/index.html>

Human Genetics References and Human Diseases Pages. Prepared by Robert J. Huskey, University of Virginia. Contains links to documents, illustrations and animations related to topics in human genetics. Includes animations of crosses, pedigrees for several genetic disorders, explanation of blood grouping systems, and others. The human diseases pages contains links to sites related to human diseases, including hereditary illnesses. (In English. Not illustrated. NO revision date.)

<http://www.people.virginia.edu/~rjh9u/hgenes.html> / <http://www.people.virginia.edu/~rjh9u/disease.html>

Human Genetics. These pages, prepared by M.J.Farabee, are part of the Online Biology Book hosted by Estrella Mountain Community College in Avondale, Arizona. Page covers the following topics: 1. human karyotypes, 2. human chromosomal abnormalities, 3. human allelic disorders (recessive), 3. human allelic disorders (dominant), 4. sex linked traits, 5. diagnosis of human genetic diseases, 6. radioactive probes, and a section on links. (In English. Illustrated. Last revised 2001.)

<http://www.emc.maricopa.edu/faculty/farabee/BIOBK/BioBookhumgen.html>

The Human Genome: A Guide to Online Information. Maintained by the National Center for Biotechnology Information. This guide contains links to multiple resources related to the human genome. There is also an interesting section on genes and disease (see second link below), as well as links to other genome pages. (In English. Illustrated. Continuously updated.)

<http://www.ncbi.nlm.nih.gov/genome/guide/human/>; <http://www.ncbi.nlm.nih.gov/disease/>

Ethical, Legal and Social Implications of the Human Genome Project. An excellent collection of links maintained by the Genetics Education Center of the University of Kansas Medical Center. Contains links to government agencies, and private and educational institutions with material relevant to the subject. (In English. Not illustrated. Continuously revised.)

<http://www.kumc.edu/gec/prof/geneelsi.html>

Part Six

Reproduction

Asexual Reproduction. From the Kimball's Biology Pages. This page discusses the basic aspects of asexual reproduction in plants and animals. A glossary defines key terms when these are selected in the text. (In English. Illustrated. Last revised January 2002.)

<http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/A/AsexualReproduction.html>

Flowering Plant Reproduction. Part of the Online Biology Book by Michael J. Farabee, Estrella Mountain Community College, Arizona. The first of these pages covers plant life cycles and the flower as a reproductive structure. The second part focuses on fertilization and fruit production. (In English. Illustrated. Revised in 2001.)

<http://www.emc.maricopa.edu/faculty/farabee/BIOBK/BioBookflowers.html>

<http://www.emc.maricopa.edu/faculty/farabee/BIOBK/BioBookflowersII.html>

Human Reproductive System. Prepared by J. Stein Carter, University of Cincinnati, Clermont College. These two pages describe the human reproductive system and some of its physiological aspects. User must select Reproductive System and Conception and Prenatal buttons. (In English. Illustrated. No revision date.)

<http://biology.clc.uc.edu/courses/bio105/carter.htm>

Sexual Reproduction in Humans and Hormones of the Reproductive System. From the Kimball's Biology Pages. These pages discuss the human reproductive system, its function, and the physiology of pregnancy, birth and lactation. The second link covers the most important aspects of human reproductive endocrinology. (In English. Illustrated. Last revised August 2002.)

http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/S/Sexual_Reproduction.html

<http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/S/SexHormones.html>

Histology of the Male and Female Reproductive Systems. Prepared by Pawlina Wojciech and hosted by the University of Florida. These pages examine the histology of the human reproductive system. Photos of slides are accompanied by a list of structures that the student can locate in the picture. A glossary of key terms is provided. (In English. Illustrated. Revised in 1998.)

