

Protein Project – Protein Examples

Directions: Work with your lab group to investigate five or six proteins. Choose your top three favorites and hopefully you will get to research your top pick. If another team chose the same protein, you may have to investigate your second choice. Website can be easily accessed at the AP Bio Moodle site - <http://ab.thinkingdistance.org/login/index.php>

Protein name	Background	Molecular structure	Molecular function	References
Antifreeze proteins				<p>Antifreeze proteins (Molecule of the Month) - http://www.pdb.org/pdb/results/results.do?grid=612655D6&tabtoShow=Current</p> <p>Why Some Antifreeze Proteins Inhibit Ice Growth Better Than Others - http://www.sciencedaily.com/releases/2007/03/070307075558.htm</p> <p>Structure and function of antifreeze proteins - http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1692999/pdf/12171656.pdf</p> <p>Origin of antifreeze protein genes: A cool tale in molecular evolution - http://www.pnas.org/content/94/8/3485.full</p>
Bacteriorhodopsin				<p>Bacteriorhodopsin (Molecule of the Month) - http://www.pdb.org/pdb/results/results.do?grid=E4313089&tabtoShow=Current</p> <p>Activating neurons in living animals with light - http://www.sfn.org/index.aspx?pagename=publications_rd_lightmolecules</p> <p>Blind mice see the light - http://www.nature.com/news/2008/080425/full/news.2008.781.html</p> <p>Altered Heart Cells Controlled with Light - http://www.photonics.com/Article.aspx?AID=44525</p>
Botulinum toxin				<p>Botox - http://www.nlm.nih.gov/medlineplus/botox.html</p> <p>Botulinum toxin (Botox) - http://www.webmd.com/healthy-beauty/botulinum-toxin-botox</p> <p>Botulinum toxin - http://emedicine.medscape.com/article/325451-overview</p>
Bromelain (stem or fruit)				<p>Pineapple enzymes tenderize - http://science.howstuffworks.com/innovation/edible-innovations/pineapple-enzyme-tenderize-steak1.htm</p>

bromelain)				<p>Bromelain - http://www.umm.edu/altmed/articles/bromelain-000289.htm</p> <p>Fruits can ruin gelatin - http://www.sciencebuddies.org/science-fair-projects/project_ideas/FoodSci_p004.shtml</p> <p>Bromelain investigation - http://www.ableweb.org/volumes/vol-23/16-glider.pdf</p> <p>Meat tenderizing enzymes - http://www.enzymedevelopment.com/html/applications/protein.html</p>
Bt delta endotoxin				<p>Bacillus thuringiensis - http://www.ext.colostate.edu/pubs/insect/05556.html</p> <p>Bacillus thuringiensis (2) - http://www.bt.ucsd.edu/</p> <p>Biological Control - http://www.nysaes.cornell.edu/ent/biocontrol/pathogens/bacteria.html</p>
Cellulase				<p>"Stone" Washing Jeans: Cellulases - http://webphysics.iupui.edu/webscience/bio_archive/goodfor15.html</p> <p>Cellulase - http://www.gmo-compass.org/eng/database/enzymes/82.cellulase.html</p> <p>Stone Washed Jeans May be Changing Again - http://articlehive.org/fashion/202-fashion/142149-Stone%20Washed%20Jeans%20May%20be%20Changing%20Again.html</p> <p>Characterisation Of Cellulase From Organisms Isolated From Rumen Fluid - http://www.pharmainfo.net/reviews/characterisation-cellulase-organisms-isolated-rumen-fluid</p> <p>Cellulase - http://www.slashnburn.org/index.php?option=com_awiki&view=mediawiki&article=Endoglucanase?qs=3044</p>
Collagen				<p>Collagen (Molecule of the Month) - http://www.rcsb.org/pdb/101/motm.do?momID=4</p> <p>Collagen - http://proteopedia.org/wiki/index.php/Collagen</p> <p>Collagen injections - benefits, cost, & side effects - http://www.yourplasticsurgeryguide.com/injectables-and-fillers/collagen.htm</p> <p>Collagen (Jmol tutorial) - http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/protein2.htm#aac8</p>
Conotoxins				<p>Cone snail - http://www.venomdoc.com/conotoxins.html</p> <p>Cone snails help neurobiologists - http://www.sciencedaily.com/releases/2010/02/100210101510.htm</p>

