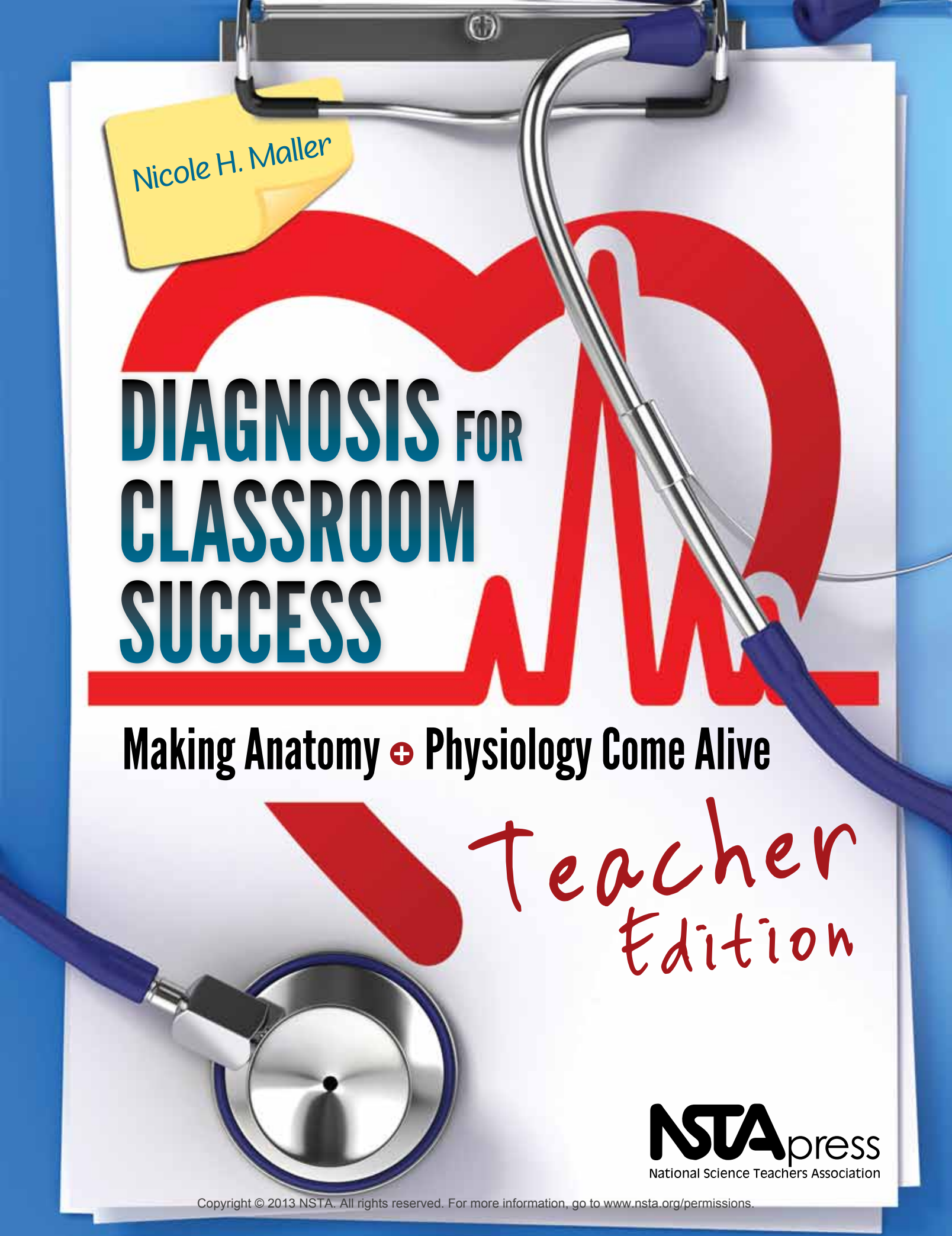