<http://www.medinfo.ufl.edu/year1/histo/review/lab21.html>

<http://www.medinfo.ufl.edu/year1/histo/review/lab22.html>

Part Seven

Development

Dynamics of Development. Developed by Jeff Harding at the University of Wisconsin. Features tutorials on the development of fish (unfinished), echinoderms, and amphibians. Includes an extensive glossary on developmental biology. (In English. Illustrated. Last revised August 2002.)

http://worms.zoology.wisc.edu/embryology_main.html

Developmental Biology Virtual Library. Maintained by The Society for Developmental Biology. Provides links to research laboratories and educational sites on developmental biology. Also includes the award winning The Interactive Fly, an online tutorial to Drosophila genes and their role in development. (In English. Illustrated. No revision date.)

<http://sdb.bio.purdue.edu/>

Developmental Biology Page. Developed by Bill Wasserman, Loyola University. Page includes a tremendous collection of movies on oogenesis, sperm formation, fertilization, cleavage, gastrulation and many other developmental events. Also provides links to developmental biology journals and web resources. Requires Quicktime or Quicktime for Windows to view movies. (In English, with movies. Last revised June 2002.)

<http://www.luc.edu/depts/biology/dev.htm>

The Virtual Embryo. Page prepared by Leon Browder, University of Calgary. This page includes vast resources for the study of developmental biology. Most important is Dynamic Development, an online tutorial covering all the key topics in developmental biology. Includes links to pages on developmental biology courses and other resources, as well as links to research sites. (In English. Illustrated. Last revised July 12, 2001.)

<http://www.ucalgary.ca/UofC/eduweb/virtualembryo/>

SECTION FIVE: EVOLUTION AND DIVERSITY OF ORGANISMS

Part One

Evolution and Population Genetics

Introduction to Evolutionary Biology. Written by Chris Colby and hosted by TalkOrigins. The author discusses most important elements of evolutionary thinking including genetic variation, natural selection, sexual selection, mutation, micro- and macroevolution, and also provides an explanation of the origins of life and examines criticism of evolutionary theory. (In English. Not illustrated. Last revised January 7, 1996.)

<http://www.talkorigins.org/faqs/faq-intro-to-biology.html>

Evolution and Natural Selection. A primer on evolution and natural selection prepared by faculty at The University of Michigan. Contains links to definitions of key terms and list of suggested readings, as well as a short test on the subject. User may also access other lectures on related topics by following the second link below. (In English. Illustrated. No revision date.)

<http://www.globalchange.umich.edu/globalchange1/current/lectures/selection/selection.html>

<http://www.globalchange.umich.edu/globalchange1/current/lectures/>

Evolutionary Biology Resources. Prepared by F. J. Pitochelli, Saint Anselm College. A list of internet resources on evolutionary biology. Includes links to an anthropology and archaeology, history of evolutionary theory, general information, and evolution simulations. (In English. Not illustrated. No revision date.) <http://www.anselm.edu/homepage/jpitocch/resevol.html>

Evolution. Pages prepared for an evolution course by D. R. Walters, California Polytechnic State University. This site includes very detailed class notes, arranged under the headings Introduction to Evolutionary Thought, A History of Life, Microevolution and Population Genetics, and Classification, Systematic and Speciation Patterns of Species Groupings Through Space and Time. (In English. Illustrated. Last revised October 28, 1998.)

<http://www.bio.calpoly.edu/BioSci/Courses/BIO/BIO414/>

The Hardy-Weinberg Law and Genetic Equilibrium. Prepared by David C. Hines, Tulane University. This page includes an extensive and detailed explanation of the Hardy-Weinberg law. Explains its assumptions and significance. (In English. Not illustrated. Prepared in 1995.)
http://www.tulane.edu/~guill/hardy_weinberg.html

Georgetown's Hardy-Weinberg Page. Pages hosted by the Department of Biology at Georgetown University. Includes a basic explanation of the Hardy-Weinberg Law and provides access to an allele frequency calculator and a link to a discussion on selection. (In English. Illustrated. No revision date.)
<http://www.georgetown.edu/departments/biology/class/hardy/>

