

## More on Phototrophic Potential

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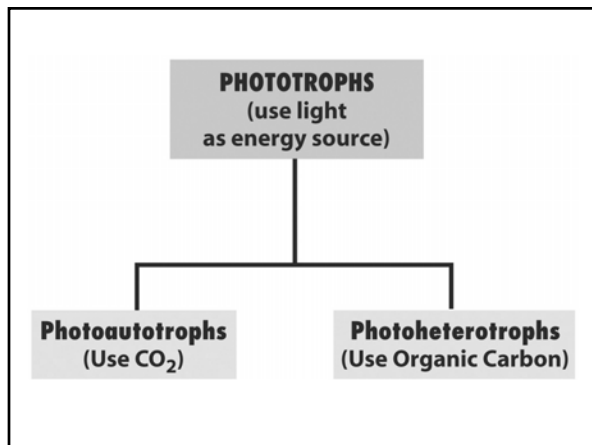
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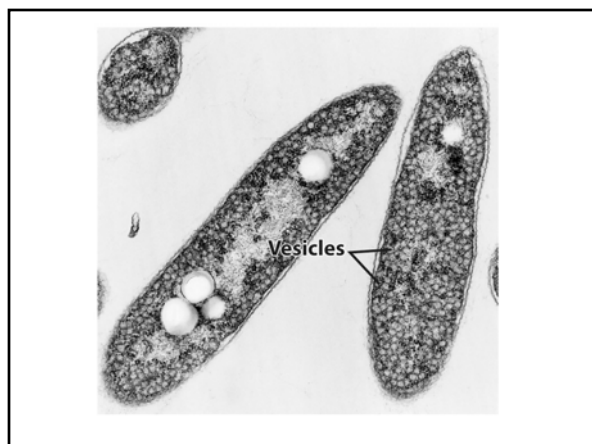
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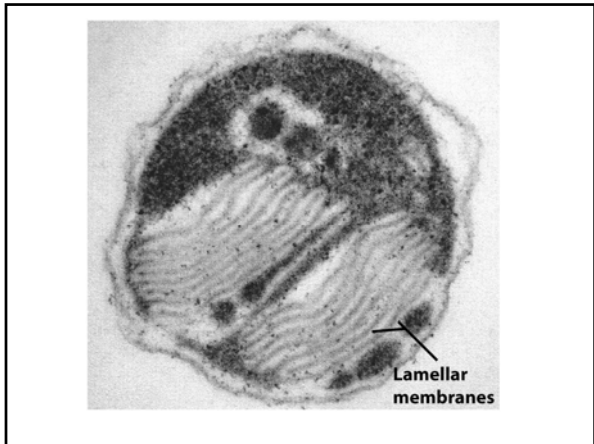
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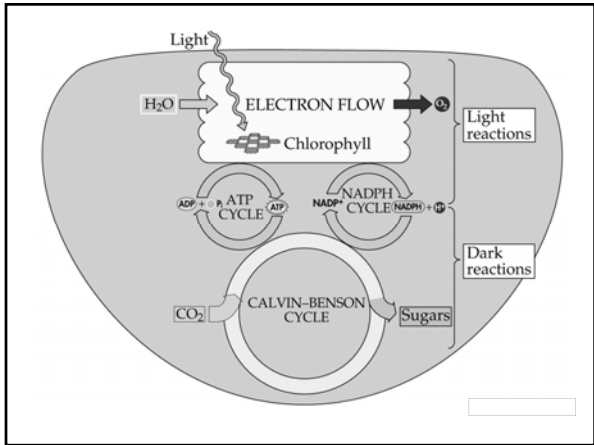
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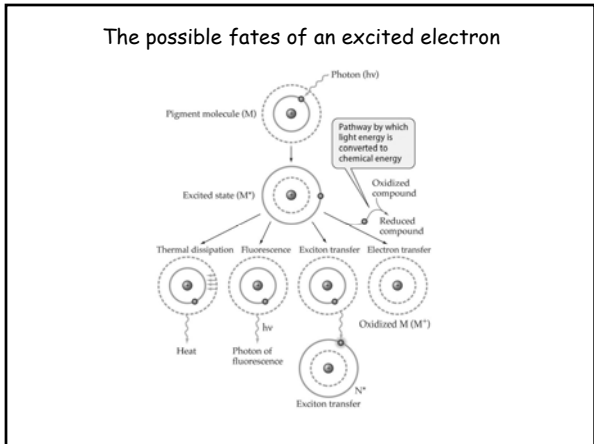
