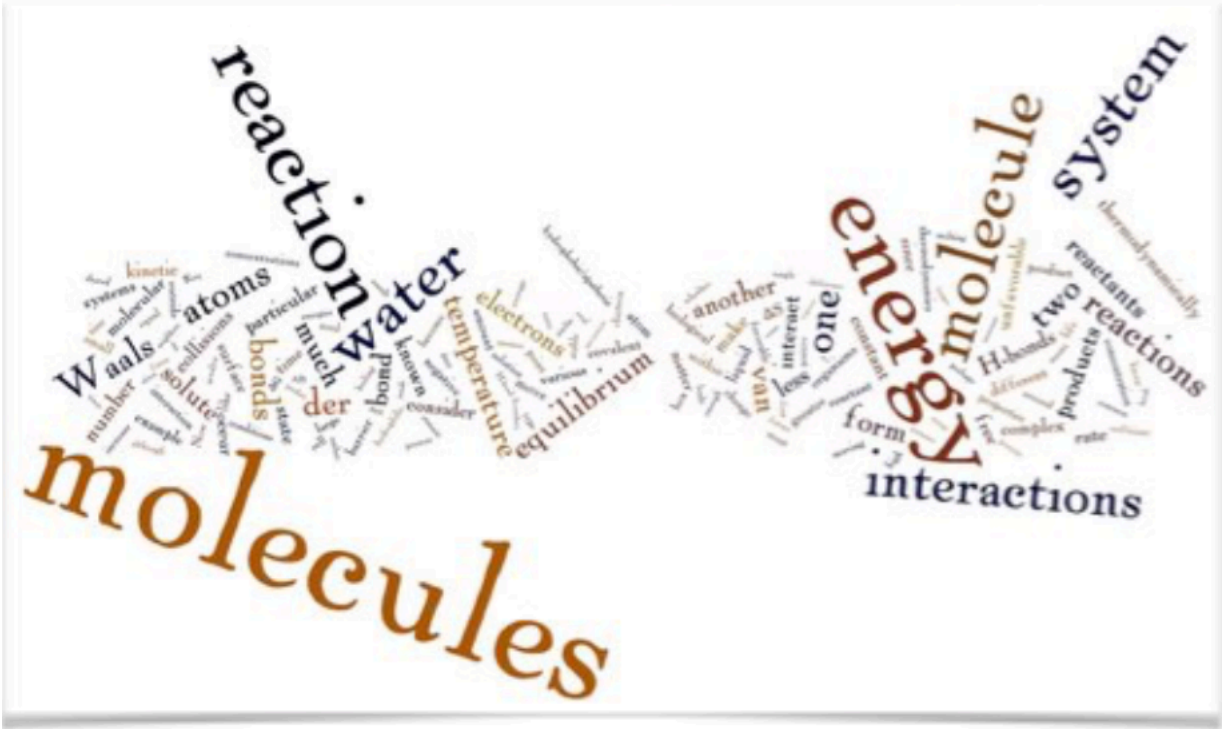


Putting together membranes, reactions, and capturing energy

course web site

Which will move through a pure lipid membrane (no carriers, channels, sym-/anti-porters or pumps)
faster?

O2
H+
H2O **explain why**

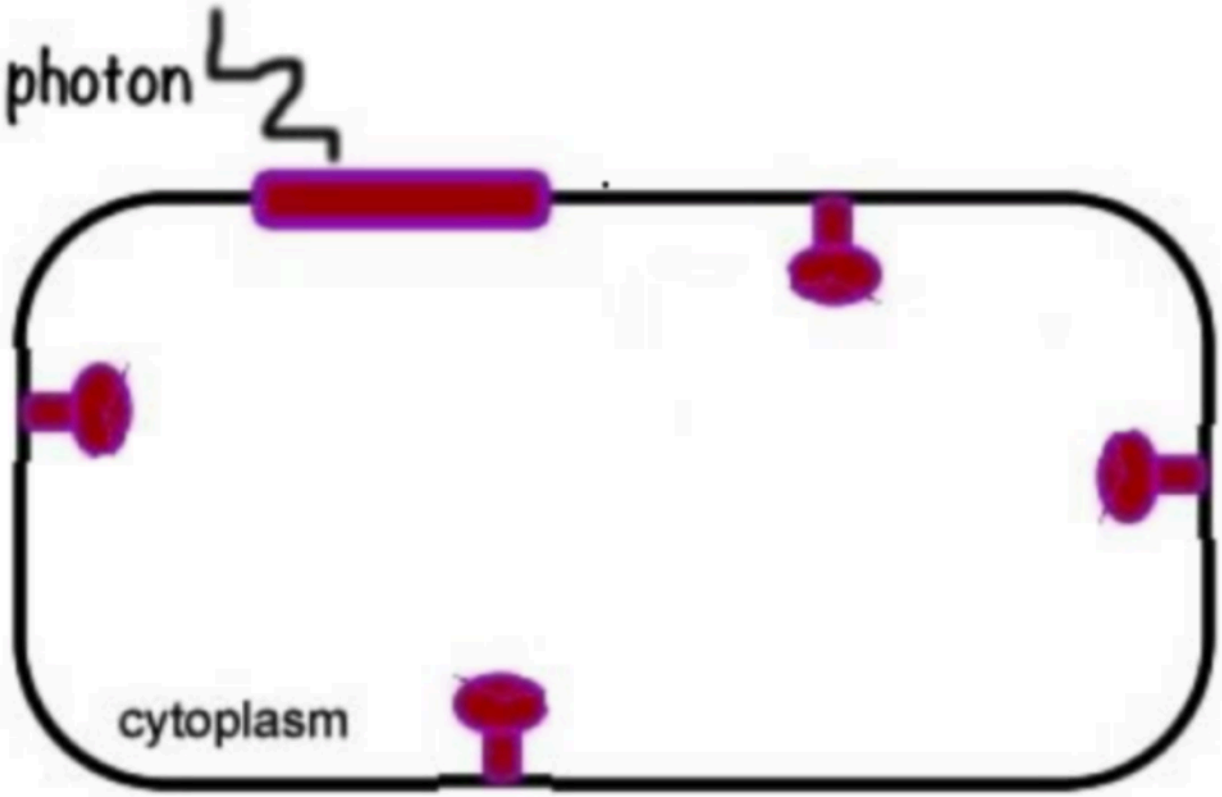
critical point: different ions have different diameters, water-shells, so that channels/carriers/pumps can be specific in which ions/molecules they transport.