Population Genetics. Lecture notes for a course on population genetics prepared by Michael Whitlock, University of British Columbia. The notes are in outline form and cover numerous topics such as allele frequencies, genetic drift, mutation, selection, inbreeding, sex ratio evolution, and others. (In English. Illustrated. Last revised 2001.)
<http://www.zoology.ubc.ca/~whitlock/bio434/>

Population and Evolutionary Genetics. Pages prepared by Phillip McLean, North Dakota State University. Explains the following topics: allelic frequencies, Hardy-Weinberg equilibrium, evolutionary genetics, Darwin's theory of natural selection, and speciation. Includes access to overheads, study questions and a list of links. (In English. Illustrated. Prepared in 1997.)
<http://www.cc.ndsu.nodak.edu/instruct/mcclean/plsc431/popgen/popgen1.htm>

Populus. Published by Don Alstad, University of Minnesota. This software package consists of a series of simulations used to teach evolutionary and population biology. Includes simulations for population growth, predator-prey interactions, demography, and competition, among others. Free for students and faculty at educational institutions. Available for DOS under Windows, Macintosh OS-X, and Java virtual machines. Must follow downloading instructions. (In English. Revised May 2002.)
<http://www.cbs.umn.edu/software/populus.html/index.html>

PopBio. Developed by Robert Kaplan, Reed College. This is a population biology simulation software that covers topics such as population genetics, population growth, predator-prey interactions, and competition. Available for Macintosh computers only. Must follow downloading instructions. (In English. No revision date.)
<http://academic.reed.edu/biology/Software.html>

Part Two

Diversity of Living Organisms

The Tree of Life. An ongoing effort by biologists and systematists from around the world. This page presents a current classification of all extinct and living organisms, from prokaryotes to mammals. The user accesses taxa by navigating through the tree or using a search engine. For each taxon there is information on its characteristics, phylogenetic relationships, and biology and ecology. Links and a list of references are also provided. (In English. Illustrated. Continuously updated.)
<http://tolweb.org/tree/phylogeny.html>

Introduction to the Bacteria. Pages hosted by The Museum of Paleontology, University of California, Berkeley. Pages include basic information on the evolution, life history and ecology, and systematics, and morphology of the bacteria. (In English. Illustrated. No revision date.)
<http://www.ucmp.berkeley.edu/bacteria/bacteria.html>

Classification (of Bacteria). This page was prepared by Gary Olson of the University of Illinois, and is hosted by the MicrotextBook at the University of Wisconsin. This chapter starts with an explanation on the basics of classification of living organisms and ends with a classification for the bacteria. (In English. Not illustrated. Last revised September 2001).

<http://www.bact.wisc.edu/MicrotextBook/ClassAndPhylo/classify.html>

Kingdom Protocista. Page prepared by Frances M. Cardillo, Manhattan College. Includes a classification of Protozoa with short descriptions of selected taxa. (In English. Illustrated. No revision date).

<http://web1.manhattan.edu/fcardill/plants/protoc/protoc1.html>

Resource Guide to Protista. Pages prepared and hosted by BIOSIS. Provide an extensive list of links to resources on protozoology. (In English. Not illustrated. Continuously updated).

http://www.biosis.org/zrdocs/zoolinfo/grp_prot.htm

Protist Image Data. Site prepared by Charles J. O'Kelly and Tim Littlejohn, University of Montreal. Site contains images of selected algae and protozoa, and a list of links to sites containing information on protozoology. (In English. Illustrated. Last revised January 2002.).

<http://megasun.bch.umontreal.ca/protists/>

Fungi. Page prepared by Tom Volk, University of Wisconsin, La Crosse. Includes an introduction to the Fungi, links to mycological resources, a section for educators, a frequently asked questions section, photographs and many other resources related to the Fungi. (In English. Illustrated. Last revised August 1, 2002.)

http://botit.botany.wisc.edu/toms_fungi/

The Algae Homepage. Pages maintained by the National Museum of Natural History – Smithsonian Institution. Contains numerous resources for the study of algae, including an introduction and classification, research notes, tips on collection and preservation, lists of publications and a list of links. (In English. Illustrated. No revision date.)

