RUBRIC 1: Biography of a scientist from an under-represented segment of society

	4	3	2	1
Understanding	Provides accurate and specific scientific facts and information that fully explain the biography of the scientist.	Provides scientific facts and information that usually are accurate and explain the biography of the scientist.	Provides scientific facts and information that are unrelated to the biography of the scientist or are off topic.	Provides vague or incomplete information that does not explain the biography of the scientist.
Thinking/Inquiry	Demonstrates a thorough understanding of obstacles the scientist overcame in the pursuit of their career.	Demonstrates some understanding of the obstacles overcome by the scientist.	Demonstrates an understanding of the obstacles that must be overcome, but does not relate them to a specific scientist.	Demonstrates a vague acknowledgement of the obstacles overcome.
Communication	Always uses appropriate scientific terminology to enhance the text.	Frequently uses appropriate scientific terminology to enhance the text.	Sometimes uses scientific terminology to enhance the text.	Rarely uses proper scientific terminology to enhance the text.
Application	Fully describes the experimental protocols followed by the scientist.	Describes the experimental protocols followed by the scientist.	Lists experimental protocols followed by the scientist.	Mentions that experimental protocols were followed by the scientist.

BLM 1: Quotations to initiate thinking

"Women are more likely to have their research published if the referees who review their work are unaware of their gender."

- New Scientist, January 2008

"Troubling performance gaps exist between Hispanic and African American students and their white peers, and also across socioeconomic divisions. These achievement gaps continue to show up in grades, dropout rates, advanced science course selection, and standardized test scores. African American and Hispanic science students continue to underperform compared to white students, and poor school districts underperform compared to affluent ones."

- Science Teacher, March 2007

"A number of factors contribute to the high attrition for women (and under-represented minority men) in science."

- Office of the Dean of the College at Brown University, 2005

"If academia is to offer varied role models and perspectives for a diverse population of students, it must become more welcome to women and ethnic minorities."

- Nature, March 2007

BLM 2: Prompts for responses to quotes

i. Why may gender bias exist in peer reviewed journals?

ii. Why do you think gaps in achievement exist?

iii. What could be done to improve or change the achievement of minority groups?

iv. What may be some of the causes of a high drop out or switch out rate among women and men from under-represented minority groups?

v. How could academia become more welcoming to women and ethnic minorities?

BLM 3: Interactive notes on readings

Interactive note taking helps to guide you through a reading and to focus your attention on the important points.

<table>
<tr><th>BEFORE
(prepare to read)</th><th>DURING
(question and comment)</th><th>AFTER
(summarize and synthesize)</th></tr>
<tr><td>• List
o title
o headings
o objectives
o themes
o words to know
• Questions?
• Purpose?
• Important concepts?</td><td>• I wonder why…
• I think…
• This is important because…
• What did they mean by…
• I can relate to this because…
• As I read, I keep asking myself…</td><td>• Some important ideas are…
• The author wants us to…
• I still don’t know why…
• The author’s purpose was to…</td></tr>
<tr><td></td><td></td><td rowspan="2"></td></tr>
</table>

Questions based on the readings:

i. Why might science be viewed as a “male career”?

ii. Is gender and visible minority bias in the sciences a societal issue or something that should be handled by academic institutions?

iii. What types of accommodations might encourage more women and visible minorities to enter scientific fields?

iv. Is there blatant discrimination against women and visible minorities entering the sciences or is there more subtle discouragement?

v. What might subtle discouragement look like?

vi. Create two test questions related to the articles.

vii. Place a comment related to the articles, on the blackboard.

BLM 4: Biography outline

Ask yourself what the focus of your paper, presentation, or poster is. Identify four different aspects of the scientist's life, including:

i. the focus of their research	ii. their greatest accomplishments
iii. how their accomplishments contributed to scientific knowledge and/or improvement to the quality of life	iv. what extensions to the subjects research have been or may be performed

Additional details:

BLM 5: Problem-Solution Sheet

Problems Encountered	Ideas for Solutions
1.	
2.	
3.	
4.	
5.	

Rubric 2:
Research paper on obstacles that must be overcome by an individual with a genetic anomaly

	4	3	2	1
Communication	The writer clearly persuades, convinces or informs the reader about obstacles to be overcome. The writer follows up on these details throughout the document.	The writer attempts to persuade, convince or inform the reader about obstacles to be overcome.	Little attempt is made to persuade, convince or inform the reader about obstacles to be overcome.	Obstacles to be overcome are mentioned.
Knowledge	Information is always accurate and supports the writer's argument.	Information supports the writer's argument.	Information is supported with little fact.	Information is not supported. For example, blanket statements "research shows"
Thinking	Complete solutions to overcoming obstacles are included with explanations of their plausibility.	Solutions to overcoming obstacles are included, but they may not always be plausible.	Solutions to overcoming obstacles are included, with no support for their plausibility.	Solutions are mentioned.