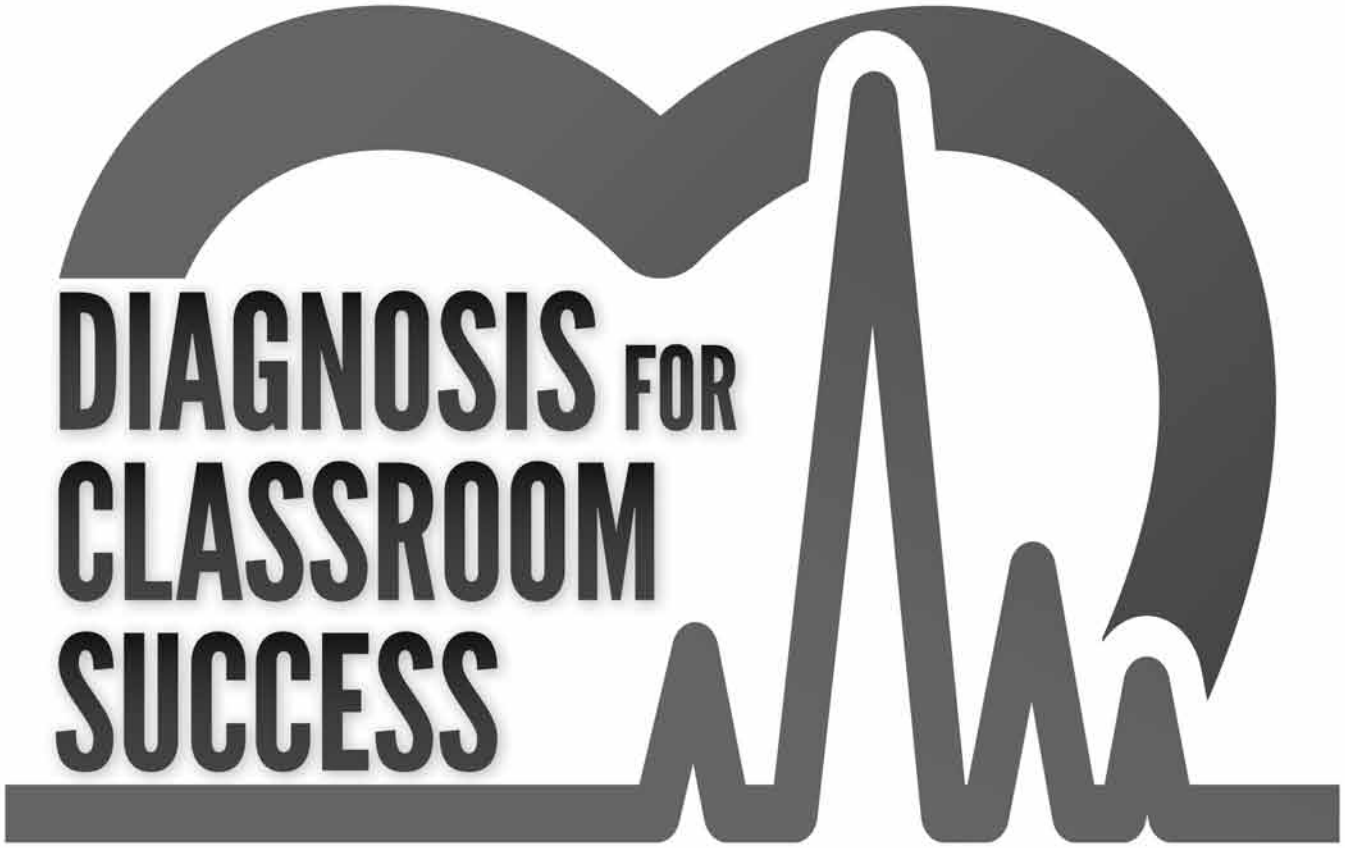