<http://www.nmnh.si.edu/botany/projects/algae/Alg-Menu.htm>

Evolution of Plants. Lecture notes prepared by S. T. Abedon. Covers the most important aspects of plant evolution. Explains plant life cycles, reproduction, plant anatomy and morphology, and provides a classification of plants. (In English. Not illustrated. Prepared in 1997.)

<http://www.mansfield.ohio-state.edu/~sabedon/biol3060.htm>

Classification of Plants. Page prepared by Frances M. Cardillo at Manhattan College,. Pages include a current classification of plants with explanations on their phenology, typical life cycles, and reproductive strategies. (In English. Illustrated. No revision date.)

<http://web1.manhattan.edu/fcardill/plants/intro/plantmen.html>

General Plant Biology. Homepage for the General Plant Biology course at Ohio State University. Includes notes on topics such as plant evolution, plant chemistry and physiology, and plant anatomy and morphology. Also provides an overview of plant classification with notes on the major taxa of non-vascular and vascular plants, including the Bryophyta, Hepaticophyta, Pterophyta, gymnosperms, and angiosperms. Includes a list of links, and a micrograph gallery. (In English. Illustrated. No revision date.)

<http://www.hcs.ohio-state.edu/hcs300/index.html>

Internet Directory for Botany. Maintained by Botany.Net. The directory contains a database of sites related to botany, but some addresses may not be up to date. The user selects from an alphabetical list of topics or chooses from a subject list. May also be searched from the mirror site in Berlin. (In English. Not illustrated. Last updated August 10, 1998.)

<http://www.botany.net/IDB/>

<http://bgbm3.bgbm.fu-berlin.de/idb/botmenu.html>

Land Plants Online. Pages prepared by Dan Nickrent and Karen Renzaglia, Southern Illinois University at Carbondale. These excellent pages include a wealth of information on land plants. Most notable are the sections dedicated to plant phyla, which include descriptions of each phyla with key terms linked to illustrations, links to classification systems, and photographs of selected representatives. Also includes a complete overview of plant phylogenetic relationships and links to sites related to plant evolution. (In English. Illustrated. Last revised May 1, 2001.)

<http://www.science.siu.edu/landplants/>

The Herbarium – Flowering Plant Index. Site maintained by the Texas A&M Biology Department. Most notable on this site is the Flowering Plant Index gateway, a search tool prepared by the Bioinformatics Group, that allows the user to search a web site index for information on specific taxa. User may search by family name or may browse through several classification systems. (In English. Not illustrated. Last revised June 9, 1998).

<http://www.csd.tamu.edu/FLORA/biolherb/tamudata.htm>

Animal Diversity Web. Prepared by students and staff at The Museum of Zoology, University of Michigan. This work in progress includes a classification of the Animal Kingdom, with detailed information for selected taxa. Avigation is through a search engine or a phylogenetic tree. (In English. Illustrated. Continuously updated)

<http://animaldiversity.ummz.umich.edu/>

Biosis Guide to the Animal Kingdom. Prepared and hosted by Biosis. Pages present a current classification (above the family level) of the animal kingdom. Most taxa includes links to related pages. (In English. Not illustrated. Continuously updated).

http://www.biosis.org/free_resources/classifn/classifn.html

Zoology Lab. Page prepared by Rick Gillis and Roger J, Haro, University of Wisconsin, La Crosse. This is the best online manual for a general zoology laboratory. Includes detailed information for selected representative taxa within the Animal Kingdom as well as a collection of pictures from whole and dissected specimens, models, and microscope slides. Includes tests. (In English. Illustrated. Last revised July 22, 2002). <http://bioweb.uwlax.edu/zoolab/index.htm>

General Zoology Homepage. Prepared by Dawn M. Kitchen and Tim Susman, University of Minnesota. These pages include an overview of key phyla covered in a general zoology course, namely Protozoa, Porifera, Cnidaria, Platyhelminthes, Nematoda, Mollusca, Annelida, Arthropoda, Echinodermata, and Chordata. Includes a description of each phyla with links to related sites, dissection reviews with numerous photographs, and other resources. (In English. Illustrated. Last revised January 10, 2001.)