BLM 6: Genetic anomalies KWHL chart

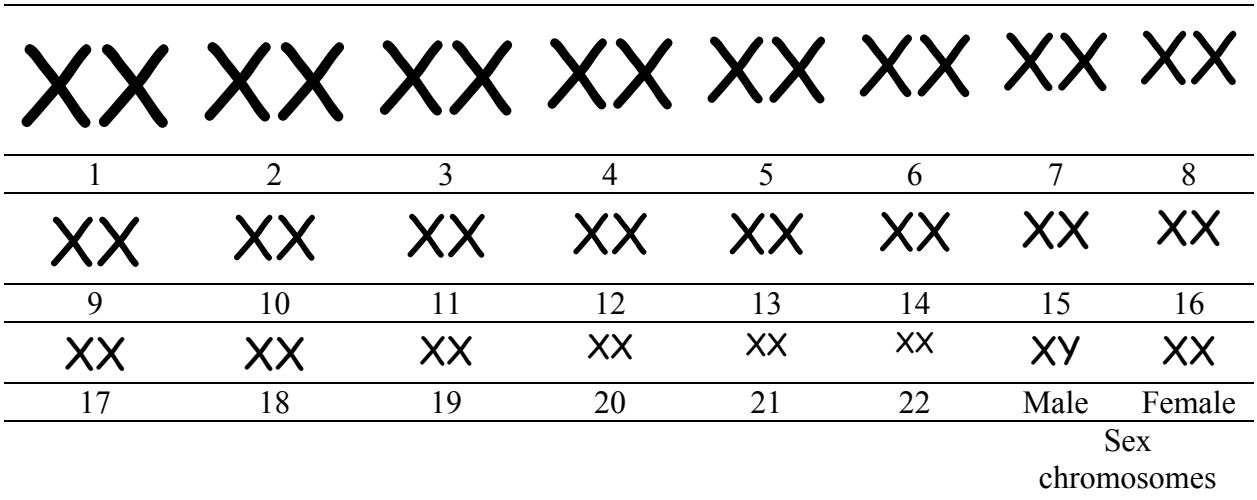
Topic:

What do I **KNOW**?	What do I **WANT** to know?	**HOW** will I learn?	What did I **LEARN**?

Other areas of concern

BLM 7: Karyotype mapping

Karyotype analysis involves organizing chromosomes based on their size and the location and sizes of stained segments of DNA. Our genetic information is stored in 23 pairs of chromosomes that vary in size and shape. Chromosome 1 is the largest, and chromosome 22 is the smallest. The 23rd pair of chromosomes are the sex chromosomes, X and Y. Females have two X chromosomes but males have one X and one Y chromosome. Each chromosome has a centromere that divides the chromosome into a long arm and a short arm and giving chromosomes their usual X shape. Each chromosome has a banding pattern of DNA segments that can be stained to make it visible.



Modified from:

http://www.ncbi.nlm.nih.gov/books/bv.fcgi?rid=gnd.chapter.272

http://www.biology.arizona.edu/human_bio/activities/karyotyping/karyotyping.html

BLM 8: Research into a genetic anomaly

Name of student: _____

Name of genetic anomaly:

Causes:

Symptoms:

Treatments and prevention:

Societal challenges and triumphs:

BLM 9: Comparison organizer for personal response

Subject:	

Use the following terms in the development of your response

CONTRAST

- although
- but
- however
- in contrast
- yet
- nonetheless
- still
- while
- despite
- regardless
- though
- instead

COMPARE

- again
- also
- similarly
- likewise

Examples

- indeed
- such as
- after all
- even
- in fact
- for instance
- for example

Subject:

Main Idea (What do you have to say about the subject):

Paragraph:

Rubric 3: Development of a model of the *Plasmodium vivax* lifecycle

	4	3	2	1
Knowledge	Content of the model is always accurate and complete and contributes to the understanding of the *Plasmodium vivax* lifecycle.	Content of the model is mostly accurate, somewhat complete, and contributes to the understanding of the *Plasmodium vivax* lifecycle.	The model begins to explain the *Plasmodium vivax* lifecycle.	Content of the model does not demonstrate an understanding of the *Plasmodium vivax* lifecycle.
Application	A detailed explanation of all steps of the *Plasmodium vivax* lifecycle enhances the model.	An explanation of some steps of the *Plasmodium vivax* lifecycle enhances the model.	An explanation of the *Plasmodium vivax* lifecycle accompanies the model.	An incomplete explanation of *Plasmodium vivax* lifecycle accompanies the model.
Communication	The model of the *Plasmodium vivax* lifecycle is completely, accurately and neatly labeled.	The model of the *Plasmodium vivax* lifecycle is completely labeled.	The model of the *Plasmodium vivax* lifecycle is mostly labeled	The model of the *Plasmodium vivax* lifecycle is limited in its labeling.

