Biology 1305 – Modern Concepts in Bioscience – ICB Textbook
Week of November 15th, 2020
Marco Franco

Hello everyone!! I hope you are all enjoying the Biology ICB class. I would like to remind you that if you wish to attend group tutoring, make sure you reserve a spot via the tutoring center website.

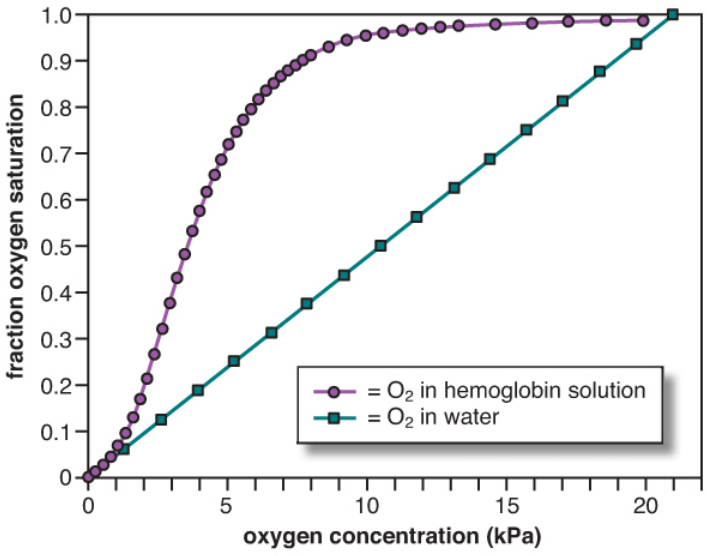
Our Group Tutoring sessions will be every Tuesday from 6:00 – 7:00 PM. You can reserve a spot at https://baylor.edu/tutoring. I hope to see you there!

We are very close to the end of the semester and there are only a few new concepts that you will need to learn in preparation for your final exam. Last week, we went over chapter 10 and explored how molecules carry energy and how food is converted to molecular energy. That resource can be found here:
https://www.baylor.edu/support_programs/index.php?id=967950

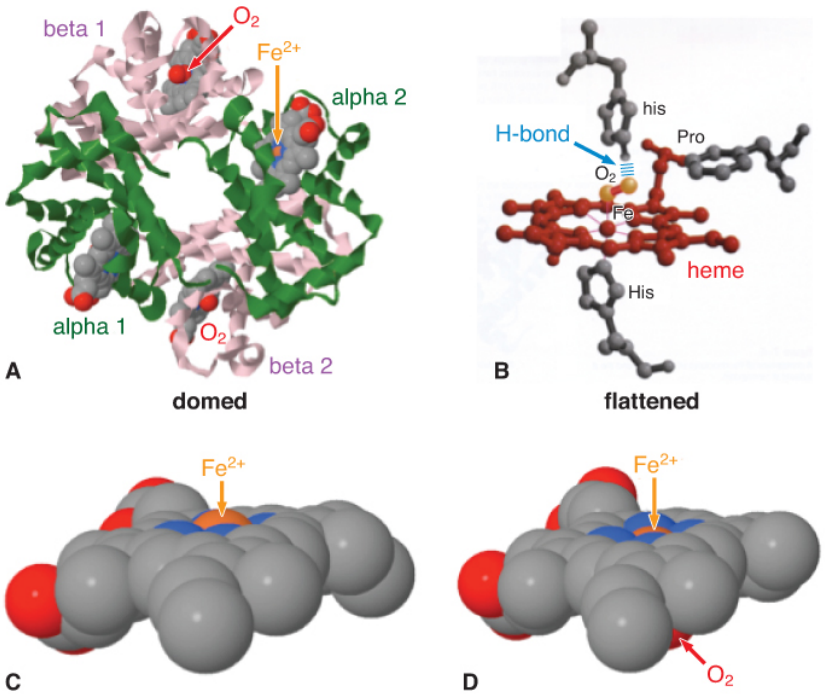
This week is the second to last week of resources, and this document will cover concepts from chapter 13, dealing with molecular switches. First let's discuss **EMERGENT PROPERTIES.**

This set of properties result from molecular interactions that cannot be predicted by studying individual components of biological processes. In other words, these properties are often part of a collection or complex system but nor part of individuals themselves. Think of an organ like the heart, which major function is to pump and distribute blood, but heart cells themselves do not pump blood but rather are part of a complex that does.