<http://www.cbs.umn.edu/class/spring2000/biol/2012/>

Animal Physiology. Prepared by D. Facey and others, College of St. Michael. Pages explains the basic aspects of animal physiology, including metabolism and energetics, circulatory and immune systems, osmoregulation and excretion, nervous and endocrine systems, respiration, and muscles. A very good glossary of terms appears at the bottom of this frames page. (In English. Not illustrated. No revision date.) <http://academics.smcvt.edu/dfacey/animalphysiology/>

Atlas of the Body. Maintained by the American Medical Association. This atlas of the human body contains basic information of human anatomy and physiology. Illustrations are accompanied by short description of functions of the different systems. (In English. Illustrated. No revision date.)
<http://www.ama-assn.org/ama/pub/category/7140.html>

Part Three

Human Evolution

Human Evolution: The Fossil Evidence in 3D. Page prepared by Philip L. Walker and Edward H. Hagen, University of California. This animated site allows the user to navigate through the human evolutionary tree and by using fossil and modern primated crania as supporting evidence. Also provides distribution maps. Requires Macromedia Shockwave plug-in. (In English. With Animation. No revision date.) <http://www.anth.ucsb.edu/projects/human/#>

The Long Foreground: Human Prehistory. Pages hosted by Washington State University. Pages include an explanation of human evolution with a hominid species timeline that includes detailed information on key species. Presents supporting fossil evidence and theories on hominid radiations. (In English. Illustrated. No revision date.)
http://www.wsu.edu:8001/vwsu/gened/learn-modules/top_longfor/overview/overvw1.html

Becoming Human. Prepared by The Human Origins Institute, Arizona State University, and hosted by Becoming Human.org. Includes an impressive online documentary prepared by D.C. Johansson, a learning center, and an extensive list of links to resources, including a glossary, on human evolution. Requires a high speed connection and Macromedia Flash Player 5. (In English. With movies and illustrations. No revision date.)
<http://www.becominghuman.org/>

The Origin of Modern Humans. Page written by Michael Roberts, Linfield College. This work discusses the origins of modern humans and is divided in three parts: 1. Models of the origin and dispersal of Homo sapiens, 2. When, where, and how did the step to moderns occur?, and 3. Replacement vs. Regional continuity hypotheses: implications for human nature. (In English. Illustrated. Last revision July 2002.)
<http://www.linfield.edu/~mrobert/origins.html>

Human Evolution. Page hosted by Handprint Media. Includes a chart depicting human evolution, a tour of the fossil record, a short essay on the evolution of the hominid brain, pictures of hominid tools, and a summary of hominid sites and theories of dispersal. (In English. Illustrated. Last revised June 1999.)
<http://www.handprint.com/LS/ANC/evol.html>

A Brief Bibliography of Human Evolution. Prepared by the Institute of Human Origins, Arizona State University. Includes a list of the most relevant recent literature related to human evolution. User may check other resources at the Institute or the Department of Anthropology by navigating the menu. (In English. Not illustrated. No revision date.)
<http://www.asu.edu/clas/ihg/general.html>

Part Four

Puerto Rico's Sites

Caribbean Journal of Science. This journal publishes articles on the natural history of the Caribbean. Online issues available from June 1998. Contains links to special publications. Requires Adobe Acrobat Reader. (In English and Spanish. Illustrated. Continuously updated). <http://caribjsci.org/>

The Herbarium. Page hosted by the University of Puerto Rico, Rio Piedras. Includes a list of Caribbean orchids, with locality data, and links to other herbaria. (In English. Not illustrated. No revision date).
<http://www.cnnnet.clu.edu/biol/herbariu.html>