BLM 10: Percentage of Persons with Hb^S by Country

Country	Percentage	Country	Percentage
Tanganyika	5 – 40	Trinidad	10
Uganda	2 – 40	Mauritania	5 – 10
Mozambique	1 – 40	Mexico	0 – 10
Democratic Republic of Congo	4 – 36	USA	0 – 10
Angola	4 – 35	Upper Volta	3.5 – 9.3
Nigeria	18 – 32	Jamaica	6 – 9
Greece	0 – 32	Martinique	6 – 9
Cameroon	6 – 28	Curacao	5 – 9
Liberia	0.7 – 28	Colombia	0 – 9
Burundi	1 – 27	Panama	8
Sierra Leone	27	Guadalupe	0 – 8
Congo (Brazzaville)	26	Cuba	5 – 7
Gabon	13 – 25	Puerto Rico	5 – 7
Kenya	0 – 25	Rwanda	1 – 5
Togo	23	Tunisia	2
Ghana	8.3 – 23	Algeria	1.5
Gambia	4 – 23	Morocco	1.5
Madagascar	3 – 22	Ethiopia	1
Surinam	0 – 22	French Somaliland	1
Niger	20.6	South Africa	1
Chad	20	South West Africa	1
Mali	10 – 20	United Arab Republic	1
Zambia	10 – 2 0	Chile	1
Guinea	8.5 – 20	El Salvador	1
Ivory Coast	4 – 20	Ceylon	1
British Honduras	0 – 20	Cyprus	1
Portuguese Guinea	0.3 – 19.5	India	1
Sudan	2 – 18	Indonesia	1
Dahomey	17	Iran	1
Turkey	0 – 17	Iraq	1
French Guiana	4 – 15	Israel	1
Guyana	0 – 15	Jordan	1
Venezuela	1 – 13	Lebanon	1
Brazil	0 – 13	Macao	1
Senegal	5 – 12	Muscat and Oman	1
Saudi Arabia	0 – 11	Pakistan	1
Dominican Republic	10	Syria	1
Southern Rhodesia	10	Portugal	1

Modified from: Abramson, Harold et. al, 1973. Sickle Cell Disease: diagnosis, management, education and research. The C.V. Mosby Company, Saint Louis

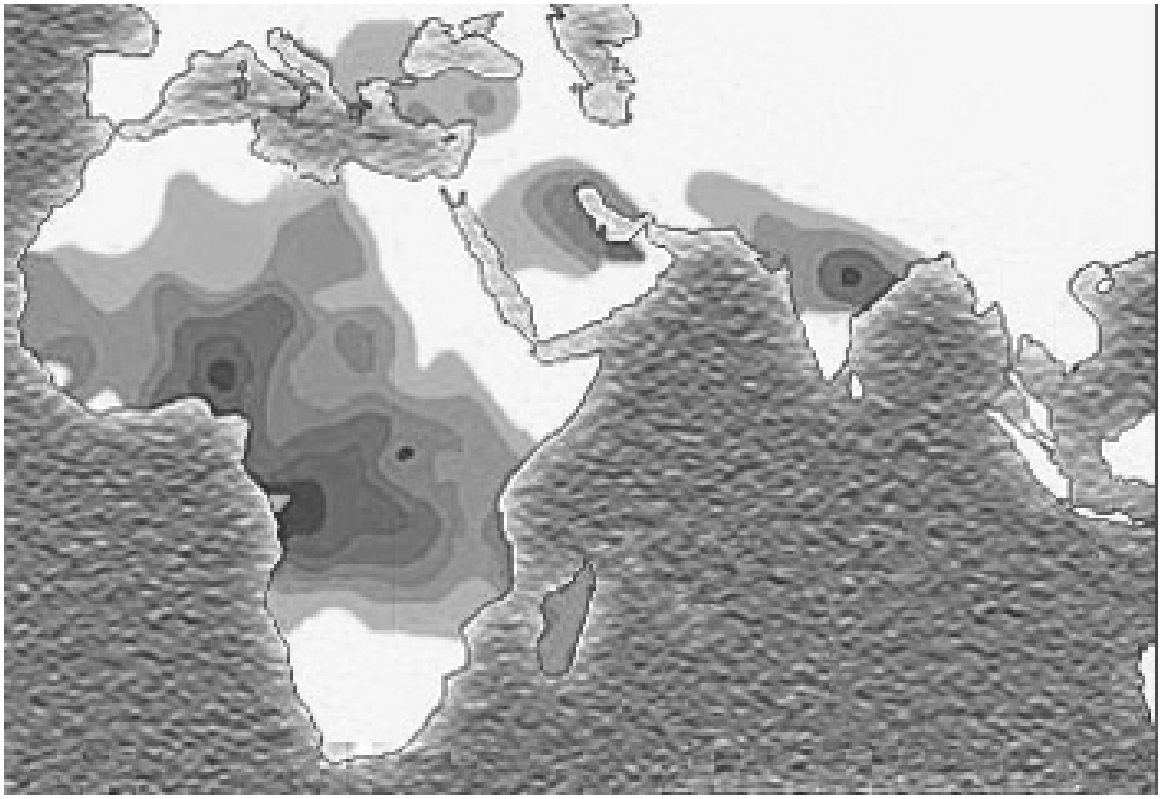
BLM 11: Rate of malarial infection per 100 000 individuals in the population.

