**Nicholas’ Story**

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**Preparation:**

Prior to the case discussion in class (as a homework assignment), get acquainted to the case.

* Watch the video titled “Managing Sickle Cell Disease as a Teenager”

<https://www.youtube.com/watch?v=iKQmQHh4E2w>.

* Review the materials presented in Part 0 and answer the questions.

**Part 0: Understanding Sickle Cell Disease (SCD)**

*Box 1: Storyline*

The video that you watched described Nicholas’ experiences living with sickle cell disease (SCD). Before we explore any specific questions about Nicholas’ experiences, it may be helpful to understand what SCD is, how it is caused, and its key molecular players. This section presents a conversation between students in a classroom that introduces SCD.

a. Read the following conversation (a classroom scene) and explore the links listed herein:

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*Alex:* Seems like we need to review some biology and chemistry to really get this. Does anybody remember what causes sickle cell? I seem to remember from high school bio that it is caused by a single mutation in the gene that produces hemoglobin. Anyone else remember anything about SCD?

*Beatrice:* Yaa! Hemoglobin – that is the oxygen-transporting protein of red blood cells. Right? I remember that it has four polypeptide subunits; 2 alpha chains and two beta chains. My bio teacher said that Hemoglobin changes shape when it binds oxygen and that the amount it can hold varies with pH. That’s why it picks up oxygen in the lungs and dumps it in the muscles.

*Charlie:* Yes! We did a unit in my AP Bio class on hemoglobin and mutations. I think sickle cell is caused by one amino acid change in one of the subunits.

*Dorothy:* Really? One little amino acid change and then it can’t bind oxygen properly? How does that work?

*Charlie:* So, it makes a valine instead of a glutamate at this one position. Maybe that affects the shape of the molecule? We saw this cool animation in my high school class that shows how the mutation changes the shape. Here, let me show you. It’s on YouTube.

<https://www.youtube.com/watch?v=Y66B7PWrE00&feature=youtu.be>

*Eliza:* I read that there’s a lot of people, especially in tropical areas that carry that mutation, or something similar. I think its related to protection from malaria.

*Farah:* Yeah. I remember I did this study for my freshman seminar. There is a cool video about how Tony Alison figured out the relationship between sickle cell disease and Malaria. We should watch that you know <https://www.hhmi.org/biointeractive/making-fittest-natural-selection-humans>. Sickle cell disease affects millions of people worldwide. It is most common among people whose ancestors come from Africa; Mediterranean countries such as Greece, Turkey, and Italy; the Arabian Peninsula; India; and Spanish-speaking regions in South America, Central America, and parts of the Caribbean. Did you know that individuals with sickle cell disease have a lot of pain too – just like Nicholas. I never really understood why they have pain though.

*George:* I remember my friend, Harry, telling me about some new drug, Crizan… something, that can help reduce the pain. His aunt, Melissa Creary, helped develop the sickle cell program at CDC. She also studied communities in Brazil with high prevalence of sickle cell trait. Now she teaches at the University of Michigan. Perhaps we can email Dr. Creary and ask some questions about sickle cell disease and the causes of pain.

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Answer the following questions in a few sentences each:

Q1. What causes sickle cell disease?

Q2. What is hemoglobin? Where is it present in our body? Why is it so important for us?

Q3. What is the overall composition of hemoglobin?

Q4. How does the sickle cell mutation in hemoglobin (HbS) cause red blood cells to sickle?

Q5. What are some current medications/strategies for treating sickle cell disease?