Group (discuss and draw on the white board)

How does Halobium capture (eat) light, and what does it do with it? Include all of the key components and what they do (exactly).

Here is a schematic of a Halobium, which absorbs light and uses the energy to generate a [H+] gradient across its plasma membrane. The energy stored in that gradient to drive ATP synthesis. As the sun rises, indicate which directions H+s are moving and were ATP is synthesized

explain you logic



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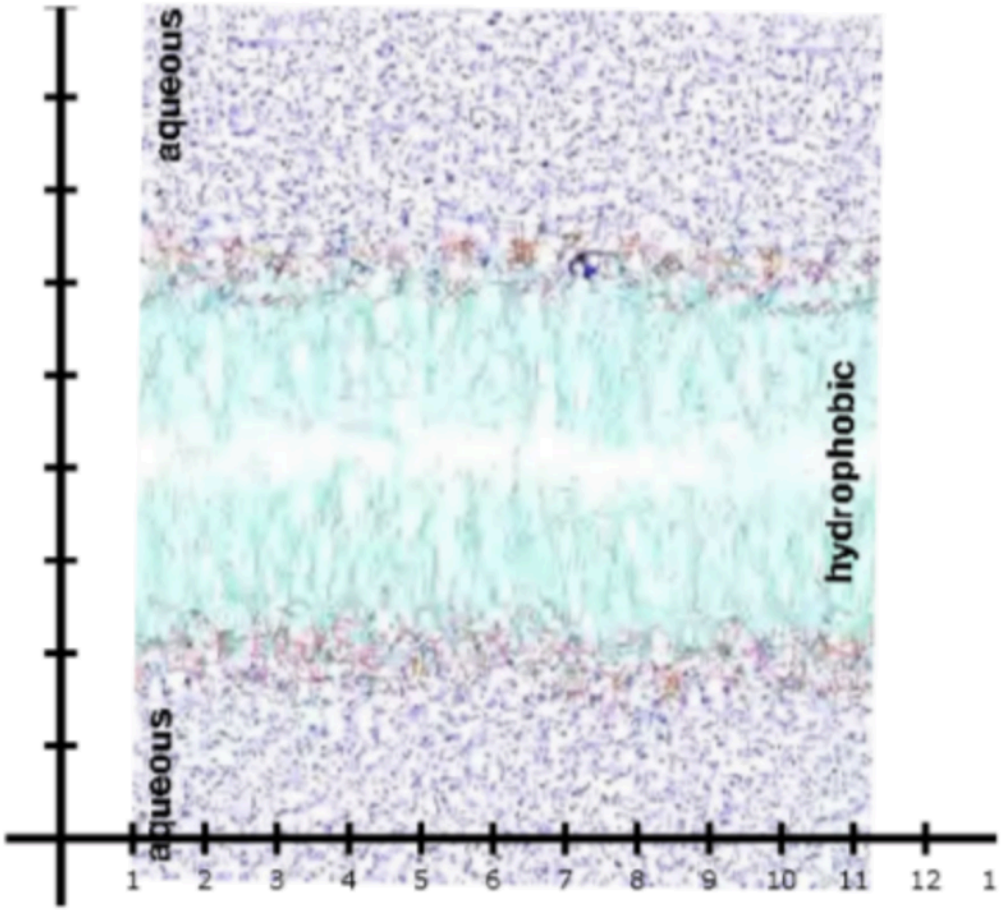
In the Halobium (purple) membrane, the light turns on at time = 2, indicate on the graph the size of the [H+} concentration gradient.