Country	Rate per 100 000 individuals in the population	Country	Rate per 100 000 individuals in the population
Uganda	477.93	Kenya	3.94
Sao Tome and Principe	393.53	Colombia	3.72
Liberia	301.51	Belize	3.70
Tanzania (United Rep. of)	289.71	Lao People's Democratic Rep.	3.34
Burundi	273.96	Peru	2.93
Mozambique	269.72	Panama	2.88
Malawi	240.36	Guatemala	2.52
Namibia	223.44	Somalia	2.36
Zambia	190.18	Bolivia	2.31
Solomon Islands	189.94	Brazil	2.13
Ghana	169.81	Bhutan	1.69
Guinea-Bissau	134.57	India	1.67
Benin	121.98	Honduras	1.46
Madagascar	121.49	Nicaragua	1.25
Senegal	119.25	Venezuela	1.23
Burkina Faso	114.95	Haiti	1.18
Guinea	109.53	Indonesia	1.01
Angola	106.90	Tajikistan	0.87
Rwanda	102.09	Pakistan	0.80
Gambia	100.47	Korea (Dem. Peo. Rep. of)	0.73
Zimbabwe	97.60	Thailand	0.56
Sierra Leone	95.41	Philippines	0.55
Togo	92.15	Sri Lanka	0.55
Sudan	91.77	Viet Nam	0.46
Congo (Dem. Republic of)	83.13	Bangladesh	0.39
Vanuatu	71.90	Nepal	0.37
Gabon	66.78	Cape Verde	0.33
Mali	62.23	South Africa	0.30
Mauritania	59.64	Iran (Islamic Republic of)	0.25
Niger	59.05	Paraguay	0.24
Chad	47.66	Malaysia	0.22
Cameroon	45.96	Costa Rica	0.17
Timor Leste	40.89	Dominican Republic	0.15
Guyana	36.09	Turkey	0.13
Swaziland	34.03	Kyrgyzstan	0.09
Suriname	33.65	Azerbaijan	0.06

