

Name \_\_\_\_\_

Date \_\_\_\_\_

Period \_\_\_\_\_

# Lesson 5.1 What is Sickle Cell Anemia?

## Key Terms

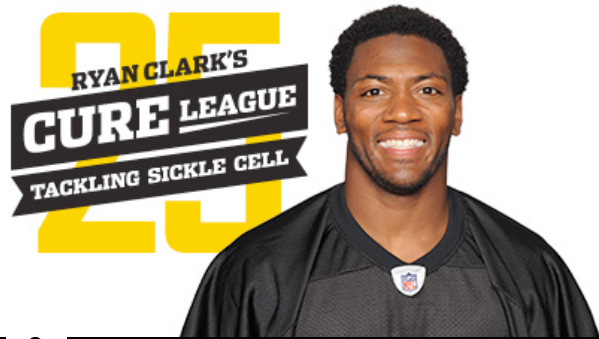
Sickle Cell Anemia



Engage

Listen to your teacher tell the story of Ryan Clark.

1. Why couldn't Ryan Clark play in Denver?
2. How did Ryan Clark's child get Sickle Cell?
3. What physical traits did you inherit from your parents?

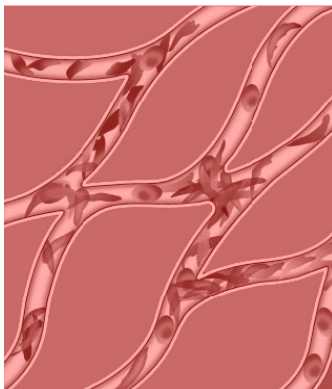
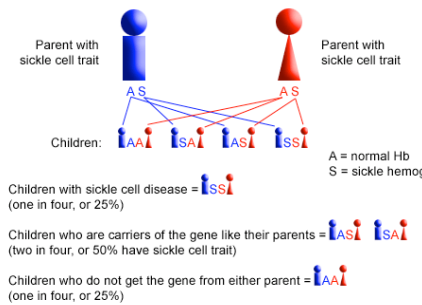


Explore/Explain I

### Inside Story: Your Body, Your Health (United Streaming)

Your teacher will show you a video about Sickle Cell Anemia.

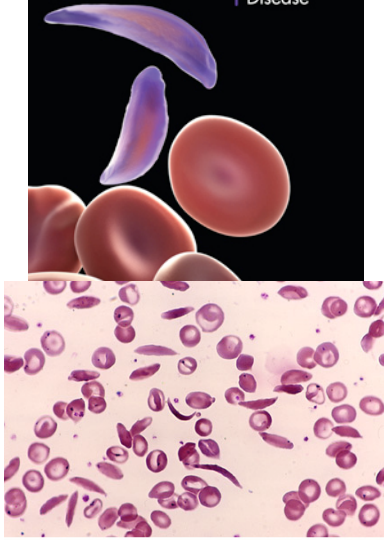
Enjoy watching and please answer the questions as you follow along



1. What is Sickle Cell disease?
2. What are three reasons Infinity had to go to the hospital?
3. Where is Sickle Cell disease most common?
4. How many babies are born in the U.S. annually with Sickle Cell?
5. What must a person have in order to get the disease?
6. What are the odds that two people, each with one trait, will have a child with Sickle Cell?
7. How does Sickle Cell disease affect people that suffer from it?
8. Normally red blood cells are soft and round and can easily squeeze through tiny blood vessels, however in people with Sickle Cell disease the blood cells become stiff and pointed. What do these stiff pointed red blood cells do?
9. What are some of the things that can cause a Sickle Cell crisis?
10. What are some of the organs that are affected by Sickle Cell?
11. In addition to African-Americans, \_\_\_\_\_ Hispanic and \_\_\_\_\_ white Americans are born with Sickle Cell trait each year.
12. Why is it difficult for doctors to find a cure for Sickle Cell disease?

## HYDROXYUREA

Treatment for  
Sickle Cell  
Disease



Source: Lichtman MA, Shafer MS, Falgar RE, Wang N:  
Lichtman's Atlas of Hematology; <http://www.accessmedicine.com>  
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Sickle cell disease  
is a hereditary  
blood disorder  
that affects  
hemoglobin, the  
substance in red  
blood cells that  
carries oxygen.