Explain your logic - what factors will act to limit the maximum size of the concentration gradient



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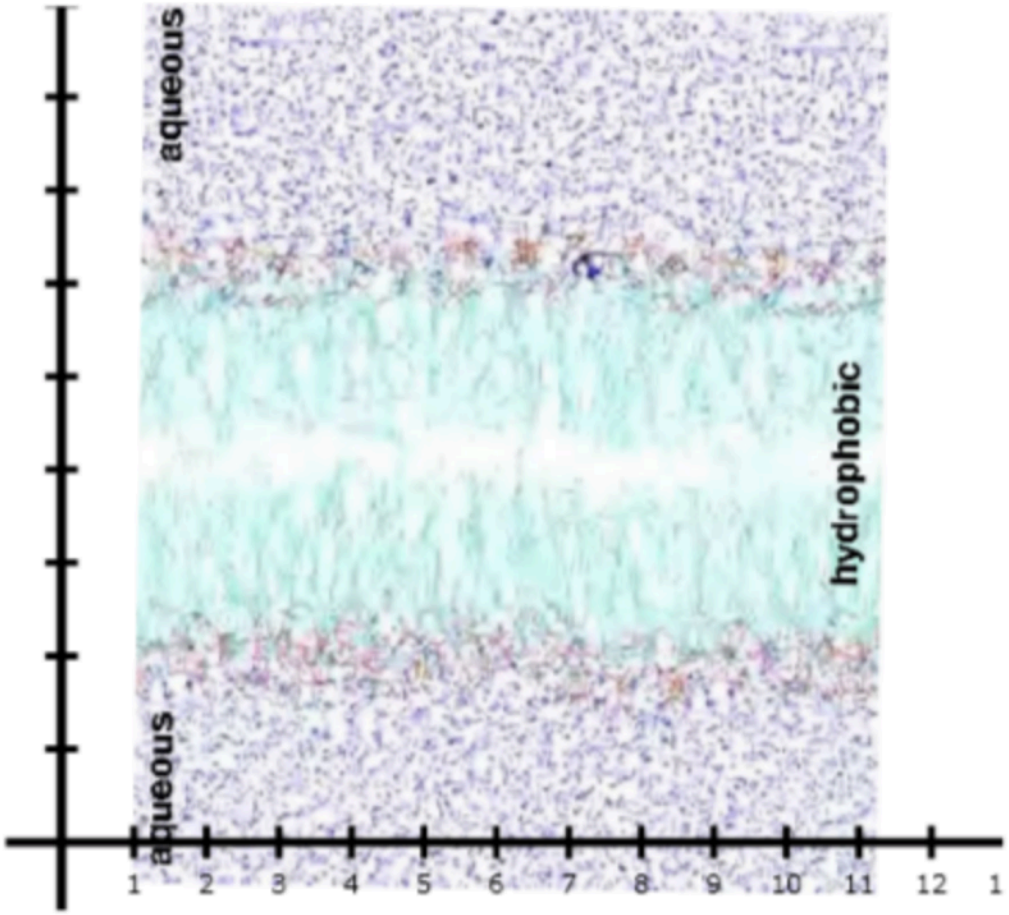
The light turned on at time = 2; now assume the light goes off at t = 8. Indicate how that influences the [H+} concentration gradient.

intracellular extracelluar



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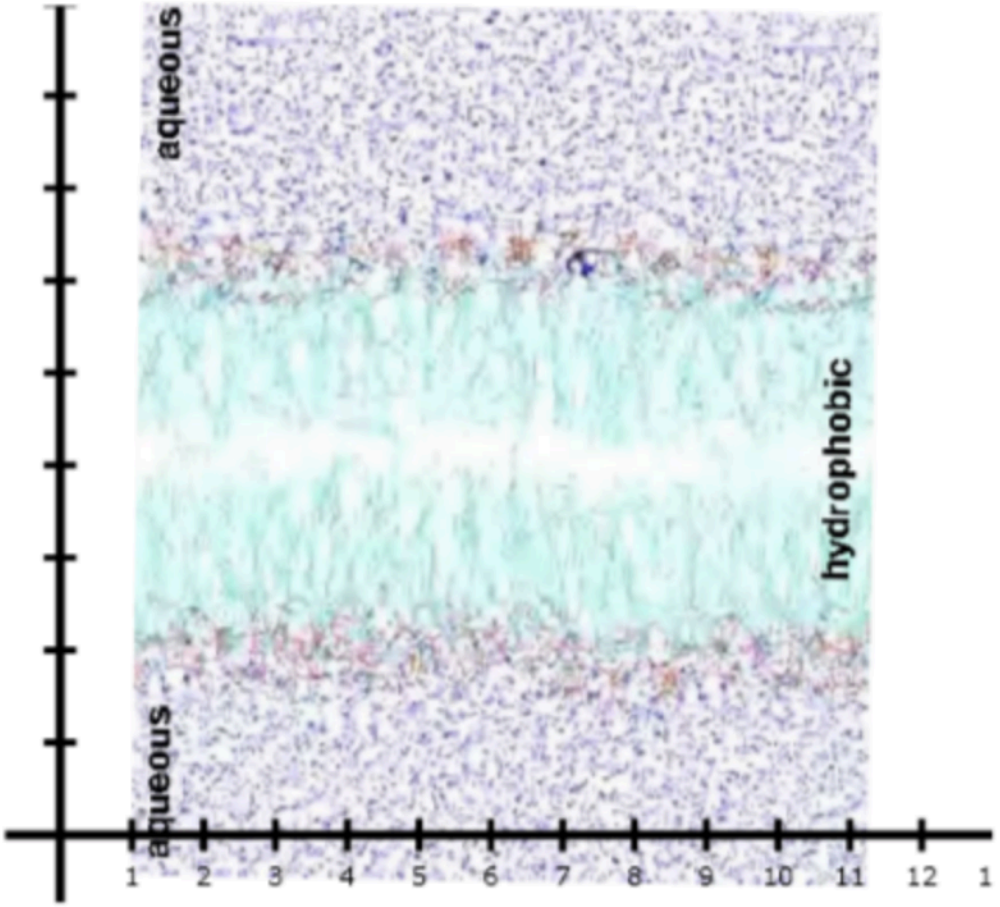
Explain your logic