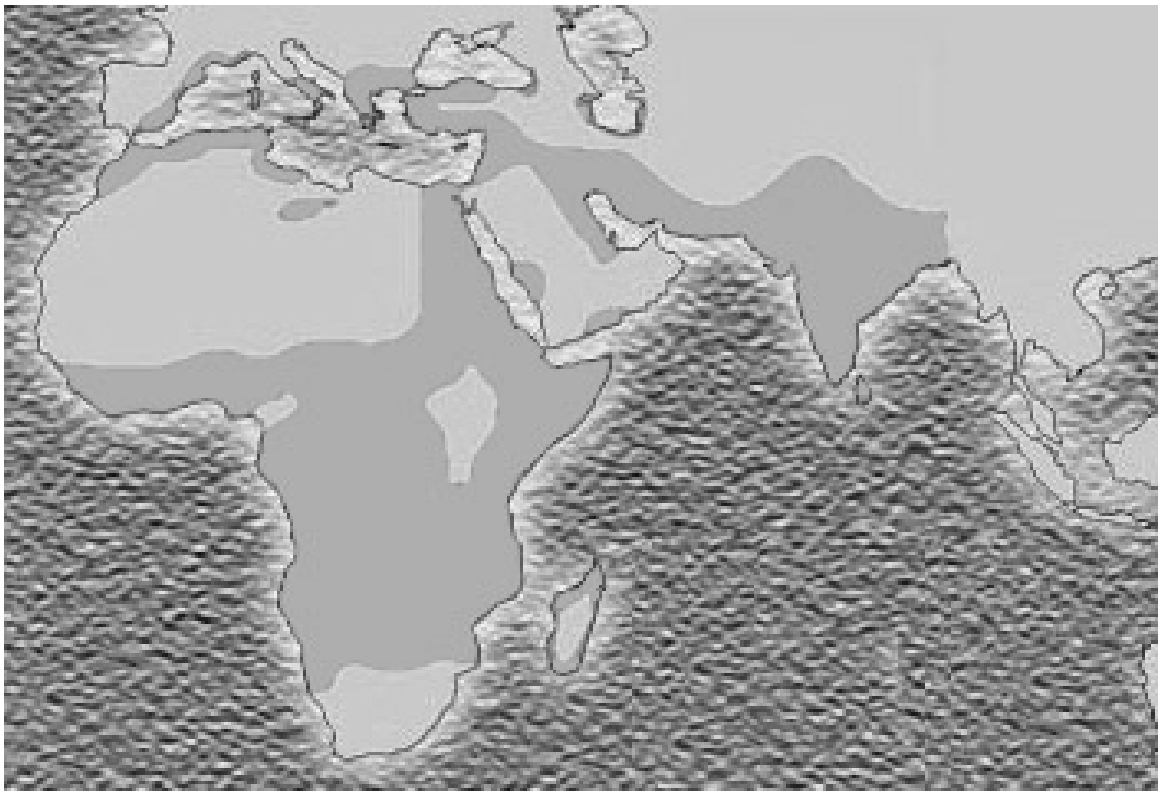
Equatorial Guinea	31.25	Georgia	0.06
Cote d'Ivoire	24.87	Mexico	0.04
Afghanistan	24.75	China	0.02
Central African Republic	24.75	Korea (Republic of)	0.02
French Guiana	21.49	Mauritius	0.02
Nigeria	21.03	Saudi Arabia	0.02
Eritrea	17.39	El Salvador	0.01
Myanmar	14.47	Iraq	0.01
Yemen	13.24	Argentina	0.00
Botswana	12.56	Algeria	<0.01
Papua New Guinea	12.30	Armenia	<0.01
Ethiopia	8.00	Egypt	<0.01
Djibouti	7.17	Morocco	<0.01
Congo	5.28	Oman	<0.01
Comoros	5.12	Syrian Arab Republic	<0.01
Cambodia	5.04	Turkmenistan	<0.01
Ecuador	4.00	Uzbekistan	<0.01

From: http://www.globalhealthfacts.org/topic.jsp?i=24#table
WHO, Roll Back Malaria, & UNICEF, World Malaria Report 2005, Table A.21