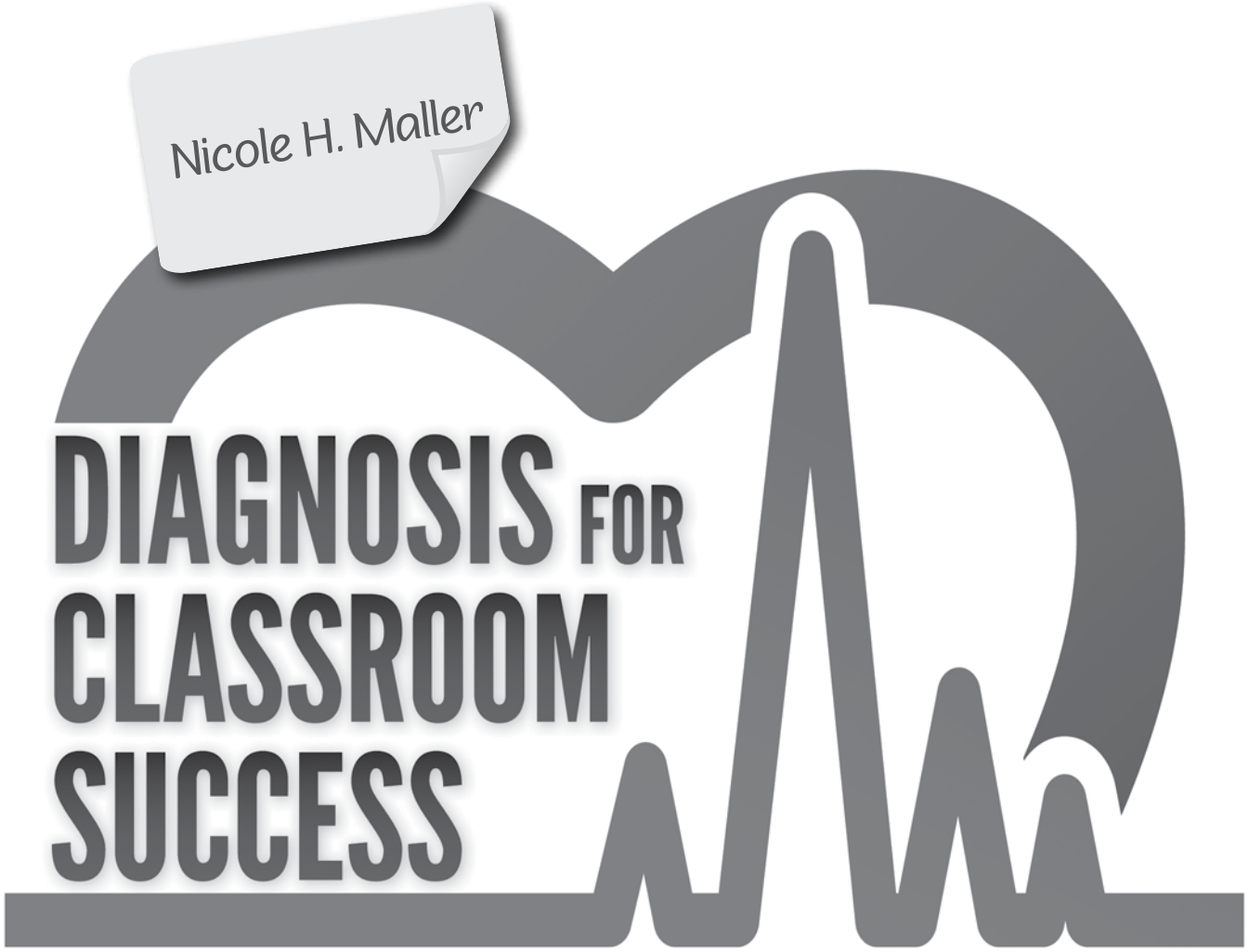


DIAGNOSIS FOR CLASSROOM SUCCESS

Making Anatomy + Physiology Come Alive

Teacher Edition

Nicole H. Maller



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Teacher Edition

NSTA press
National Science Teachers Association

Arlington, Virginia

NSTA press®
National Science Teachers Association

Claire Reinburg, Director
Jennifer Horak, Managing Editor
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Art and Design
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Joe Butera, Senior Graphic Designer, cover and interior design
Images courtesy of ThinkStock.

