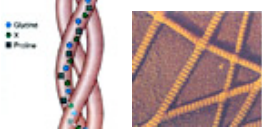

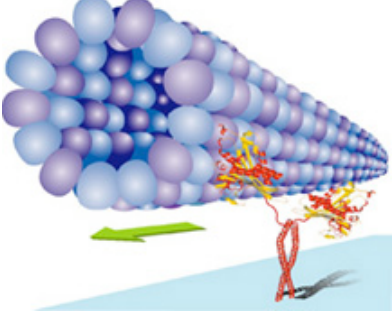

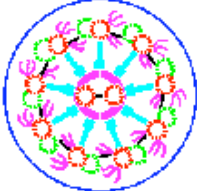
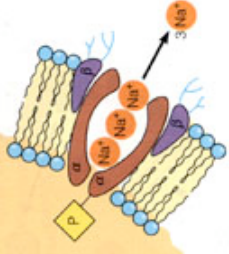


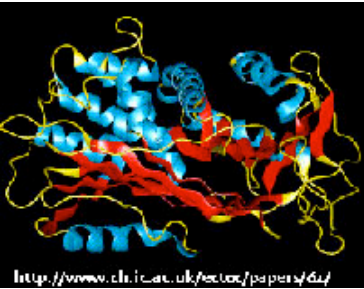
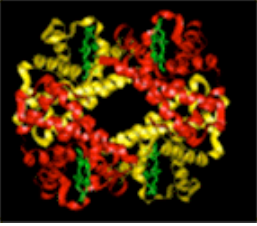





SOME PROTEIN JOBS: MOLECULAR COUNTERPARTS TO OUR "REAL WORLD" MACHINERY, AND MORE

Proteins make up the machinery of our cells, most working by converting energy in an ATP molecule into force. They use energy (delivered to them by ATP) to drive metabolic reactions, do mechanical work, such as moving muscles, rotating cilia and flagella, and transporting substances across membranes. Carbohydrates supply the energy to make ATP, nucleic acids the coded information and lipids play many roles, a particularly important one being membrane composition. This chart develops the idea of proteins as "machines", chains that are shaped to do specific jobs in the cells. Some jobs in a cell have counterparts in the tools and machinery used in the human world. (Some, of course, are quite different, but that's a story for another page...)

MACHINE	FUNCTION	EXAMPLE OF MOLECULAR TOOLS OR MACHINES	IMAGES OF WORKING PROTEINS
<p>Structures</p> <p>Tracks , cables, filaments, beams, struts, cross-links, pipes</p>	<p>Transmit force; reinforce Transmit tension, maintain shape</p>	<p>Microtubules made of tubulin, collagen</p>	 <p>Long hollow tubes</p> <p>http://www.rcsb.org/pdb/molecules/pdb4_2.html</p>
<p>Motors and Gears</p>  <p>Linear Motors</p>	<p>Moving things, Turn shafts, move along lines in step-wise fashion</p>	<p>Myosin grabs actin filaments and pulls. Dynein and kinesin crawls along microtubules. Kinesin goes out to membrane and dynein goes back.</p>	 <p>Molecular "fingers" of stalk are able to grab hold of tubes.</p> <p>1.</p> <p>http://www.stir.ac.uk/departments/naturalsciences/DBMS,coursenotes/30CB/KINESINS1.html</p>
<p>Motors and Gears</p>  <p>Rotary Motors</p>	<p>Rotates cilia and flagella</p>	<p>Bacterial flagella protein</p>	 <p>Protein dynein moves microtubules.</p> <p>http://www.bmb.leeds.ac.uk/illingworth/motor01/#dynein</p>

<p>Pumps</p>	<p>Move fluids and ions from one side of a membrane to another.</p>	<p>Membrane channel proteins, e.g. potassium-sodium pump</p>	 <p>Mathews, van Holde, Biochemistry, Benjamin Cummings, 1996, p. 343</p> <p>The protein pump (brown) is shaped to let one ion, sodium, go through.</p>
<p>Joiners, and clamps</p>  <p>hinges</p>	<p>Make compounds; Hold workpieces</p>	<p>Enzymes e.g., aldosase, an enzyme</p>	 <p>Aldosase - NIH The active site of the enzyme aldolase joins two molecules, red and yellow here, together in a cradle so they can bond.</p>
<p>Chaperones</p>	<p>Assists movement, structures development, enzymatic action by shielding molecules from charges of other molecules.</p>	<p>Serpin, helps the triple helix collagen fold.(See above.)</p>	 <p>http://www.ch.ic.ac.uk/factor/papers/64/</p> <p>Some scientists think the kind of "cradle" of red beta sheets helps the serpin hold onto the collagen strands.</p>
<p>Holders and Transporters</p>	<p>Carries molecules, usually with the help of a metal, to where they are needed.</p>	<p>Hemoglobin holds and transports oxygen to where it is needed.</p>	 <p>Hemoglobin is made of 4 protein strands, each of which holds a heme (green), a kind of platter that carries the oxygen.</p>
<p>Cutters</p> 	<p>Cut into pieces</p>	<p>Enzymes e.g. lysosyme</p>	 <p>The active site of the enzyme lysosyme breaks a molecule into several pieces. www.sci.sdsu.edu</p>

Decoders	Identify molecular fragments	The 'stalk' or barrel of an antibody holds on firmly while two "hands" identify specific molecules.	
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