Talking about blood, **do you know how blood actually carries oxygen?** We know that blood must pass to through the lungs to get oxygen but how are oxygen molecules distributed all over the body. The answer is **HEMOGLOBIN**, which is also an example of an emergent property because is a complex protein made of different subunits that allow it to have high affinity for oxygen. Look at the graph to the right and notice how the saturation of oxygen is more prominent and occurs at higher rates of change in a solution with hemoglobin compared to a water solution only. The graph shows that as the oxygen concentration increases, so does its saturation, yet the presence of hemoglobin significantly increases this saturation.



Hemoglobin is composed of four subunits or **HEME** components, two α and two β hemes, and which are held together by chemical interactions of the amino acids. Iron (Fe2+) also plays a fundamental role in the functioning of hemoglobin, because oxygen molecules bind to this Fe atom in one of the four hemes. The binding of oxygen causes a conformational change of hemoglobin (change in shape), from a domed heme (C) to a flattened heme (D), as shown in the diagram to the right.



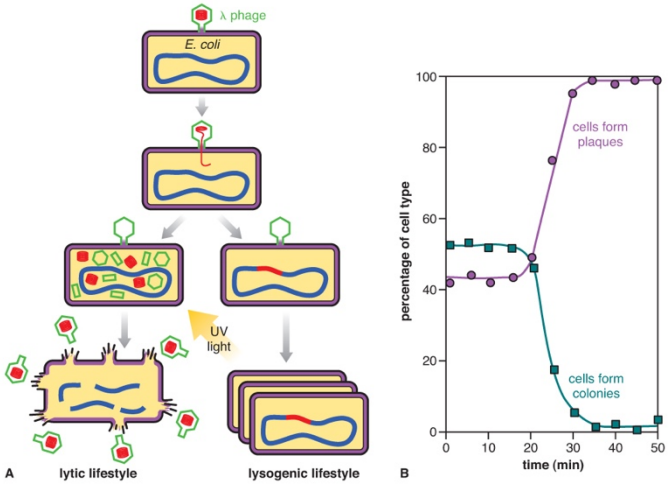
Similar to hemoglobin, we have **MYOGLOBIN**, another protein involved in oxygen transport, but this one is a single polypeptide, not a complex like hemoglobin.

Check out this video to learn more about hemoglobin, myoglobin, and oxygen transport:
https://www.youtube.com/watch?v=Qv-KExGKAYw

Now, let's look at another example resulting from emergent properties and competition or cooperation. Let's answer the question: **When does a virus kill its host?**

As we find ourselves in the middle of a pandemic, hopefully we all now know that viruses need hosts in order to replicate. **The reproductive success of viruses depends how good they match their replication processes with the physiology of their hosts.**

Viruses can "live" in two lifestyles: **LYSOGENIC** and **LYTIC**. **Lysogenic lifestyles is when viruses do not replicate after infecting a host. Instead, they remain dormant while the host replicates the viral genome, and only when the time is right they can produce hundreds of thousands of viruses. This change corresponds to the lytic lifestyle, where the viral load causes the host cells to rupture (lyse), releasing all the new viruses.**



Let's look at the Lambda phage life styles in the diagram above. Lambda can insert its genome into *E. coli's* chromosome and be lysogenic or produce new viruses and kill its host in a lytic lifestyle. UV light switches the virus from lysogeny to lysis. **A,** Life history of λ phage. **B,** Growth of lysogenic *E. coli* after UV exposure. Infected cells were exposed to UV light at time zero and spread onto plates at the indicated time after UV exposure.

The following video from Khan academy does an excellent job in detailing lytic vs lysogenic viral lifestyles in 5 minutes. Check it out https://www.youtube.com/watch?v=J4BN4dARpio

I hope that the Biology 1306 resources I shared with you this semester were helpful and efficient in addressing your academic needs. As we approach the end of the fall semester, I would like to let you know that there will be one more resource for this class next week, which will help you review the material for your final exam. All resources for this semester can be found here: https://www.baylor.edu/support_programs/index.php?id=967950. Also, please do not forget that the week of November 16 - 20 is the last week where group tutoring sessions will take place. If you wish to attend the last session, please make sure you check out the tutoring center website (https://www.baylor.edu/tutoring) and follow the instructions to register for group tutoring.