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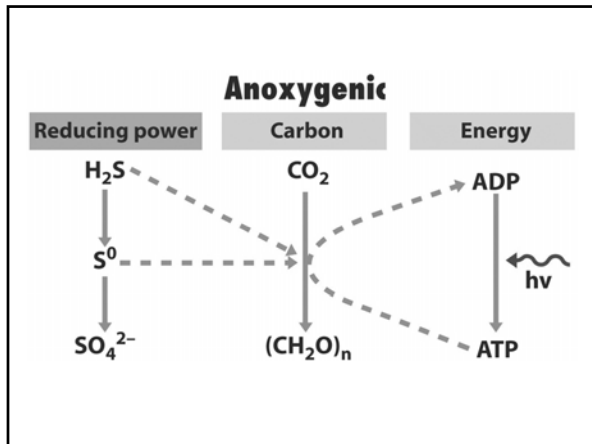
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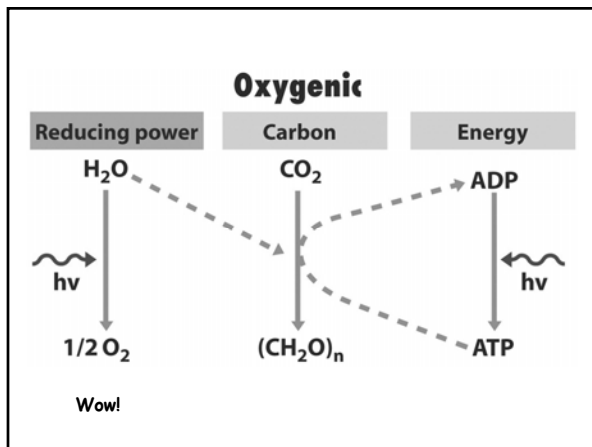
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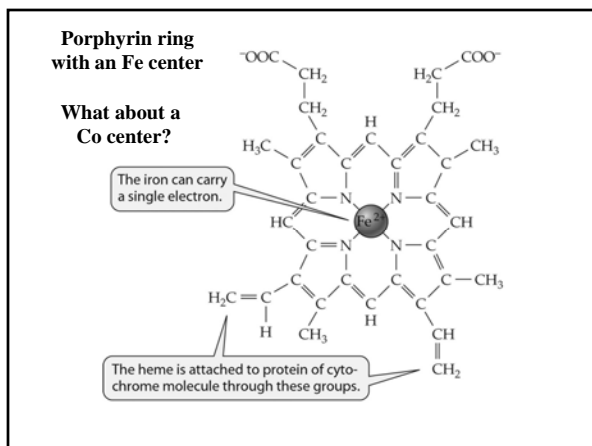
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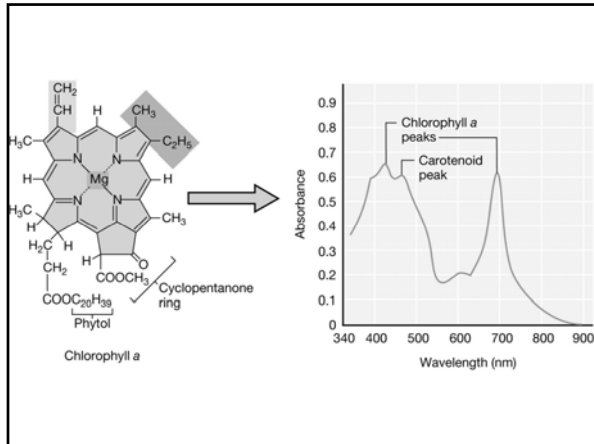
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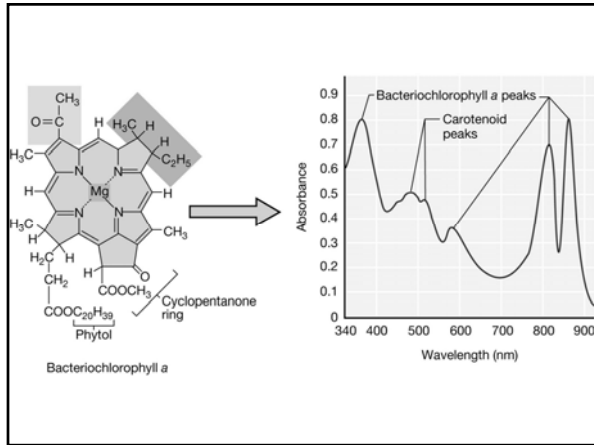
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**Bacteriochlorophyll Structures**