Praderas de Hierbas Marinas. Page prepared by Cedar García, University of Puerto Rico, Humacao. This excellent page provides a detailed description of marine seagrass (*Thalassia*) beds in Puerto Rico. Includes extensive notes on their biology and natural history. (In Spanish. Illustrated. No revision date).
<http://cuhwww.upr.clu.edu/~cgarcia/ecologiacostanera/Clase/Tha-001/THALASIA.98.htm>

Las Playas de Arena de Puerto Rico. Page prepared by Cedar García and Alberto Cortés, University of Puerto Rico, Humacao. This important work describes important aspects of the sandy beach ecosystems in Puerto Rico. Includes a map with locations of sandy beaches on the island, explanation of sand formation and sand characteristics, faunal adaptations, and an extensive summary of the natural history of the fauna of sandy beaches. (In Spanish. Illustrated. Prepared in 2001).
<http://cuhwww.upr.clu.edu/~cgarcia/ecologiacostanera/Clase/pla-doc/playa-2001.htm>

Los Quitones de Puerto Rico. Prepared by Cedar García, University of Puerto Rico, Humacao. This pages summarizes the current knowledge on the 22 known species of chitons or “quitones” in Puerto Rico. Includes description of their anatomy, notes on their biology, and a list of references. (In Spanish. Illustrated. No revision date).
<http://cuhwww.upr.clu.edu/~cgarcia/quitones/>

Parasites of Puerto Rican Freshwater Sportfishes. Work authored by Lucy Bunkley-Williams and Ernest H. Williams, Jr., University of Puerto Rico, Department of Marine Sciences. This is the complete, downloadable version of this interesting and exciting work. Requires Adobe Acrobat. (In English. Illustrated. Published in 1994).
<http://www.uprm.edu/biology/cjs/epub5/book.pdf>.

Proyecto Coqui. Pages prepared by Rafael Joglar and Patricia Burrowes, University of Puerto Rico. Pages dedicated to the study and conservation of Puerto Rican tree frogs of the genus *Eleutherodactylus* (coquies). Includes a list of species as well as checklists for the reptiles and amphibians of the island. Includes a list of references and links to other herpetology pages. (In English and Spanish. Illustrated. No revision date).
<http://www.cnnnet.clu.edu/procoqui/>

Tiburones de Puerto Rico. Page prepared by Cedar García and José O. Sotero Esteva, University of Puerto Rico, Humacao. Includes notes on the 21 known shark species inhabiting Puerto Rico’s seawaters. (In Spanish. Illustrated. No revision date).
<http://cuhwww.upr.clu.edu/~cgarcia/tiburon/>

Sociedad Ornitológica Puertorriqueña. Page maintained by the society. It is dedicated to the study and conservation of the Puerto Rican avifauna. Includes the Society’s bulletin, links to publications, and photographs. Some downloads require Adobe Acrobat. (In Spanish. Illustrated. No revision date)
<http://www.avesdepuertorico.org/main.htm>

Red Caribeña de Varamientos. Prepared by the Caribbean Stranding Network. The page is dedicated to the study, conservation, and education on marine mammals. Includes links to research and educational sites, and sections with up to date information on undergoing rescues and rehabilitations. (In Spanish and English. Illustrated. Last revised June 25, 2002).
<http://rcv.caribe.net/>

SECTION SIX: ECOLOGY AND BEHAVIOR

Part One

Principles of Ecology

Principles of Ecology. Pages prepared by K. S. Killburn, Old Dominion University. These pages include lecture notes and study guides for an introductory ecology course. Focuses on the following topics, earth biomes, autecology, ecology of populations, interactions among species, communities, and large scale ecology. There are lists of related links for each topic. (In English. Not illustrated. No revision date.)

<http://www.lions.odu.edu/~kkilburn/ecohome.htm#VL>

Ecology WWW Page. Maintained by the University of Lyon, France. This is an extensive list of links to ecological sciences resources on the web. Resources are listed alphabetically, and some of the links may need updating. (In English. Not illustrated. Last revised in 1998.)