13. Why are most children who inherit Sickle Cell pain free for the first six months of their lives?

14. What does Hydroxyurea do for Sickle Cell patients?

15. Why would the bone marrow transplant be helpful for Infinity?

16. What are some of the risks of the bone marrow transplant?

17. Who is Nina Herrera?

18. Infinity's bone marrow transplant did not work. Does she still have Sickle Cell? Why or why not?

19. What is so special about the mice at the Lawrence Livermore Laboratories in Berkeley, California?

20. How is the new work on Sickle Cell disease paying off for other diseases?



### Explore/Explain II

#### Areas affected by Malaria



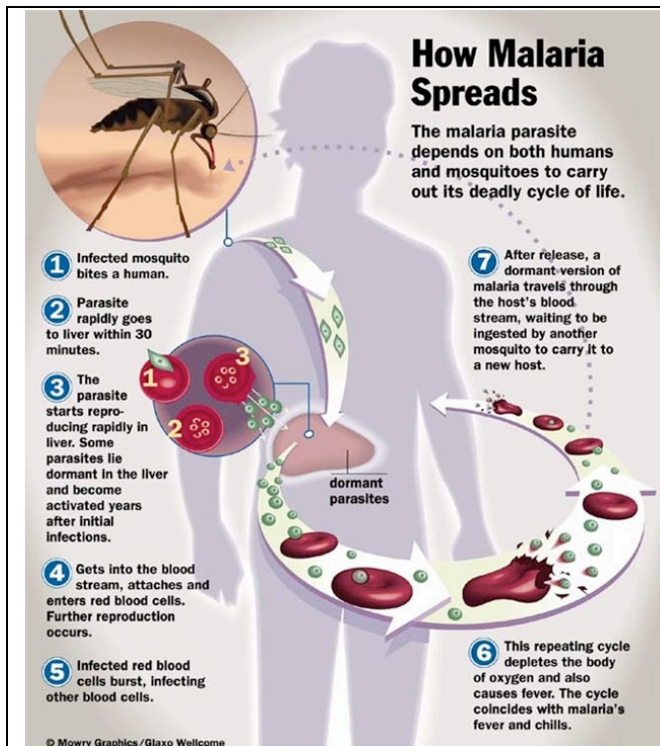
This map is only intended to highlight destinations with possible malaria risk. Countries in RED are considered by the World Health Organization (WHO) to have some malaria risk. It does not necessarily mean that the entire country is affected, as malaria may be restricted to certain areas or regions.

#### Proteins determine the traits (phenotypes) of living things.

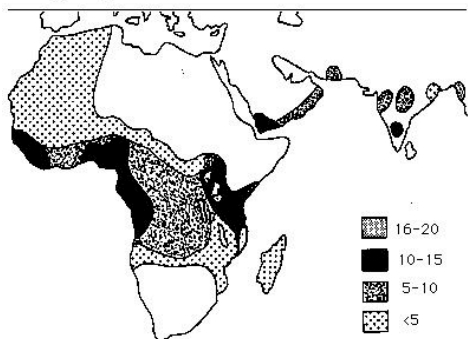
Now that you have learned a little about Sickle Cell Anemia let's learn about why this particular gene is still present in the world. In other words, if it is such a devastating disease why have selection pressures wiped it out? Here is an example of a selection pressure affecting a phenotype and a genetic response to that pressure.

Malaria is caused by a microorganism transmitted by the anopholes mosquito. Sickle Cell Anemia on the other hand is a disease that is inherited from parents that posses that genetic trait. In certain parts of the world the disease MALARIA is a serious threat to the health of millions of people. Approximately 40 percent of the world's population- mostly those living in the poorest countries- are at risk for malaria. The World Health Organization (WHO) estimates that there are 300 million malaria cases annually, directly causing over one million deaths. Malaria kills one child every 30 seconds, while many children who survive an episode of severe malaria suffer from learning impairments or brain damage.

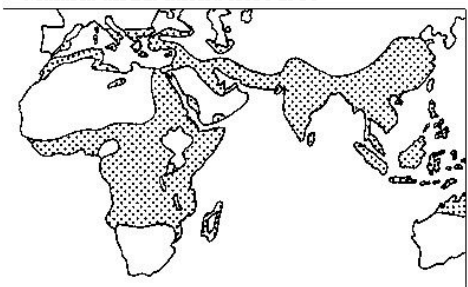
Anopholes mosquitos drink blood from a human host and can possibly transmit plasmodium in its saliva. Plasmodium microorganisms then infect red blood cells and they eventually burst, infecting other blood cells. This repeating cycle depletes the body of oxygen and fever and chills set in. Symptoms of malaria include fever and flu-like illness, including shaking and chills, headache, muscle aches, and tiredness. Nausea, vomiting, and diarrhea may also occur. Malaria may cause



Frequency of Sickle Cell allele



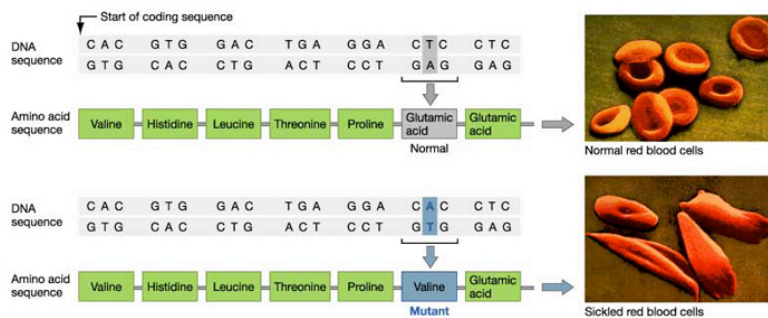
Malaria distribution before 1930



anemia and jaundice (yellow coloring of the skin and eyes) because of the loss of red blood cells. Infection may cause kidney failure, seizures, mental confusion, coma, and death.

An interesting pattern was observed in the location of malaria infections and the incidence of Sickle Cell Anemia. The distribution of Sickle Cell is almost identical to the distribution of malaria.

It was discovered that individuals who are carriers (SA) were resistant to malaria infection. This means that they do not get malaria if they are bitten by a mosquito that has plasmodium microorganisms. A single change in the genetic code, probably through a mutation during DNA replication, allowed the sickle cell trait to enter in the human gene pool. It probably remains in the gene pool because those individuals who are carriers do not get malaria.



The change in amino acid sequence causes hemoglobin molecules to crystallize when oxygen levels in the blood are low. As a result, red blood cells sickle and get stuck in small blood vessels.

21. How is malaria transmitted?

22. How is Sickle Cell Anemia transmitted?

23. Would malaria or Sickle Cell disease have a greater likelihood of killing the victim?

24. What is the advantage of being a carrier of Sickle Cell?

25. How many DNA bases are different between a person with the Sickle Cell trait and a person without the trait?

26. How many amino acids are different between a person with the Sickle Cell trait and a person without the trait?

27. How could this difference in the sequence of DNA have occurred?

28. Diagram a normal red blood cell and a blood cell affected by Sickle Cell in the space below.

29. If Sickle Cell is such a bad disease then why is the Sickle Cell gene still present in the human population?