Printing and Production
Catherine Lorrain, Director

National Science Teachers Association
David Evans, Executive Director
David Beacom, Publisher
1840 Wilson Blvd., Arlington, VA 22201
www.nsta.org/store

16 15 14 13 4 3 2 1

Library of Congress Cataloging-in-Publication Data
Maller, Nicole H.
Diagnosis for classroom success: making anatomy and physiology come alive / by Nicole H. Maller. — Teacher edition.
pages cm
Includes index.
ISBN 978-1-936959-52-5
1. Diagnosis—Study and teaching. 2. Human anatomy—Study and teaching. 3. Human physiology—Study and teaching. 4. Diagnosis. I. Title.
RC71.3.M273 2013
612.0076—dc23

2013009441

CONTENTS

CONTENTS

2 DURING

3 AFTER

Note: **The complete text of the *Student Edition* follows the Index.**

About the Author

Nicole H. Maller received a B.S. in Teaching Biology 7–12 from New York University in 2006 and M.A. in Science Education from New York University in 2010. Her career in education began in Williamsburg, Brooklyn at The Green School: An Academy for Environmental Careers. A year later, she relocated to Manhattan and worked at Vanguard High School, where she continues to teach Living Environment to 10th graders and a Biopsychology course she developed specifically for 11th and 12th graders. During her summers, Nicole teaches Introductory Chemistry and Introductory Forensics at Columbia University's six-week Upward Bound program to first-generation college-bound students. She also tutors middle school and high school students in Manhattan.

Acknowledgments

Vanguard High School
for providing teachers the freedom to teach students the best way they know how

Catherine Bell
for helping me make this vision come to life in the classroom

NYU Professors
Dr. Pamela Fraser-Abder, Catherine Milne, Jason Blonstein, and Bob Wallace
for your guidance and professional insight

Tal Savariego
for your continuous support and editing skills

Jaimie Glick, M.D.
for evaluating my 'Docs' at round tables

Adam Handler, M.D.
for providing feedback and editing for medical accuracy

Family and Friends
for listening to and believing in my ideas

Chapter 8

Teacher Guide for Let's Diagnose Them, Lab 3

Blood Smears

Before the Lesson

- Review the circulatory system with your students. Be sure to discuss:
    - the role of the circulatory system
    - the following blood vessels: *veins*, *arteries*, and *capillaries*
    - the following parts of the heart: *superior* and *inferior vena cava*, *right atria*, *right ventricle*, *pulmonary artery*, *pulmonary vein*, *left atria*, *left ventricle*, and *aorta*
    - the following parts of blood: *red blood cells*, *white blood cells*, *plasma*, and *platelets*.
    - problems that may arise from poor nutrition or genetics: *high blood pressure*, *heart attack*, *strokes*, *hemophilia*, and *sickle cell anemia*.
- Visit our website (*www.StylishSchooling.com*) to download suggested activities and worksheets prior to starting this lab:
    - If your class hasn't watched *Super Size Me* yet, this would also be a good time to show it
    - Have students memorize the *Vena Cava* song for extra credit
    - Dissect a sheep's heart
    - Review how to focus a compound light microscope
- Obtain and set up the following supplies for the Blood Smears lab.

    For each group of four:

    - 1–2 compound light microscopes

- Provide 3 prelabeled, normal blood smears (Patient #1, Patient #2, and Patient #3)
- Provide 1 prelabeled sickle cell blood smear (Patient #4) per group

**Note*: Sometimes students have difficulty observing the slides under the microscope. As an alternative to the microscope, you could print out normal and sickle blood smears from the internet and label them Patient #1–#4.

During the Lesson

- Establish roles for each student:
  - Task Manager—reads procedure and ensures that everyone is following proper lab procedures
  - Materials Manager—retrieves and returns materials; cleans materials and table
  - Doctor(s)—completes the lab work (i.e., focusing the microscope); role is to be completed by more than one group member
  - Recorder—ensures that the group's data is recorded
- Review the procedure before allowing students to begin. Ask for any clarifying questions.
- Monitor student work. Ensure that students are making proper observations and sketching accordingly.

After the Lesson

- Discuss Blood Smear results with the class.
- Ensure that students have returned to their patients' medical charts (Tables 2.1, 2.2, 2.3, and 2.4 on pages 20–23 in Chapter 2, student edition) and completed the section labeled "Lab 3—Blood Smears" for each of the four patients. Make sure they have checked off the evidence collected from each patient and have considered whether or not their original hypothesis is still supported or refuted by the evidence.