				<p>Snail venom inspires powerful pain reliever - http://news.discovery.com/human/snail-venom-painkiller.html</p> <p>Lecture 1: From venom to drugs - http://www.hhmi.org/biointeractive/biodiversity/lectures.html</p>
DNA ligase				<p>DNA ligase (molecule of the month) - http://www.pdb.org/pdb/101/motm.do?momID=55</p> <p>Milestones in DNA technologies - http://www.nature.com/milestones/miledna/full/miledna02.html</p> <p>Mechanisms of recombination - http://www.dnalc.org/resources/3d/20-mechanism-of-recombination.html</p> <p>Recombinant DNA technology & transgenic animals - http://www.nature.com/scitable/topicpage/recombinant-dna-technology-and-transgenic-animals-34513</p>
EcoRI				<p>Restriction enzymes - http://www.nature.com/scitable/topicpage/restriction-enzymes-545</p> <p>Restriction endonucleases: overview - http://www.neb.com/nebecomm/tech_reference/restriction_enzymes/overview.asp</p> <p>Restriction endonucleases: Molecular scissors - - http://www.scq.ubc.ca/restriction-endonucleases-molecular-scissors-for-specifically-cutting-dna/</p> <p>Restriction enzymes - http://www.youtube.com/watch?v=-sI5vy-cD2g&NR=1</p> <p>Mechanisms of recombination - http://www.dnalc.org/resources/3d/20-mechanism-of-recombination.html</p>
Green fluorescent protein (GFP)				<p>Green fluorescent protein - http://www.conncoll.edu/ccacad/zimmer/GFP-ww/GFP-1.htm</p> <p>GFP (Molecule of the Month) - http://www.rcsb.org/pdb/static.do?p=education_discussion/molecule_of_the_month/pdb42_1.html</p> <p>Green Fluorescent Protein - http://www.proteopedia.org/wiki/index.php/Green_Fluorescent_Protein</p>
Hydrogenase				<p>Hydrogenase (Molecule of the Month) - http://www.rcsb.org/pdb/101/motm.do?momID=111</p> <p>Hydrogen-eating bacteria - http://astrobiology.arc.nasa.gov/news/expandnews.cfm?id=1340</p> <p>Symbiotic bacteria living in mussels eat hydrogen - http://coolgreenmag.com/2011/08/15/scientists-discover-deep-sea-mussels-that-can-convert-hydrogen-into-energy/</p> <p>The promise of cheap renewable energy - http://www.ks.uiuc.edu/Research/hydrogenase/</p>

Lactase				<p>Got lactase? - http://evolution.berkeley.edu/evolibrary/news/070401_lactose</p> <p>View lactase's interaction with lactose - http://molvis.sdsc.edu/fgij/fg.htm?mol=http://www.umass.edu/molvis/bme3d/materials/structures/1jyn_a.pdb.gz&</p> <p>Nutritional Adaptation - http://anthro.palomar.edu/adapt/adapt_5.htm</p> <p>The lactase protein - http://macromoleculeinsights.com/lactase.php</p>
Lipase				<p>Lipase - http://www.umm.edu/altmed/articles/lipase-000311.htm</p> <p>Enzymes in detergents - http://www.lsbu.ac.uk/biology/enztech/detergent.html</p> <p>Cheese Ingredients - http://www.cheeseforum.org/Making/Lipase.htm</p>
Luciferin & Luciferase				<p>Luciferase - http://www.pdb.org/pdb/results/results.do?grid=33D0A19B&tabtoshow=Current</p> <p>How do fireflies light up? - http://animals.howstuffworks.com/insects/question554.htm</p> <p>Chemistry of Bioluminescence - http://www.lifesci.ucsb.edu/~biolum/chem/</p> <p>Luciferase - http://millar.bio.ed.ac.uk/lucifer.html</p> <p>Firely Bioluminescence - http://www.photobiology.info/Branchini.htm</p> <p>The Next War Could be Fought with Fireflies - http://cleantechnica.com/2012/06/17/dod-funds-biomimicry-research-on-firefly-lights/</p>
Lysozyme				<p>Lysozyme - http://www.rcsb.org/pdb/static.do?p=education_discussion/molecule_of_the_month/pdb9_1.html</p> <p>Lysozyme - http://lysozyme.co.uk/</p> <p>Lysozyme - http://www.piercenet.com/browse.cfm?fldID=3C6EACCB-232E-44DC-913F-6D9B16BEF8D5</p> <p>Lysozyme (Jmol tutorial) - http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/protein2.htm#aacd8</p>
Melittin				<p>Melittin.net - http://www.melittin.net/</p> <p>Bee sting therapy - http://health.howstuffworks.com/medicine/tests-treatment/bee-sting-therapy.htm</p>