Pigment / Absorption maxima (in vivo)	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	R <sub>4</sub>	R <sub>5</sub>	R <sub>6</sub>	R <sub>7</sub>
<b>Bchl a</b> (purple bacteria)/ 805, 830-890	$\begin{array}{c} \text{C}-\text{CH}_3 \\    \\ \text{O} \end{array}$	$-\text{CH}_3^b$	$-\text{CH}_2-\text{CH}_3$	$-\text{CH}_3$	$-\text{C}-\text{O}-\text{CH}_3$	$\text{P/Gg}^d-\text{H}$	
<b>Bchl b</b> (purple bacteria)/ 835-850, 1020-1040	$\begin{array}{c} \text{C}-\text{CH}_3 \\    \\ \text{O} \end{array}$	$-\text{CH}_3^c$	$\begin{array}{c} \text{C}-\text{CH}_3 \\   \\ \text{H} \end{array}$	$-\text{CH}_3$	$\begin{array}{c} \text{C}-\text{O}-\text{CH}_3 \\    \\ \text{O} \end{array}$	$\text{P}$	$-\text{H}$
<b>Bchl c</b> (green sulfur bacteria)/745-755	$\begin{array}{c} \text{H} \\   \\ \text{C}-\text{CH}_3 \\   \\ \text{OH} \end{array}$	$-\text{CH}_3$	$-\text{C}_2\text{H}_5$ $-\text{C}_3\text{H}_7^d$	$-\text{C}_2\text{H}_5$	$-\text{H}$	$\text{F}$	$-\text{CH}_3$
<b>Bchl e</b> (green nonsulfur bacteria)/740	$\begin{array}{c} \text{H} \\   \\ \text{C}-\text{CH}_3 \\   \\ \text{OH} \end{array}$	$-\text{CH}_3$	$-\text{C}_2\text{H}_5$	$-\text{CH}_3$	$-\text{H}$	$\text{S}$	$-\text{CH}_3$
<b>Bchl d</b> (green sulfur bacteria)/705-740	$\begin{array}{c} \text{H} \\   \\ \text{C}-\text{CH}_3 \\   \\ \text{OH} \end{array}$	$-\text{CH}_3$	$-\text{C}_2\text{H}_5$ $-\text{C}_3\text{H}_7$ $-\text{C}_4\text{H}_9$	$-\text{C}_2\text{H}_5$	$-\text{H}$	$\text{F}$	$-\text{H}$
<b>Bchl o</b> (green sulfur bacteria)/719-726	$\begin{array}{c} \text{H} \\   \\ \text{C}-\text{CH}_3 \\   \\ \text{OH} \end{array}$	$-\text{C}-\text{H}$ $  $ $\text{O}$	$-\text{C}_2\text{H}_5$ $-\text{C}_3\text{H}_7$	$-\text{C}_2\text{H}_5$	$-\text{H}$	$\text{F}$	$-\text{CH}_3$
<b>Bchl g</b> (halobacteria)/ 670, 788	$\begin{array}{c} \text{H} \\   \\ \text{C}-\text{CH}_2 \\   \\ \text{O} \end{array}$	$-\text{CH}_3^b$	$-\text{C}_2\text{H}_5$	$-\text{CH}_3$	$-\text{C}-\text{O}-\text{CH}_3$	$\text{F}$	$-\text{H}$

<sup>a</sup>P, Phytol ester (C<sub>20</sub>H<sub>39</sub>O—); F, farnesyl ester (C<sub>15</sub>H<sub>25</sub>O—); Gg, geranylgeranyl ester (C<sub>24</sub>H<sub>41</sub>O—); S, stearyl alcohol (C<sub>18</sub>H<sub>35</sub>O—).

<sup>b</sup>No double bond between C<sub>3</sub> and C<sub>4</sub>; additional H atoms are in positions C<sub>3</sub> and C<sub>4</sub>.

<sup>c</sup>No double bond between C<sub>3</sub> and C<sub>4</sub>; an additional H atom is in position C<sub>3</sub>.

<sup>d</sup>Bacteriochlorophylls c, d, and e consist of isomeric mixtures with the different substituents on R<sub>3</sub> as shown.