Let's Diagnose Them, Lab 3: Blood Smears

Some doctors on your team are beginning to think that some of your patients' symptoms may be caused by either a pathogen or a genetic disorder. A pathogen causes harm or disease in another living organism. Examples include viruses, bacteria, and fungi. Genetic disorders are diseases inherited from one's parents.

Today your team of doctors will analyze the red blood cells (RBCs) of patients under a microscope. Nurses have also provided you with your patients' red blood cell and white blood cell counts. Use your medical school notes (Table 5.1) as a reference for diagnosing your patients.

TABLE 5.1. MEDICAL SCHOOL NOTES REGARDING RED AND WHITE BLOOD CELLS

	Function	Healthy if ...	Unhealthy if ...
Red blood cells (RBC)	Uses the protein, hemoglobin, to carry oxygen around the body	Shaped like a donut Female RBC count = 4.2–5.4 million/µL/cu mm Male RBC count = 4.7–6.1 million/µL/cu mm	Shaped like a sickle, indicating a genetic disorder called **sickle cell anemia**. If *lower* than normal, could indicate anemia, such as **sickle cell anemia**. However, anemia is also common during the first six months of **pregnancy.** If *higher* than normal, could indicate polycythaemia, a disorder of the bone marrow.
White bblood cells (WBC)	Help fight infections by (A) Phagocytosis of foreign agents (B) Producing antibodies against foreign agents	WBC count = 4,300–10,800 cells/µL/cu mm	If *lower* than normal, could indicate viral infections like **HIV**, low immunity and bone marrow failure. If *higher* than normal, could indicate infection, systemic illness, inflammation, allergy, leukemia, and tissue injury caused by burns, or **pregnancy**.

Lab Roles (Fill in Names of Team Members)

1. _____ is the task manager (reads procedure and ensures everyone is following proper protocol).
2. _____ is the materials manager (retrieves and returns materials; cleans materials and table).
3. _____ are the doctors (completes lab work, such as adding chemicals, heating chemicals, and so on; to be completed by more than one group member).
4. _____ is the recorder (ensures the group's data is properly recorded).

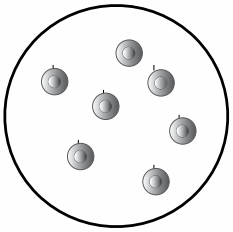
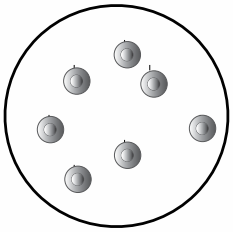
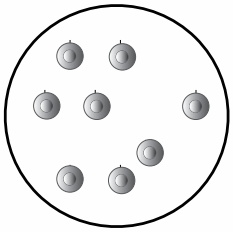
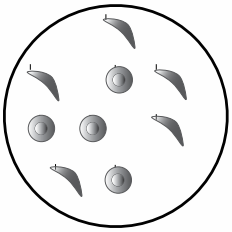
Materials

- 1–2 compound light microscopes
- Blood smears from your four patients, provided by your teacher

Procedure

1. Start with the microscope stage as far away from the lens as possible.
2. Place Patient #1's blood smear on the stage and secure it with the stage clips.
3. Place the objective lens to low power (4×).
4. Using the coarse adjustment (big knob), begin to focus the slide.
5. Once focused, change the objective lens to medium power (10×).
6. Using the coarse adjustment (big knob), begin to focus the slide.
7. Once focused, change the objective lens to high power (40×).
8. Using the fine adjustment (small knob), begin to focus the slide.
9. Sketch your observation of red blood cells at the power most easily observable in Table 5.2.
10. Repeat steps 1–9 for patients #2, #3, and #4.