				<p>Bee venom may soothe rheumatoid arthritis - http://news.healingwell.com/index.php?p=news1&id=522164</p> <p>The structure of melittin - http://www.jbc.org/content/257/11/6016.full.pdf</p> <p>Applying Melittin's structure to inhibit the proliferation of tumor cells - http://cosmos.ucdavis.edu/archives/2011/cluster8/WEINBERG_MARISA.pdf</p>
Monellin				<p>Monellin - http://lexicon.dansukker.com/print_expl.asp?id=201</p> <p>Potential sweeteners - http://www.nutritionj.com/content/4/1/5</p> <p>Structure–taste relationships of the sweet protein monellin - http://old.iupac.org/publications/pac/2002/pdf/7407x1235.pdf</p>
Myosin				<p>Myosin (Molecule of the Month) - http://www.rcsb.org/pdb/101/motm.do?momID=18</p> <p>Myosin - http://molvis.sdsc.edu/fgij/fg.htm?mol=http://www.umass.edu/molvis/bme3d/materials/structures/1b7t_ch.pdb.gz&</p> <p>Mysosin - http://www.rpi.edu/dept/bcbp/molbiochem/MBWeb/mb2/part1/myosin.htm</p> <p>Molecular motor myosin - http://www.sciencedaily.com/releases/2004/09/040901091750.htm</p> <p>Nano-motor with a light switch light-triggered myosin - http://www.nanotech-now.com/news.cgi?story_id=42430</p>
Papain (papaya proteinase I)				<p>Papain production - http://practicalaction.org/practicalanswers/product_info.php?products_id=355</p> <p>Papain - http://www.sigmaaldrich.com/life-science/metabolomics/enzyme-explorer/analytical-enzymes/papain.html</p> <p>Papain from papaya - http://www.techno-preneur.net/information-desk/sciencetech-magazine/2009/november09/Papain%20from%20papaya.pdf</p> <p>Meat tenderizing enzymes - http://www.enzymedevelopment.com/html/applications/protein.html</p>
Petroleum-Digesting enzymes (ex. AlkB1 alkane hydroxylase)				<p>Alcanivorax - http://microbewiki.kenyon.edu/index.php/Alcanivorax</p> <p>How microbes eat up an oil spill - http://www.scientificamerican.com/article.cfm?id=how-microbes-clean-up-oil-spills</p> <p>Searching for oil digesting bacteria - http://agsci.oregonstate.edu/aquatic-bt/curriculum/marine-biotech/oil-digesting-bacteria</p>

				The great vanishing oil spill - http://www.technologyreview.com/energy/26138/
Osmotin				Plant protein mimics hormone that mitigates diabetes and obesity - http://www.medicalnewstoday.com/articles/19226.php Osmotin (chemical structure and interaction) - http://www.ergogenics.org/osmotin.html Osmotin protein mimics hormone - http://news.uns.purdue.edu/html4ever/2005/050124.Bressan.osmotin.html
Penicillin-Binding Protein				Penicillin-binding proteins - http://www.pdb.org/pdb/results/results.do?grid=246A4E75&tabtoShow=Current Penicillin: the first miracle drug - http://herbarium.usu.edu/fungi/funfacts/penicillin.htm Fleming discovers penicillin - http://www.pbs.org/wgbh/aso/databank/entries/dm28pe.html How penicillin kills bacteria - http://www.cellsalive.com/pen.htm
Protease				Detergents - http://www.enzymes.co.uk/detergents.html New enzyme offers better wash - http://www.biotimes.com/en/Articles/2005/March/Pages/Newenzymeoffersbetterwash%E2%80%93performanceatlowercost.aspx Enzymes in Laundry Detergent - http://terpconnect.umd.edu/~nsw/ench485/lab2.htm
Rennin (chymosin)				Rennet for Making Cheese - http://biology.clc.uc.edu/fankhauser/cheese/rennet/rennet.html Chymosin (Rennin) and the Coagulation of Milk - http://www.vivo.colostate.edu/hbooks/pathphys/digestion/stomach/rennin.html Chymosin - http://www.gmo-compass.org/eng/database/enzymes/83.chymosin.html The Primary Structure of Calf Chymosin - http://www.jbc.org/content/254/17/8447.full.pdf Enzymes in cheese production - http://isbibbio.wikispaces.com/cheese-ec
Silk fibroin				The Light Fantastic - http://tuftsjournal.tufts.edu/2008/09/features/04/ Bioengineering: Silkworm Optical Sensors - http://www.core.form-ula.com/2009/01/08/bioengineering-silkworm-optical-