On your graph light on at 2 and off at 8) indicate the rate of ATP synthesis as a function of time.

intracellular

extracelluar



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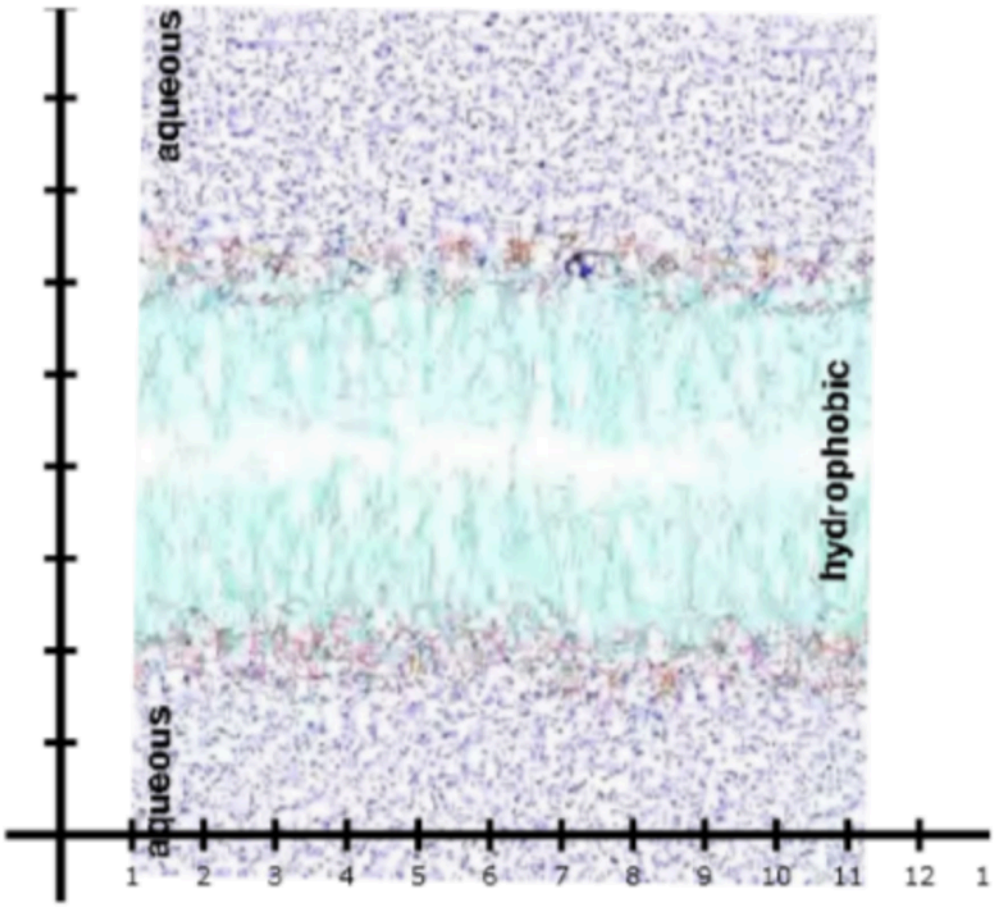
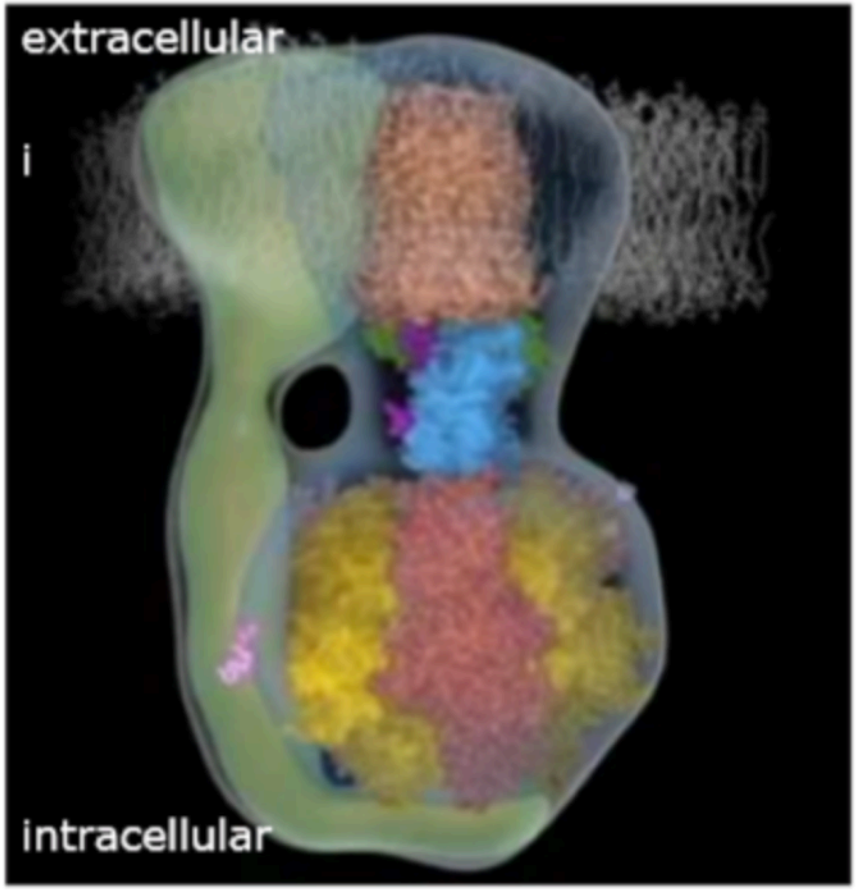
Explain your logic

