Appendix 2 – Molecular Biology Core Curriculum

Websites and Other Resources

Chapter 1 - The Molecular Basis of Cancer

1. Inside Cancer http://www.insidecancer.org/ From the Dolan DNA Learning Center Cold Spring Harbor Laboratory

Chapter 2 – Molecular Science

2. www.dbalc.org/ddnalc/resources/pcr.html - Animation of PCR cycles
3. www.dnalc.org/ddnalc/resources/electrophoresis.html - Gel Electrophoresis
4. http://highered.mcgraw-hill.com/olcweb/cgi/pluginpop.cgi?it=swf::535::535::sites/dl/free/0072437316/120078/bio_g.swf::Southern%20Blot – Southern Blot
5. http://learn,genetics.utah.edu/ - DNA to Protein (transcription)
6. http://www.dnaftb.org/dnaftbref.html - Molecules of Genetics: Concepts, animation, and problems for each unit, depending on students' previous background
7. Cell Biology and Molecular Biology – Hologic website – http://www.cytologystuff.com/indexmolecular.htm Download text and view videos and descriptions of each of the following: replication, transcription, translation, DNA, RNA, codon, mRNA, tRNA, enzymes, chromosomal abnormalities. Some animations such as "Animated tour Through the Cell", for example are also available in these 2 sections.
8. http://www.dnalc.org/resources/3d/index.html - Dolan DNA Learning Center – **DNA from the Beginning**: Classical Genetics, Molecules of Genetics, Genetic Organization and Control

In addition to the topics listed below, this site has a number of other useful sections, as well. Click on the "websites" tab for several online tutorials.

See Also Biology Animations: These may be inserted into the PowerPoints or used for other purposes as you move through the curriculum.

Cloning 101

Cycle Sequencing

DNA Arrays

DNA Restriction

DNA Transformation 1

DNA Transformation 2

Gel Electrophoresis

GeneChip®

How *Alu* Jumps

Model Organisms

Polymerase Chain Reaction

Sanger Sequencing

Stem Cell Lines

3-D Animations:

DNA Molecule:

DNA Has Four Units

Chargaff's Ratios

Triple Helix

Basepairing

How DNA is Packaged (Basic)

How DNA is Packaged (Advanced)

DNA Unzip

Chromosome Map

How Much DNA Codes for Protein?

Chromosome 11 Flyover

Transcription & Translation:

Triplet Code

Transcription (Basic)

Transcription (Advanced)

mRNA splicing

Translation (Basic)

Translation (Advanced)

Replication:

Replicating the Helix

Mechanism of Replication (Basic)

Mechanism of Replication (Advanced)

Experiments & Techniques:

Mechanism of Recombination

Microarray

Polymerase Chain Reaction

Sanger Sequencing

Public Project Sequencing

Private Project Sequencing

Disease & Mutation:

DNA Damage

Sickle Cell

Tumor Growth

How Gleevec® Works

Cell Signals

9. www.learngenetics@utah.edu Another great source for some good basic information. See
Tour the Basics – DNA, Gene, Chromosome, Protein, Heredity, Traits
DNA to Protein – Protein synthesis

Heredity and Traits – Genetics
Amazing Cells – Basic on cells
Stem Cells
Cloning
Gene Therapy
Transgenic Mice
Virtual Labs on: DNA Extraction, Gel Electrophoresis, PCR, and DNA Microarray
The Archive has some basic information on mutations and how they occur.

See also the teachers' site at http://teach.genetics.utah.edu/content/epigenetics/, which has some great information on epigenetics. The page on "Lick your Rats" is fun and good to explain epigenetics.

10. https://www.mylabonline.com/training/online_training_mdx.php (Scroll down to the bottom of the page; page updated as of 5/21/2010). Roche Genetics CD, Introduction and Journey through the Cell. This website gives information on obtaining this CD from Roche. There are also several others: Molecular Technology and Regulatory. There is a Teacher Manual for the Roche Genetics CD available online as well.

11. http://www.dnalc.org/resources/3d/index.html In Dolan DNA Learning Center, see **Flyover** – a close look at chromosome 11, and **Chromosome Close Up** which contains a 3-D animation of chromosome coiling from DNA to nucleosome to mitosis. It also includes information on X chromosome banding areas, a 2-D animation including explanations of exons and introns. **Genome mining** includes information about transcription, 3-D animation of promotors, TATA boxes, etc. Genome FISHing has a video regarding variability in the genome such as SNPs and RLFPs. **Genome Spots** compares various areas of chromosomes as to their variability, genes encoded, etc.