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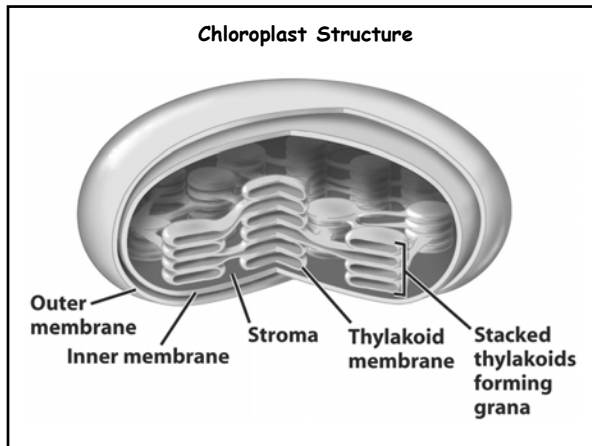
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**Table 9.1** Some general properties of the various photosynthetic bacteria

	Nonsulfur Purple Bacteria	Purple Sulfur Bacteria	Green Sulfur Bacteria	Cyano-bacteria	Helio-bacteria
Source of reducing power ( $e^-$ )	$H_2$ , reduced organic	$H_2S$	$H_2S$	$H_2O$	Lactate, organic
Oxidized product	Oxidized organic	$SO_4^{2-}$	$SO_4^{2-}$	$O_2$	Oxidized organic
Source of carbon	$CO_2$ or organic	$CO_2$	$CO_2$	$CO_2$	Lactate pyruvate
Heterotrophic growth	Common	Limited <sup>d</sup>	Limited <sup>d</sup>	Limited <sup>d</sup>	Required

<sup>d</sup>Generally limited to assimilation of low molecular weight organics during autotrophic growth.

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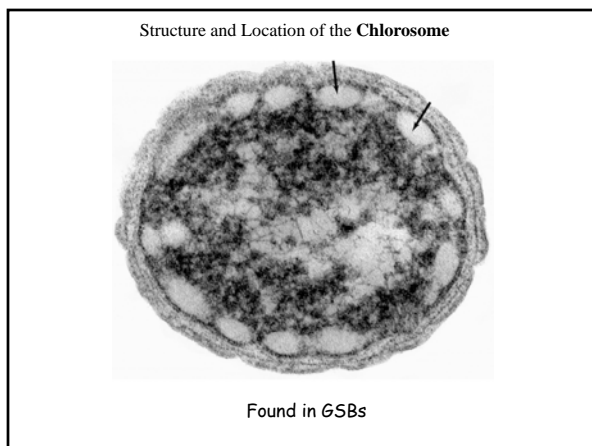
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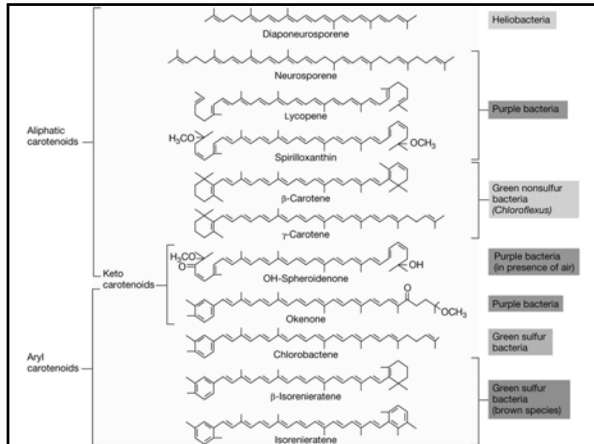
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**Table 9.2** The bacteriochlorophyll present in photosynthetic bacteria and primary acceptors involved in energy conserving reactions

	Electron Donor	Electron Acceptor
Purple nonsulfur bacteria	Bacteriochlorophyll <i>a</i> and <i>b</i>	Bacteriopheophytin <i>a</i> , $Q_A$ , and $Q_B$
Green sulfur bacteria	Bacteriochlorophyll <i>c</i> , <i>d</i> , and <i>e</i>	Bacteriopheophytin <i>a</i> and FeS-protein
Cyanobacteria photosystem I	Chlorophyll <i>a</i>	Chlorophyll <i>a</i> and FeS-protein
Cyanobacteria photosystem II	Chlorophyll <i>a</i>	Pheophytin <i>a</i> , $Q_A$ , $Q_B$ , and plastoquinones
<i>Heliobacteria</i>	Bacteriochlorophyll <i>g</i>	Bacteriochlorophyll <i>c</i> and FeS-protein