Now at time equal 6, a nasty competitor microbe releases a H+ channel molecule. Indicate how that influences ATP production by the Halobium.



Explain your logic



here is a model of the ATP synthase that couples to the H+ gradient to drive ATP synthesis. Indicate what motions occur during this reaction.

Generate a model for how such a system might be used to drive cellular movement.

Draw Erase Reset

Group (discuss and draw on the white board)

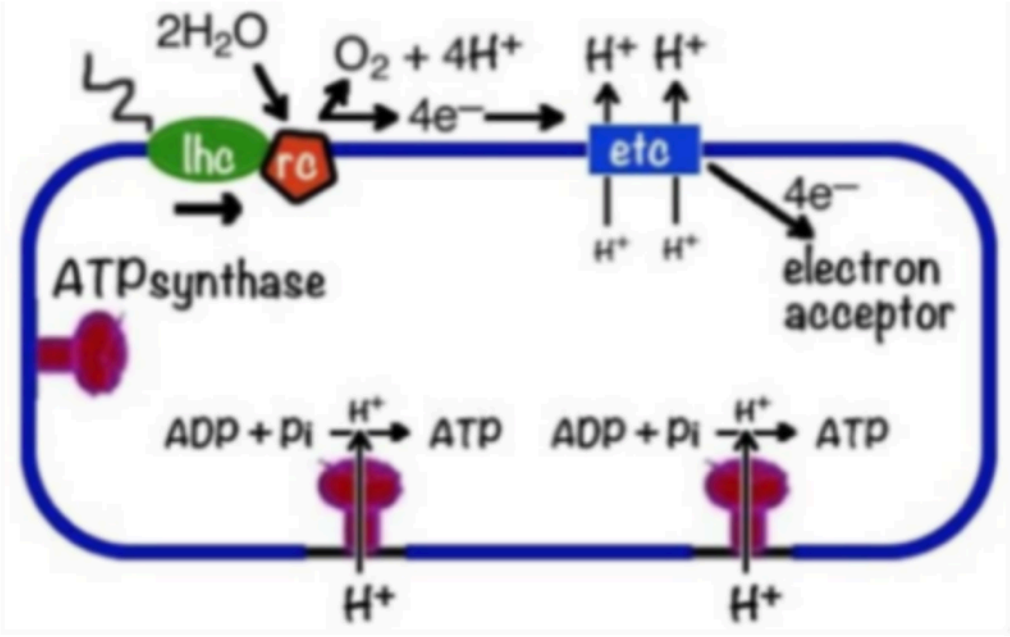
What are the key components of oxygenic photosynthesis, what do they do, and how does lead to the storage of energy?

Why (mechanistically) is water broken into O2 and 4H?

6.3 read pages 139-144 first

A major breakthrough in the evolution of life on Earth was oxygenic photosynthesis, which appears to have first appeared in cyanobacteria.

In the drawing indicate the inside, the boundary, and the outside of the cell.



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What other types of molecules does a photosynthetic organism need to "eat" in addition to light?

What are the waste products of such a photosyntheic system; how are they different from the waste products of a non-photosynthetic organisms?