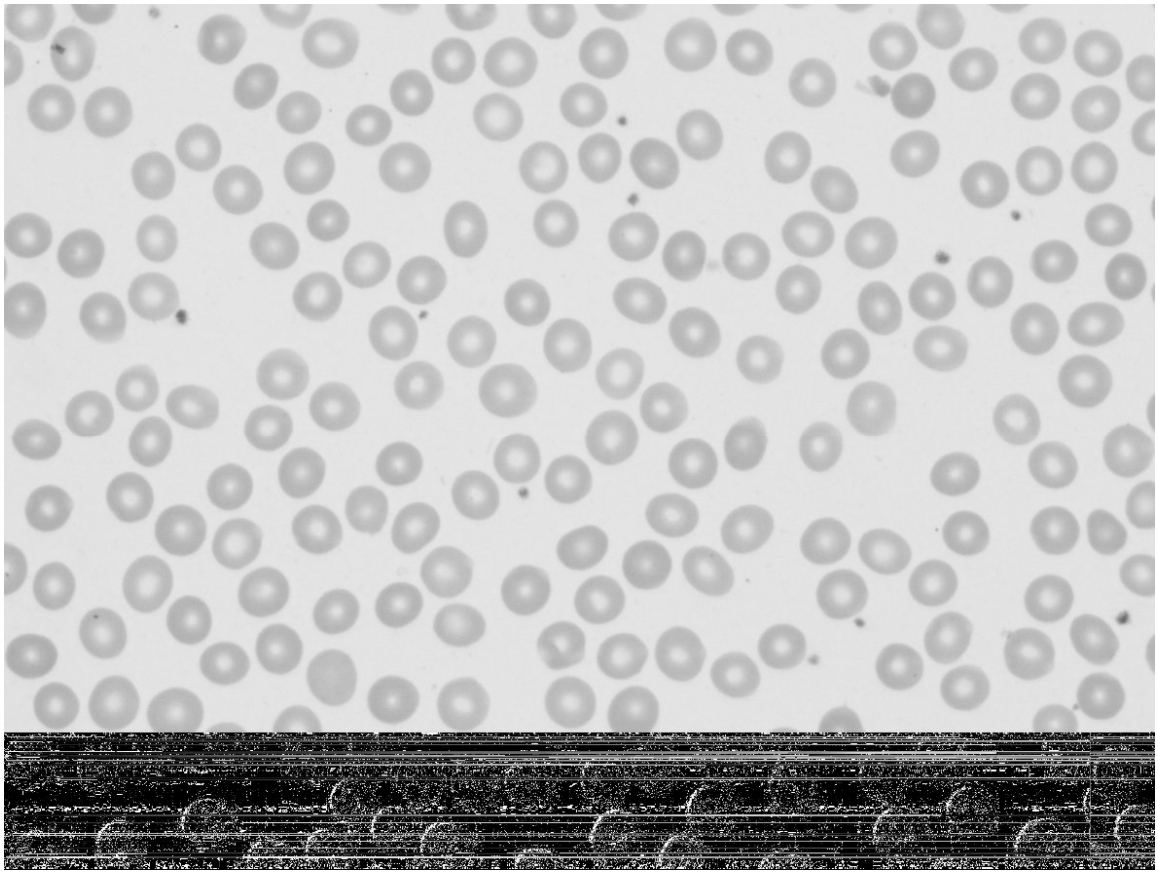
BLM 12: Sickle cell trait distribution



BLM 13: Distribution of malaria

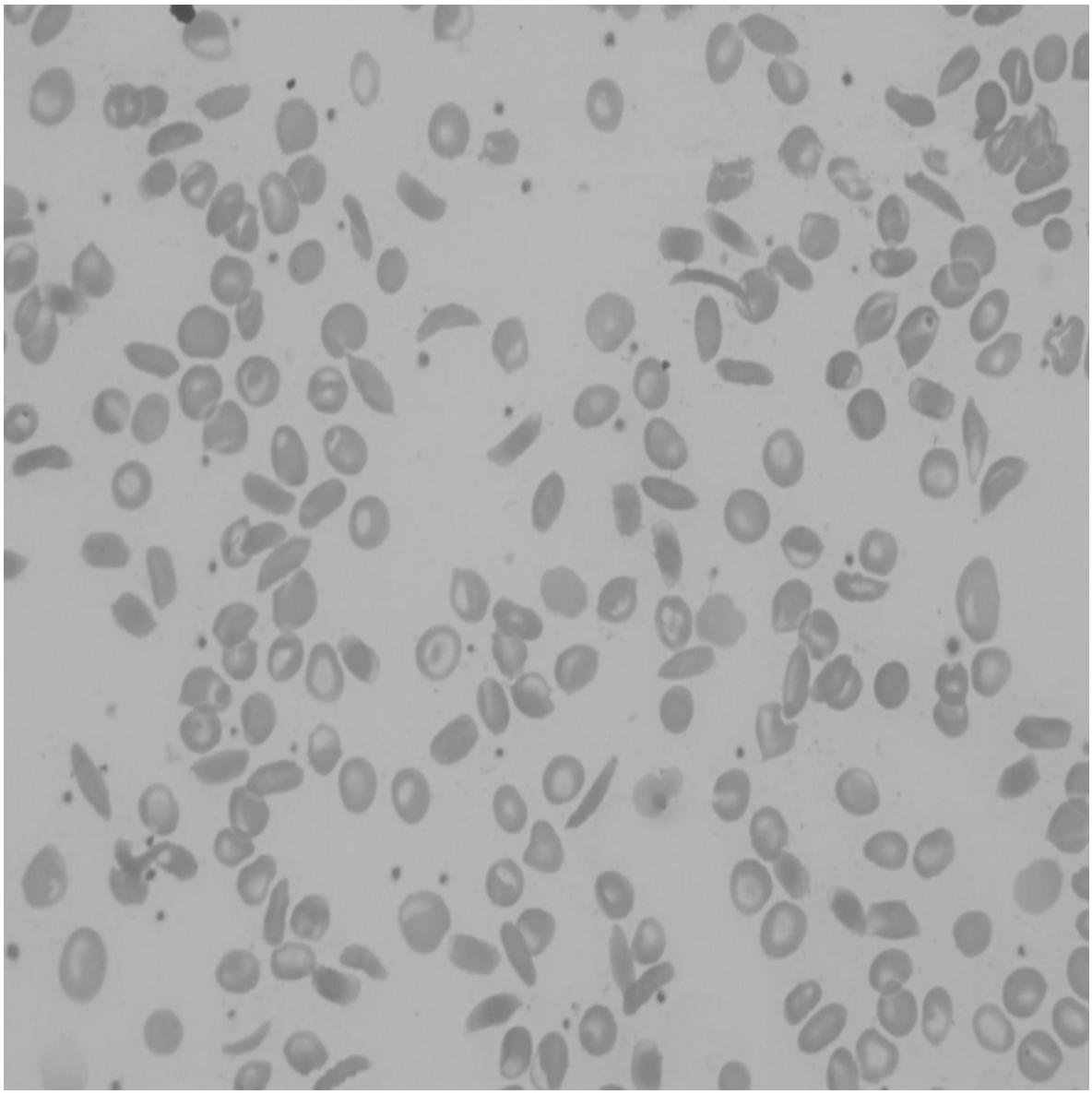


BLM 14: Normal red blood cells



http://www.healthsystem.virginia.edu/internet/hematology/HessImages/Normal-peripheral-blood-RBCs-50x-website.jpg

BLM 15: Sickle shaped red blood cells



http://www.healthsystem.virginia.edu/internet/hematology/HessImages/Sickle-Cell-Disease-40x-

BLM 16: Sickle cell trait inheritance

Sickle cell inheritance by heterozygotes is a case of incomplete dominance. Heterozygotes maintain a level of protection against malarial infection, without suffering from the full effects of sickle cell anemia.

Hb^n Normal hemoglobin protein allele

Hb^s Sickle hemoglobin protein allele

$Hb^n Hb^n$ (homozygous recessive)
Represents an individual with both alleles for normal hemoglobin production. This individual would not be anemic, but they would be susceptible to malaria.

$Hb^n Hb^s$ (heterozygous)
Represents an individual with one allele for normal hemoglobin production and one allele for sickle hemoglobin production. These individuals have a mixture of normal red blood cells and sickle red blood cells. This combination allows these individuals to have protection from malarial infection, while only having mild anemic effects.

$Hb^s Hb^s$ (homozygous recessive)
Represents an individual with both alleles for sickle cell hemoglobin. These individuals will have full blown sickle cell anemia and may die at an early age.

Example of inheritance in a monohybrid cross (heterozygote x heterozygote)