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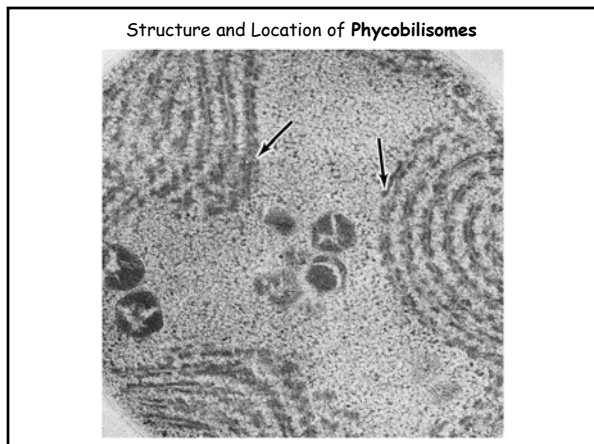
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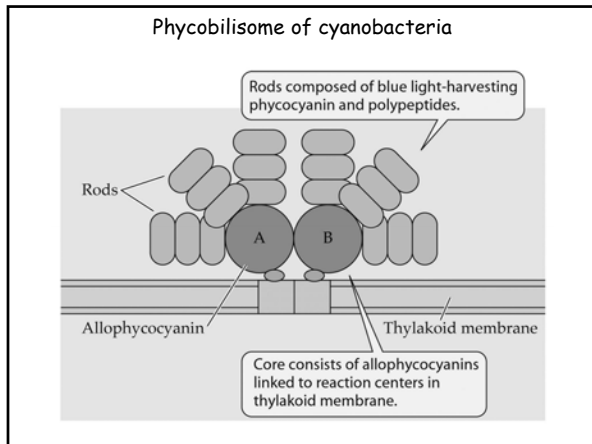
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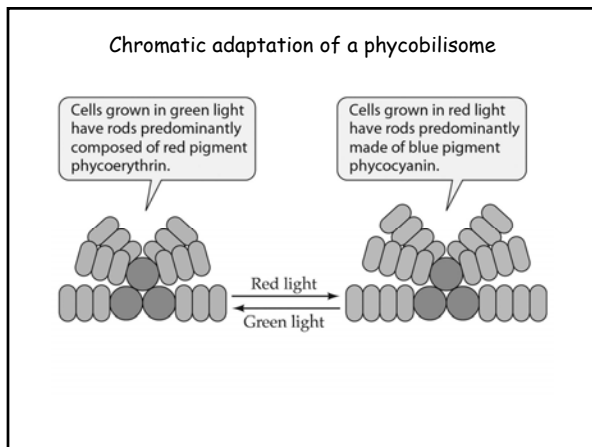
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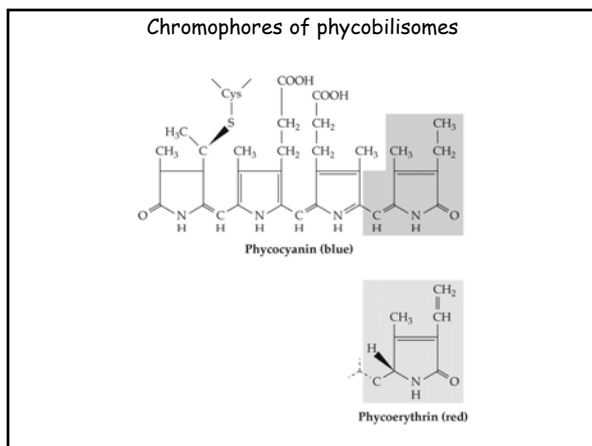
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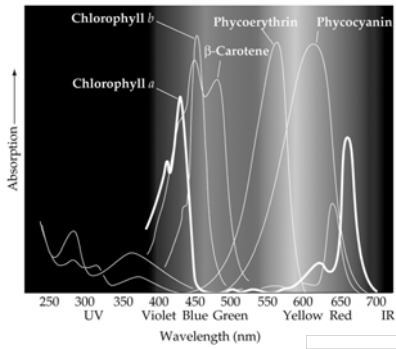
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### Absorption Spectra for Cyanobacteria