Group (discuss and draw on the white board)

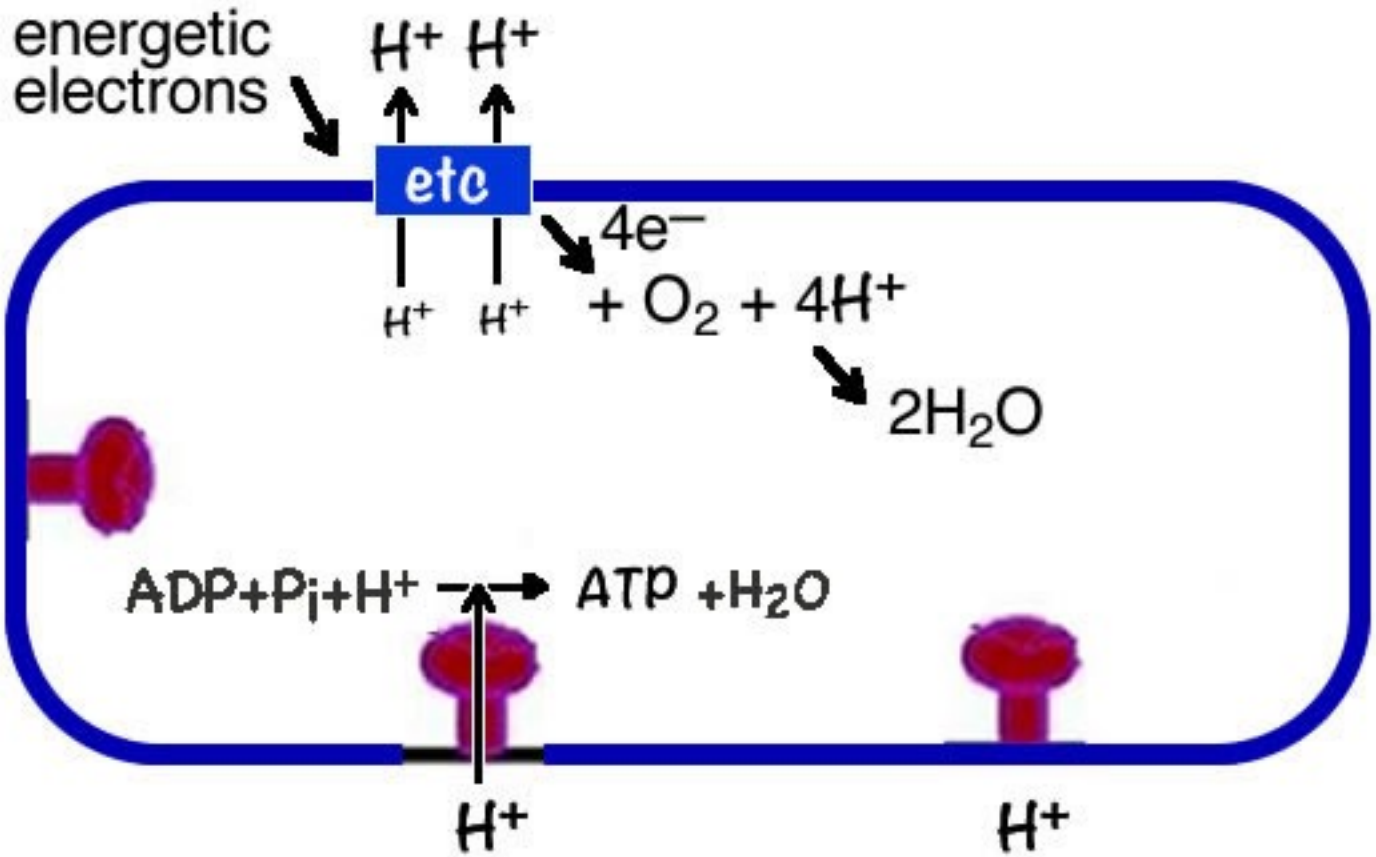
Are the Halobium system and the photosynthesis systems evolutionary homologous or analogous? what is your answer based on?

Group (discuss and draw on the white board)

Which parts of these systems might be homologous and how would you tell?

Group (discuss and draw on the white board)

What are the key components of aerobic respiration, what do they do, and how does lead to the storage of energy?


energetic
electrons
H+ H+
etc
4e−
+ O2 + 4H+
2H2O
H+ H+
ADP+Pi+H+
ATP +H2O
H+
H+

If someone asked you to explain why it is that O2 can be reduced by (accept) lower energy electrons compared to most other electron acceptors, you woul have to say it is because ...