<http://pbil.univ-lyon1.fr/Ecology/Ecology-WWW.html>

Biodiversity and Conservation. A hypertextbook prepared by Peter J. Bryant, University of California, Irvine. Includes notes by the author and links to relevant sites. Topics covered include, among others, a history of life, extinction, patterns of biodiversity, introductions, and endangered species. (In English. Illustrated. Last revised in 2001.)

<http://darwin.bio.uci.edu/%7Esustain/bio65/Titlpage.htm>

Ecology. Prepared by Peg Boulay, University of Oregon. This page contains lecture notes (with links), and a list of links relevant to the ecological sciences. (In English. Not illustrated. No revision date.)

<http://biology.uoregon.edu/classes/Bi370sum02/links/default.html>

Population Ecology. This page was prepared by Alexei Sharov at Virginia Tech, and is an excellent resource for population ecology. Includes online lectures, publications, links to ecological modeling pages and data sets, and a list of links to sites covering several topics in population ecology. (In English. Not illustrated. Last revised in 1997.)

<http://www.ento.vt.edu/~sharov/popechome/>

Community Ecology. Prepared by staff and students at the University of California, Davis. This is a collection of summaries of key papers related to the field of community ecology. A full citation and summary are provided. (In English. Not illustrated. Prepared in 1997-98.)

<http://www.itd.ucdavis.edu/~dale/studies/sum1.html>

Part Two

Behavior

Behavioral Ecology. Pages prepared by Barry Sinervo, University of California, Santa Cruz. Includes extensive and detailed lecture notes and related links on behavioral ecology. Some of the topics covered are: genes and behavior, natural and sexual selection, optimal foraging, dispersal, migration and orientation, and sensory systems and communication. (In English. Illustrated. Last revised February 20, 2001.)

http://www.biology.ucsc.edu/~barrylab/classes/animal_behavior/BEHAVIOR.HTM

Animal Cognition and Learning. Page prepared by Robert Cook at Tufts University. This page explores aspects of animal behavior, among them intelligence, perception, stimulus control, conditioning, and complex behavior. Each topic includes a list of links relevant to it. Provides access to an excellent

cyberbook on Avian Visual Cognition, on the second link below. (In English. Illustrated. No revision date.)

<http://www.pigeon.psy.tufts.edu/psych26/default.htm>

<http://www.pigeon.psy.tufts.edu/avc/>

Ethology. Prepared for an ethology course by William Tietjen at Bellarmine University. This site includes multiple resources for the behavioral sciences. Under readings and resources is an extensive list of readings and lectures notes on many topics in animal behavior including social behavior, predation and feeding, social behavior, parental behavior, as well as a history of behavior. Also includes links to simulations and tools for data collection and analysis. (In English. Illustrated. No revision date.)

<http://cas.bellarmine.edu/tietjen/Animal%20Behavior/ethologyhome.htm>

Methods in Behavioral Research. Prepared by Paul C. Cozby, California State University, Fullerton. This site is designed as a companion for the author's book of the same title. It includes links to multiple web resources related to the methodology of ethological research. Pages are organized by chapters following the book organization. (In English. Not illustrated. Last revised July 1, 2000.)

<http://methods.fullerton.edu/framesindex.html>

SECTION SEVEN: GENERAL REFERENCE WORKS

Part One

Reference Sites

Online Biology Dictionary. Written by Richard Lees. Provides brief definitions of most important biological terms with cross references to related items, but with no illustrations.

(In English. No illustrations. No revision date)

<http://www.biology-online.org/dictionary.asp>

Dictionary of Cell Biology. Edited by John M. Lackie and Julian A. T. Dow and published by Academic Press. This dictionary includes some 7,000 terms related to cell biology. Terms can be accessed by means of a map of the cell or a search engine. Free access is granted for 90 days. (In English. Not illustrated. Last revised in 1999).