			<p>sensors/</p> <p>Optical Sensor Can Make Food Safer - http://www.scientistlive.com/European-Food-Scientist/Food_Safety/Optical_sensor_can_make_food_safer/20856/</p> <p>Silk fibroin - http://ww2.chemistry.gatech.edu/~lw26/bCourse_Information/6521/protein/fibrous/fibrous.html</p>
Snake venom (ex. Vascular endothelial growth factors)			<p>Venom's healing bite - http://www.pbs.org/wgbh/nova/body/venoms-healing-bite.html</p> <p>How snake venom works - http://www.popsi.com/scitech/gallery/2008-03/how-snake-venom-works?image=0</p> <p>Making medicines from poisonous snakes - http://science.education.nih.gov/animalresearch.nsf/Story1/Making+Medicines+from+Poisonous+Snakes</p> <p>Vascular endothelial growth factor - http://proteopedia.org/wiki/index.php/Vascular_Endothelial_Growth_Factor</p> <p>Snake venom induces vascular permeability - http://www.jbc.org/content/279/44/46304/F9.expansion</p> <p>Identification of snake venom (VEGF) - http://pubs.acs.org/doi/abs/10.1021/bi050197d</p>
Streptavidin			<p>ELISA Animation - http://highered.mcgraw-hill.com/sites/0072556781/student_view0/chapter33/animation_quiz_1.html</p> <p>Streptavidin - http://faculty.washington.edu/stenkamp/strep.html</p> <p>Streptavidin surprises - http://www.bu.edu/cab/CAB%20PDF/nmeth0805.pdf</p> <p>Interaction of Biotin with Streptavidin - http://www.jbc.org/content/272/17/11288.full.pdf</p>
<i>Taq</i> Polymerase			<p>Forecast: hot & humid - http://whyfiles.org/022critters/hot_bact.html</p> <p>Yellowstone Bioprospecting - http://serc.carleton.edu/microbelife/topics/bioprospecting/index.html</p> <p>Thermostable DNA Polymerases - http://www.vivo.colostate.edu/hbooks/genetics/biotech/enzymes/hotpolys.html</p> <p>PCR – An Outstanding Method - http://www.roche.com/pages/facets/pcr_e.pdf</p> <p>Structural and functional studies of DNA polymerase I enzymes - http://people.cryst.bbk.ac.uk/~ubcg54a/New/DNArep.htm</p>

				<p>Anatomy of a Polymerase: How Structure Effects Function - http://www.neb.com/nebecomm/tech_reference/polymerases/anatomy.asp</p> <p>Biochemistry of the Polymerase Chain Reaction - http://www.biochem.arizona.edu/classes/bioc471/pages/Lecture12/Lecture12.html</p>
Telomerase				<p>Facts about telomerase - http://www4.utsouthwestern.edu/cellbio/shay-wright/intro/facts/sw_facts.html#</p> <p>Telomeres, telomerase, and cancer - http://www.scientificamerican.com/article.cfm?id=telomeres-telomerase-and</p> <p>Telomerase Nobel Prize In Physiology or Medicine 2009 -http://www.tasciences.com/telomerase/telomerase-nobel-prize-in-physiology-or-medicine-2009/</p>