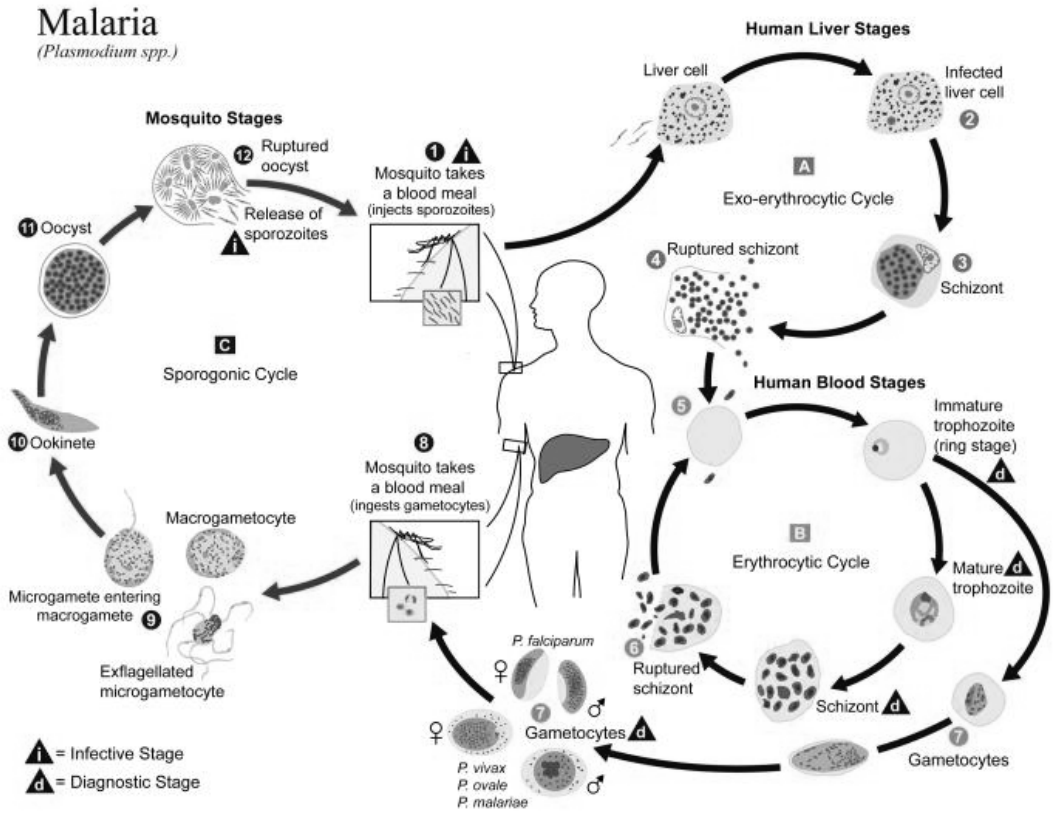
$Hb^n Hb^s$ x $Hb^n Hb^s$

	Hb^n	**Hb^s**
Hb^n	$Hb^n Hb^n$	$Hb^n Hb^s$
Hb^s	$Hb^n Hb^s$	$Hb^s Hb^s$

¼ homozygous dominant
½ heterozygous
¼ homozygous recessive

Heterozygous individuals maintain a level of protection against malarial infection, while suffering minimal anemic effects. These individuals have the fittest phenotype in an environment in which malaria is found. These individuals survive and reproduce in greater numbers than either homozygous type. This explains why the sickle cell trait remains common in regions where malaria is found.

BLM 17: Plasmodium life cycle



http://phil.cdc.gov/Phil/details.asp

BLM 18: The mutation that results in sickle cell formation

DNA Sequence	CAC	GTC	GAC	TGA	GGA	**CTC**	CTC
RNA Sequence	GUG	CAG	CUG	ACU	CCU	**GUG**	GUG
Amino Acid Sequence	Valine	Histidine	Leucine	Threonine	Proline	**GLUTAMIC ACID**	Glutamic Acid

NORMAL PROTEIN

DNA Sequence	CAC	GTC	GAC	TGA	GGA	**CAC**	CTC
RNA Sequence	GUG	CAG	CUG	ACU	CCU	**GTG**	GUG
Amino Acid Sequence	Valine	Histidine	Leucine	Threonine	Proline	**VALINE**	Glutamic Acid

MUTANT PROTEIN

One base substitution in the DNA, an Adenine substituted for a Thymine, results in the RNA codon coding for the amino acid valine, rather than Glutamic Acid in β-globin molecule. This substitution mutation results in the formation of fibres in the protein, the end result is the sickle formation of red blood cells.

Modified from: Stryer, Lubert 1988. *Biochemistry.* W.H. Freeman and Company, New York.

BLM 19: Hypothesis development

Hypothesis (What is your educated guess?)
I predict that

Reasoning (What reasons lead you to this hypothesis?)
The map for regions where malaria is commonly found is similar to the map for regions where the sickle cell allele is found at high frequencies because

Evidence (Facts, Statistics, Observations)		
Evidence	Evidence	Evidence

Acknowledge (To other viewpoints)	Respond

Modified from: http://www.englishcompanion.com/

APPENDIX A: LEARNING SKILLS ASSESSMENT

TEAMWORK	**Level Achieved**			
Shares ideas and resources with all the members their group.	N	S	G	E
Listens to and respects the ideas other members bring to the group.	N	S	G	E
Does fair share of the group's work.	N	S	G	E
Encourages and supports the contributions of others	N	S	G	E
WORKS INDEPENDENTLY	**Level Achieved**			
Uses the information they already have to accomplish work.	N	S	G	E
Begins learning activities on their own without having to be told to start	N	S	G	E
Finish's whatever learning activities started	N	S	G	E
Keeps working at something even when it is difficult for them	N	S	G	E
Revises work whenever it needs improvement	N	S	G	E
INITIATIVE	**Level Achieved**			
Looks for opportunities to learn more about topics that are important	N	S	G	E
Demonstrates curiosity by asking questions	N	S	G	E
Willing to try new roles and to practice new skills	N	S	G	E
Uses a variety of resources to help me (e.g. websites and newspapers)	N	S	G	E
Gets help from teacher and/or class mates when needed	N	S	G	E

Modified from: Arthur, Anne. et.al. 2007.
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APPENDIX B: REFERENCES

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