TABLE 5.2. THE BLOOD SMEAR RESULTS FOR EACH PATIENT

	Patient #1	Patient #2	Patient #3	Patient #4
Sketch a detailed picture of what you observe here:				
RBC Shape Normal or Sickle?	Normal	Normal	Normal	Sickle
# of RBCs million/µL/cu mm Normal, high, or low?	4.4 Normal	3.0 Low	5.1 Normal	3.2 Low
# of WBCs /µL/cu mm Normal, high, or low?	7,004 Normal	11,300 High	2,029 Low	9,001 Normal

Recall Questions

1. What is the role of the circulatory system?

   The circulatory system transports nutrients to, and waste away from, cells in the body.

2. How do arteries differ from veins?

   Arteries are blood vessels that carry oxygenated blood away from the heart toward cells. Veins are blood vessels that carry deoxygenated blood toward the heart away from cells.

3. What problems could arise in the circulatory system from poor nutrition and lack of exercise?

   Problems that can arise from poor nutrition and lack of exercise include heart attacks, strokes, blood clots, high blood pressure, etc.

4. What is the role of a red blood cell?

   Red blood cells carry oxygen molecules throughout the body.

5. How does sickle cell anemia differ from sickle cell trait?

Sickle cell anemia requires two copies of the sickle cell gene (one from mom, one from dad). A person with sickle cell anemia exhibits all the symptoms of the disease. Sickle cell trait requires one copy of the sickle cell gene (one from mom or dad). A person with sickle cell trait does not exhibit all the symptoms of the disease and is often malaria resistant.

6. What happens to the hemoglobin protein on a red blood cell if someone has sickle cell anemia?

The hemoglobin protein is mutated in a person with sickle cell anemia. Rather than carrying the normal four oxygen molecules, a person with sickle cell can only carry half of the amount.

Critical Thinking Question

1. In early 2012, coaches instructed a Pittsburgh professional football player, with the sickle cell *trait*, to sit out a game in the high-altitude city, of Denver, Colorado. Doctors claimed that the trait, in combination with extreme physical activity and a high altitude, was the primary reason he needed to have his spleen and gallbladder removed after a previous game in the city. However, it has been estimated that at least 90 other NFL players carry the sickle cell trait, and of those who have played in Denver, they have never experienced such issues before. In fact, a study performed by Howard University in 2000, showed no complications in athletes carrying sickle cell trait during the Mexico City Olympics, another high-altitude location. Suppose you were a coach of a high school, college, or professional sports team. Knowing what you know about sickle cell anemia and the trait, how would you handle a situation similar to this one, in which one of your players has sickle cell trait or the disease? Justify your position.

Answers may vary.

Conclusion

1. Look back at your medical notes in Table 5.1, and your lab results in Table 5.2. What could these results indicate about your patients?

Patient #2 has normal red blood cells, but a low red blood cell count. Her white blood cell count, however, is high.

This could indicate that she is pregnant. Patient #3 has normal red blood cells and a normal red blood cell count. However, his white blood cell count is too low. This could indicate that he has HIV. Patient #4 has abnormally shaped red blood cells and a low red blood cell count. His white blood cell count is normal. He can officially be diagnosed as having sickle cell anemia based on his blood smear. Patient #1's red blood cells and white blood cells appear normal.

2. Return to your patients' medical charts (Tables 2.1, 2.2, 2.3, and 2.4, pp. 20–23 in Chapter 2, student edition) and complete the section labeled "Lab 3—Blood Smears" for each of the four patients. Check off evidence collected from each patient and consider whether or not your original hypothesis is still supported or refuted by evidence.

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Index

*Page numbers printed in **boldface** type refer to tables or figures.*

Index

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Making Anatomy + Physiology Come Alive

Teacher Edition

"When I entered the teaching profession, I was stunned by the lack of interest my high school students had in science education. The traditional model of teaching science, often referred to as 'chalk-and-talk' with the occasional laboratory mixed in, was not working. The vast majority of my students were not going home and reading the textbooks. I knew I had to make the most of our face-to-face time."

—Author Nicole Maller

To make the most of classroom time—and make students sit up and take notice of science—author Nicole Maller turned to a combination of narrative and role-playing. Among the results is the attention-getting curriculum in *Diagnosis for Classroom Success*.

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ISBN: 978-1-936959-52-5