<http://www.mblab.gla.ac.uk/dictionary/>

The Web Atlas of Cellular Structures. Published by the Imaging Technology Group at the University of Illinois at Urbana-Champaign. This page provides excellent photographs of cellular structures obtained by light and confocal microscopy. (In English. Excellent photography. No revision date)

<http://www.itg.uiuc.edu/technology/atlas/>

Atlas of Histology. Published by the School of Medicine at the University of Illinois at Urbana-Champaign. The page presents a collection of histological specimens covering all human anatomy. User may select from menu or use search engine. Additionally, lecture notes, practice questions, and a laboratory manual are available. User must select access according to computer and connection characteristics. (In English. Excellent photographs. No revision date)

<http://www.med.uiuc.edu/histo/>

Índice de Biología. Prepared by Lourdes Luengo in Spain. The page includes multiple resources useful for an introductory biology class. Among these are illustrations, animations, and descriptions of the cell and its functioning. There is also access to several laboratory manuals. (In Spanish. With illustrations and animations. No revision date).

<http://www.arrakis.es/%7Elluengo/biologia.html>

Directorio de Sitios con Temas Biológicos. Page prepared by Georgina Arteaga, Mauricio Herrera and Octavio Reyes, and hosted by the Universidad Nacional Autónoma at Iztacala, Mexico. This page provides a collection of links to sites written in Spanish related to all aspects of biology. (In Spanish. Not illustrated. No revision date)

<http://biologia.iztacala.unam.mx/directorio.html>

BioWeb. Page prepared and maintained by members of the University of Wisconsin System. Provides a multitude of resources on biological information and sites. Includes, among others, pages on ecology, zoology, genetics, and botany. (In English. Includes illustrations, animations, and movies. No revision date)

<http://bioweb.uwlax.edu/index.htm>

Agricola. Published and maintained by the USDA's National Agricultural library. Agricola is a free searchable index containing references to literature related to agriculture. Citations include complete reference, abstract, and list of keywords. (In English. Not illustrated. Continuously updated).

<http://www.nal.usda.gov/ag98/>

Enciclopedia of Bioscience. Page hosted by Frontiers in BioScience. Provides links to resources in biological and biomedical sciences, as well as a library and knowledge center. Includes biology resources for teachers and students. (In English. Illustrated. No revision date).

<http://www.bioscience.org/current/special/subject.htm>

Glossary of Biochemistry and Molecular Biology. This glossary was prepared by David M. Glick and is a service provided by Portland Press. Provides definitions for thousands of terms related to these biological sciences. (In English. Not illustrated. Last revised July 22, 2002).

<http://db.portlandpress.com/glick/search.htm>

Biotech Resources Web Pages. Prepared by the Faculty and staff of Indiana University. These pages give access to resources related to the biotechnology. Users have access to a bio-tech dictionary, and links to bioinformatics, general science, literature and other educational resources. (In English. Last revised July 2, 2002).

<http://biotech.icmb.utexas.edu/pages/resources.html>

Glossary of Terms Used in Behavioral Ecology, Animal Behavior and Evolution. Prepared by Jane Brockmann, Peter May, and Glenn Goodfriend, and maintained by the Department of Zoology at The University of Florida. A complete glossary for use in the ethological and ecological sciences. (In English. Not illustrated. Last revised July 4, 2000.)

<http://www.zoo.ufl.edu/be/pages/Glossary.html>

Online Biology Book. A complete cyberbook for general biology written by Michael J. Farabee of the Estrella Mountain Community College in Avondale, Arizona. Covers all topics usually assigned for an undergraduate course in general biology. (In English. Illustrated. Revised in 2001.)

<http://www.emc.maricopa.edu/faculty/farabee/BIOBK/BioBookTOC.html>

Glossary of Ecology Terms. A complete glossary prepared by Joseph Dougherty and maintained by Ecology.org. (In English. Not illustrated. No revision date.)

http://ecology.org/biod/library/glos_index.html