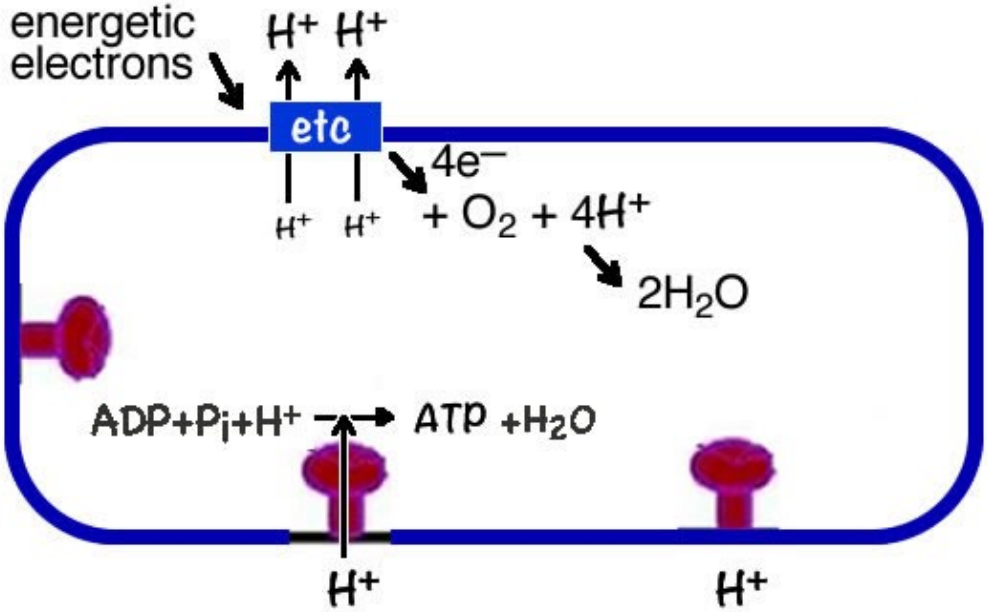
- O2 is plentify and natural
- O2 is produced by photosynthesis so it contains more energy
- quantum mechanical factors influencing orbital energies
- reducing O2 produce water
- no idea, and I know it

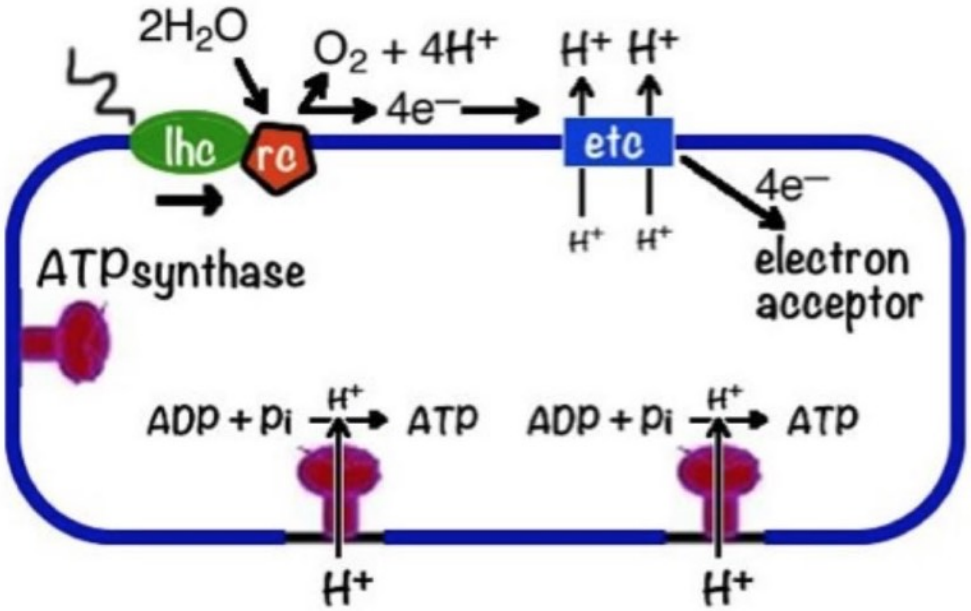
explain the logic of your answer

what might be the evolutionary advantage of using O2 as an electron acceptor?

Group (discuss and draw on the white board)

Are oxygenic photosynthesis and aerobic respiration evolutionarily homologous or analogous.

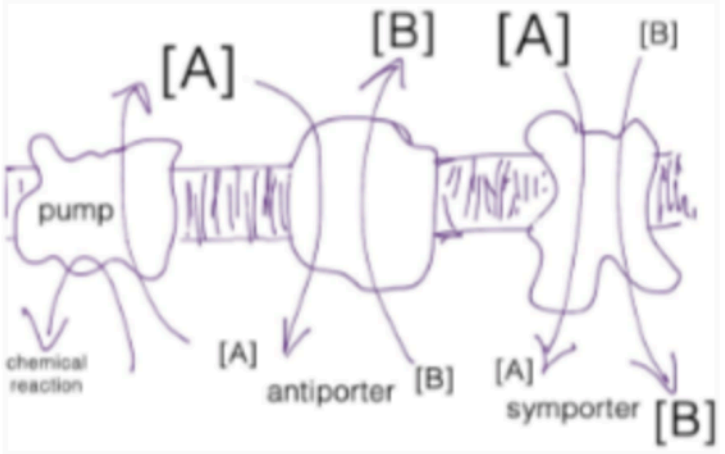

energetic electrons
H+ H+
etc
4e−
+ O2 + 4H+
2H2O
H+ H+
ADP+Pi+H+
ATP +H2O
H+
H+


2H2O
O2 + 4H+
4e−
H+ H+
lhc
rc
etc
4e−
H+ H+
ATPsynthase
electron acceptor
ADP + Pi
H+
ATP
ADP + Pi
H+
ATP
H+
H+

Group (discuss and draw on the white board)

Once a renewable ATP synthesis is present, produce a model for how it could be used to generate one or more concentration gradients across a cellular membrane.