12. http://www.cellsalive.com/cell_cycle.htm - cell cycle

13. http://www.cellsalive.com/mitosis.htm

14. http://www.youtube.com/watch?v=teV62zrm2P0 - DNA replication

Chapter 3 Molecular Techniques
15. http://www.cytologystuff.com/indexmolecular.htm
Molecular Methods of Separation and Detection

16. Actual Lab: Website: http://learn.genetics.utah.edu/content/labs/extraction/howto/ The extraction of DNA from anything living. A kitchen level actual lab which shows the principles of DNA extraction.

17. Virtual Lab: http://learn.genetics.utah.edu/ DNA Extraction.

18. Hologic website – http://www.cytologystuff.com Instrumentation – Electrophoresis Lab, ISH Lab, Amplification Lab.

19. Resource: Roche CD, Molecular Technology: Microarrays, in situ Hybridization, Agarose Gel Electrophoreses, SDS-PAGE, Southern, Northern, and Western Blots, Troubleshooting

20. Actual Labs: Colorful Electrophoresis, Build a Gel Electrophoresis Chamber.
http://teach.genetics,utah,edu/content/begin/dna/electrophoresis/index.html

21. Virtual Lab: Gel Electrophoresis – http://learn.genetics.utah.edu/

22. Resources: Roche CD, Polymerase Chain Reaction: Order CD and use PCSEC1.ppt (DNA to PCR), PCSEC2.ppt (In the test tube), PCSEC3.ppt (Minimal requirements), PCSEC4.ppt (Machines used in the process), Glossary – important terms. {Note: this CD may no longer be available from Roche – contact company for latest update}

23. http://www.cytologystuff.com/indexmolecular.htm
Molecular Methods – Amplification: PCR through LCR.

24. Virtual Lab: PCR -http://learn.genetics.utah.edu/

25. http://www.cytologystuff.com/indexmolecular.htm
Molecular Methods - DNA sequence analysis: pyrosequencing through automated sequence analysis

26. http://www.dnalc.org/resources/3d/index.html Dolan DNA Learning Center – DNA Interactive – Code. Manipulation, Techniques:
Amplifying – Making many copies 2-D and Amplifying – PCR 3-D
Cutting and Pasting – Restriction enzymes 2-D and Recombining DNA 3-D animation
Transferring and Storing DNA – Transformation – 2-D animation, Storing DNA 2-D animation
Large Scale Analysis - GeneChips® 2-D animation, Making GeneChips® Slideshow, DNA arrays 2-D
Sorting and Sequencing – Gel 2-D, Early DNA Sequencing 2-D, Cycle Sequencing 2-D

27. http://www.gene-quantification.de/movoie.html Northern blot

28. http://www.pyrosequencing.com?DynPage.aspx?id=7454 Pyrosequencing.

29. http://upload.wikimedia.org/wikipedia/en/b/bb/RFLP_genotyping.gif RFLP.
30. http://www.rvc.ac.uk/review/DNA_1/4_VNTRs.cfm VNTR

Chapter 4 – Laboratory Operations
31. http://www.cytologystuff.com/indexmolecular.htm Regulations and Licensure –
Links to state regulations and definitions of terms.

Chapter 5 – Molecular Technology Applications

32. http://www.cytologystuff.com/indexmolecular.htm Pathogens

33. http://www.dnalc.org/resources/3d/index.html Dolan DNA Learning Center – Molecular Applications: Human Identification, Family Identification, Murder (forensics), Innocence (forensics).

34. http://www.dnalc.org/resources/3d/index.html How Gleevec works. Animation in Dolan Learning Center.

35. http://learn.genetics.utah.edu/content/health/pharma/ Genetics and Health, Personalized Medicine: a. Your Doctor's New Genetic Tools, b. Making SNPs Make Sense, c. Drug Development Today and Tomorrow. 3 modules which talk about genetics and drug development. The interactive frog module is kind of fun also but may be too "young" for our students.

Chapter 6 - FISH

Chapter 7 – Circulating Tumor Cells

36. Video: http://veridex.com/CellSearch/CellSearchHCP.aspx -CellSearch®

General References:

Hologic Website Summary: www.cytologystuff.com Molecular
Although this site is referenced frequently in the appropriate places in each chapter, a summary of the various areas follows for ease of use by students and educators:

Cell Biology
Molecular Biology
Biology of Infections
Molecular Methods
Instrumentation
Regulations and Licensure