



<p style="text-align: center;"><b>MICROTUBULES</b></p> <ul style="list-style-type: none"> <li>• <b>Small</b>, hollow cylinders composed of globular protein <u>tubulin</u> that occurs as <math>\alpha</math> tubulin + <math>\beta</math> tubulin.</li> <li>• <b>Different</b> a.a sequence; form dimmers arranged in 13 rows surrounding empty, central <b>core</b>.</li> <li>• Microtubule organizing center (<u>MTOC</u>)... <ul style="list-style-type: none"> <li>○ <b>Controls</b> microtubule <b>formation</b>.</li> <li>○ <b>Centrosome</b>: main <b>MTOC</b>.</li> <li>○ <b>Microtubules</b>: maintain cell shape, form tracks for organelles <b>movement</b>.</li> </ul> </li> <li>• <b>Associate</b> w/ motor molecules (<i>kinesin</i> &amp; <i>dynein</i>) to move organelles &amp; vesicles in opposite <b>directions</b>. <ul style="list-style-type: none"> <li>○ <b>Different</b> kinds of kinesin proteins specialize to move one kind of vesicle or cell <b>organelle</b>.</li> </ul> </li> <li>• Before <b>cell division</b>, microtubules disassemble &amp; reassemble into spindle that moves chromosomes, &amp; disassemble at end of <b>cell division</b>.</li> </ul>	<p style="text-align: center;"><b>CHLOROPLASTS</b></p> <ul style="list-style-type: none"> <li>• Site of photosynthesis; type of plastid; green.</li> <li>• Own DNA + ribosomes. <p style="text-align: center;"><b>solar energy + CO<sub>2</sub> + H<sub>2</sub>O → carbohydrate + O<sub>2</sub></b></p> </li> <li>• Plants, algae &amp; cyanobacteria conduct <b>photosynthesis</b></li> <li>• Contain green pigment (<b>chlorophyll</b>).</li> <li>• Bound by <b>double membrane</b> organized into flattened disc-like sacs – <b>thylakoids</b> – formed from 3<sup>rd</sup> membrane. <p><b>Granum</b>: stack of thylakoids.</p> <ul style="list-style-type: none"> <li>○ Thylakoid space: <b>lumen</b> of thylakoid.</li> <li>○ Thylakoid membrane: contains pigment capturing <b>solar energy</b>.</li> </ul> </li> </ul>	<p style="text-align: center;"><b>CHLOROPLASTS</b></p> <ul style="list-style-type: none"> <li>• <u>Chromoplasts</u>... <ul style="list-style-type: none"> <li>○ Contain pigments that result in yellow, <b>orange</b> or <b>red</b> colour (autumn leaves, fruits, carrots).</li> </ul> </li> <li>• <u>Leucoplasts</u>... <ul style="list-style-type: none"> <li>○ <b>Colourless</b>; store starches &amp; oils (e.g. in potatoes).</li> </ul> </li> <li>• <u>Plastid</u> <ul style="list-style-type: none"> <li>○ plant &amp; algal organelles that have <b>DNA</b></li> <li>○ bounded by double <b>membrane</b></li> <li>○ contain internal membranes &amp;/or <b>vesicles</b></li> <li>○ produced by existing <b>plastids</b></li> </ul> </li> </ul>
	<p><b>ENERGY RELATED ORGANELLES</b></p>	
<p style="text-align: center;"><b>ACTIN FILAMENTS</b></p> <ul style="list-style-type: none"> <li>• <b>Long</b>, thin fibers: occur in bundles/ meshlike <b>networks</b>.</li> <li>• <b>Consists</b> of 2 chains of globular actin monomers twisted to form a <b>helix</b>.</li> <li>• <b>Structural</b> role, forming dense complex web just under plasma membrane; this accounts for formation of <u>pseudopods</u> in amoeboid <b>movement</b>.</li> <li>• In <b>microvilli</b> of intestinal cells: shorten or extend cell into <b>intestine</b>. In <b>plant</b> cells: form tracks along which chloroplasts <b>circulate</b>.</li> <li>• <b>Mysosin</b> combines w/ &amp; splits ATP, binding to actin &amp; changing configuration to pull actin filament <b>forward</b>.</li> </ul>	<p style="text-align: center;"><b>CYTOSKELETON</b></p> <ul style="list-style-type: none"> <li>• <b>Network</b> of connected filaments &amp; tubules; extends from nucleus to plasma membrane in <b>eukaryotes</b>.</li> <li>• <b>Elements</b> of the cytoskeleton include: actin filaments, intermediate filaments + <b>microtubules</b>.</li> <li>• <u>Intermediate Filaments</u>... <ul style="list-style-type: none"> <li>○ B/w actin filaments &amp; microtubules in <b>size</b>.</li> <li>○ <b>Rope-like</b> assemblies of fibrous <b>polypeptides</b>.</li> <li>○ <b>Support</b> nuclear envelope or plasma membrane + form cell-to-cell <b>junctions</b>.</li> <li>○ <b>Highly</b> dynamic, disassemble when phosphate added by <b>kinase</b>.</li> </ul> </li> </ul>	<p style="text-align: center;"><b>MITOCHONDRIA</b></p> <ul style="list-style-type: none"> <li>• <u>Double membrane</u>: inner membrane surrounds <b>matrix</b> &amp; convoluted to form <b>cristae</b> to <b>increase SA</b>.</li> <li>• <b>Matrix</b>: contains DNA, ribosomes &amp; enzymes that break down <b>carbs</b>.</li> <li>• ATP production (cellular resp.) occurs on <b>cristae</b>.</li> <li>• Smaller than chloroplasts; ribosomes &amp; <b>own DNA</b> <p style="text-align: center;"><b>carbohydrates + O<sub>2</sub> → CO<sub>2</sub> + H<sub>2</sub>O + energy (ATP)</b></p> </li> <li>• <b>N<sup>o</sup></b> depends on activity (many in <b>liver cells</b>).</li> <li>• Change <b>shape</b> (longer + thinner or shorter + <b>broader</b>).</li> <li>• <b>Fixed</b> in 1 <b>location</b> (e.g. packed b/w cardiac cells) or form long, moving <b>chains</b>.</li> </ul>