In addition to directly driving the synthesis of ATP (through coupled rections), membrane gradients can be used to move molecules (say A and B) into and out of cells (and into and out of intracellular membrane-bounded compartments).



What determines the direction of the net flux of these molecules across the membrane?

How might you use such a system to synthesize ATP?

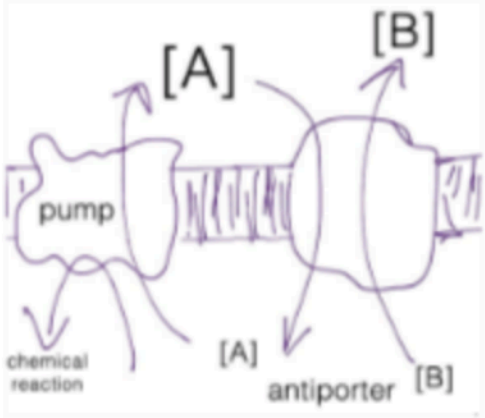
Group (discuss and draw on the white board)

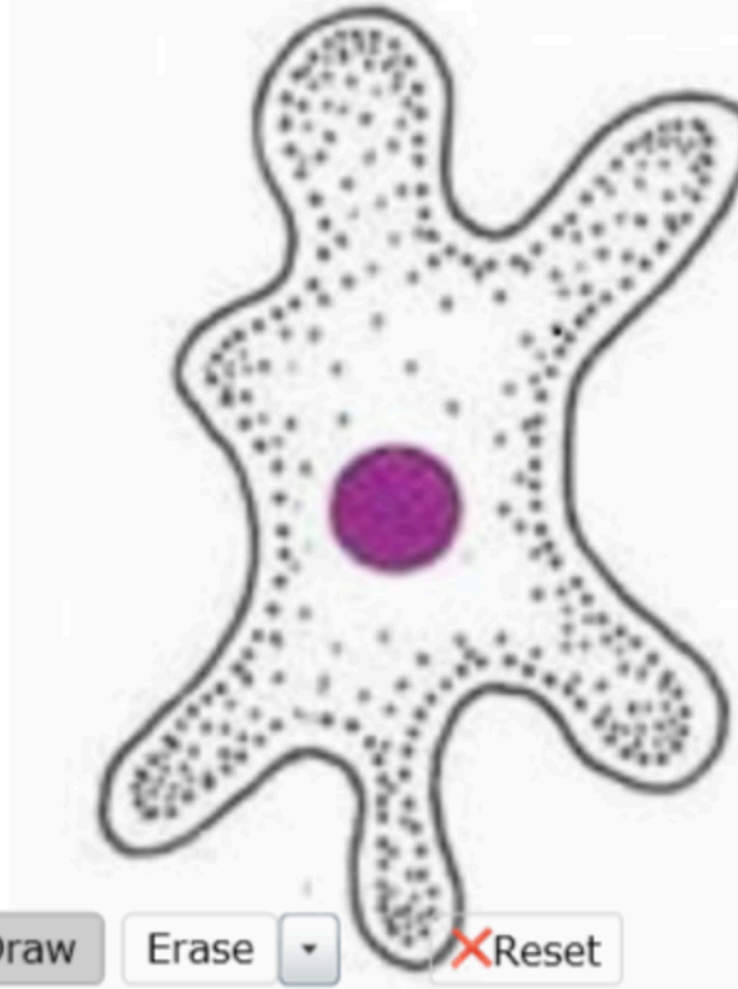
how are symporters and antiporters the same, how are they different?

Group (discuss and draw on the white board)

How would a cellular system use a anti-porter/symporter to concentrate a nutrient molecule with a cell?

This cell's membrane contains a molecular pump running on chemical energy (the ATP hydrolysis reaction). It also contains A+B antiporters. Remembering that chemical reactions occur within the cytoplasm, indicate (below) the net direction B will move as long as there is chemical energy and both A and B are present in the system.





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Predict (and explain) waht would happen to the movement of A if B were absent from the system? And under what conditions could ATP be synthesized?

In the typical energy capturing reaction, H+ ions move throught the ATP synthase to generate ATP from ADP and phosphate. Draw and label a cartoon of what happens if the reaction runs backward? Include all necessary components.

Draw | Erase | Reset

First I Know It Now exam (at the final) = 30 possible points

Monday 16 Oct.	Chapter 6.3 Membranes and capturing energy	139-144	**Complete** beSocratic #18
Wed. 18 Oct.	Chapter 6.4 Membranes and capturing energy	144-150	**Complete** beSocratic #19
Friday 20 Oct.	**REVIEW for midterm #2**		previous midterm
Monday 23 Oct.	**second midterm exam**		exam answers