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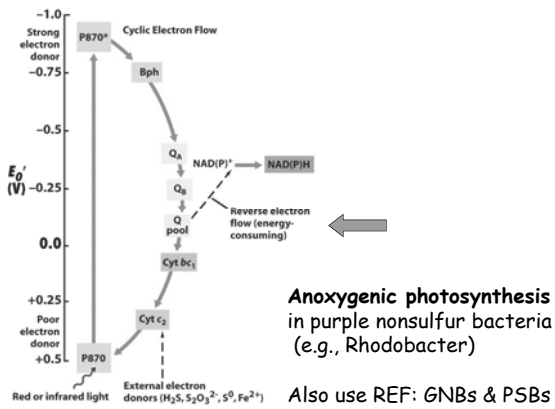
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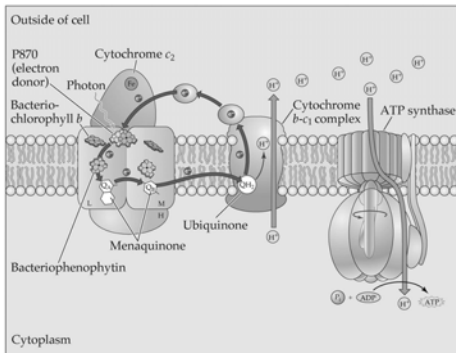
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### Reaction center of purple nonsulfur bacteria




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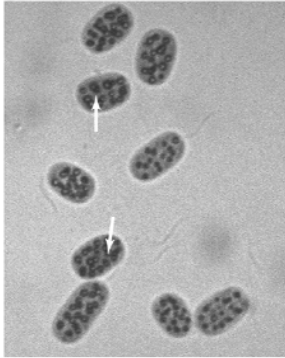
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Sulfur granules in purple sulfur bacteria  
e.g., *Chromatium*




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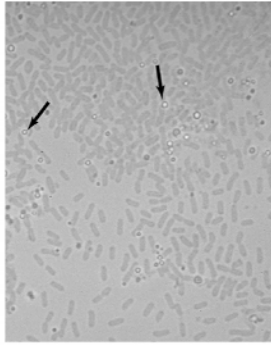
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Sulfur granules in green sulfur bacteria  
e.g., *Chlorobium*




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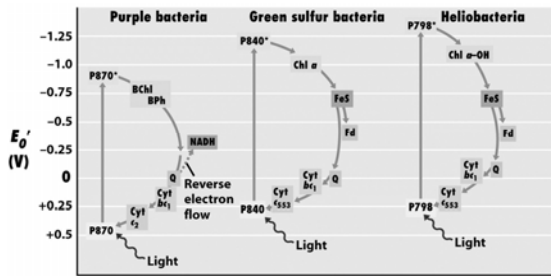
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Electron flow in phototrophs




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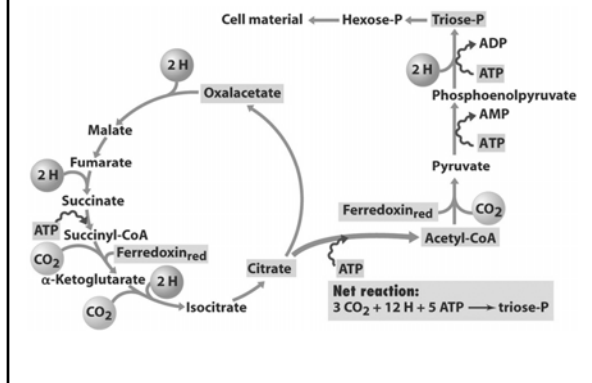
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### Reverse TCA in GSBs




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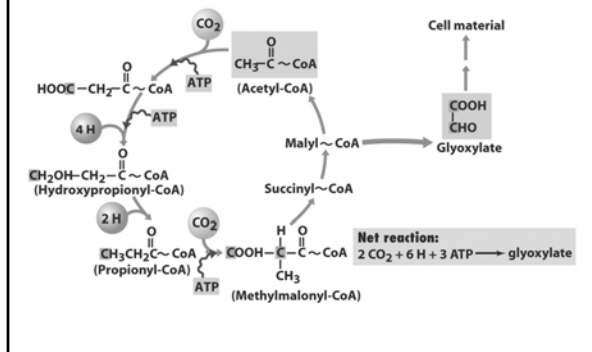
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### Hydroxypropionate in GNBs




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