

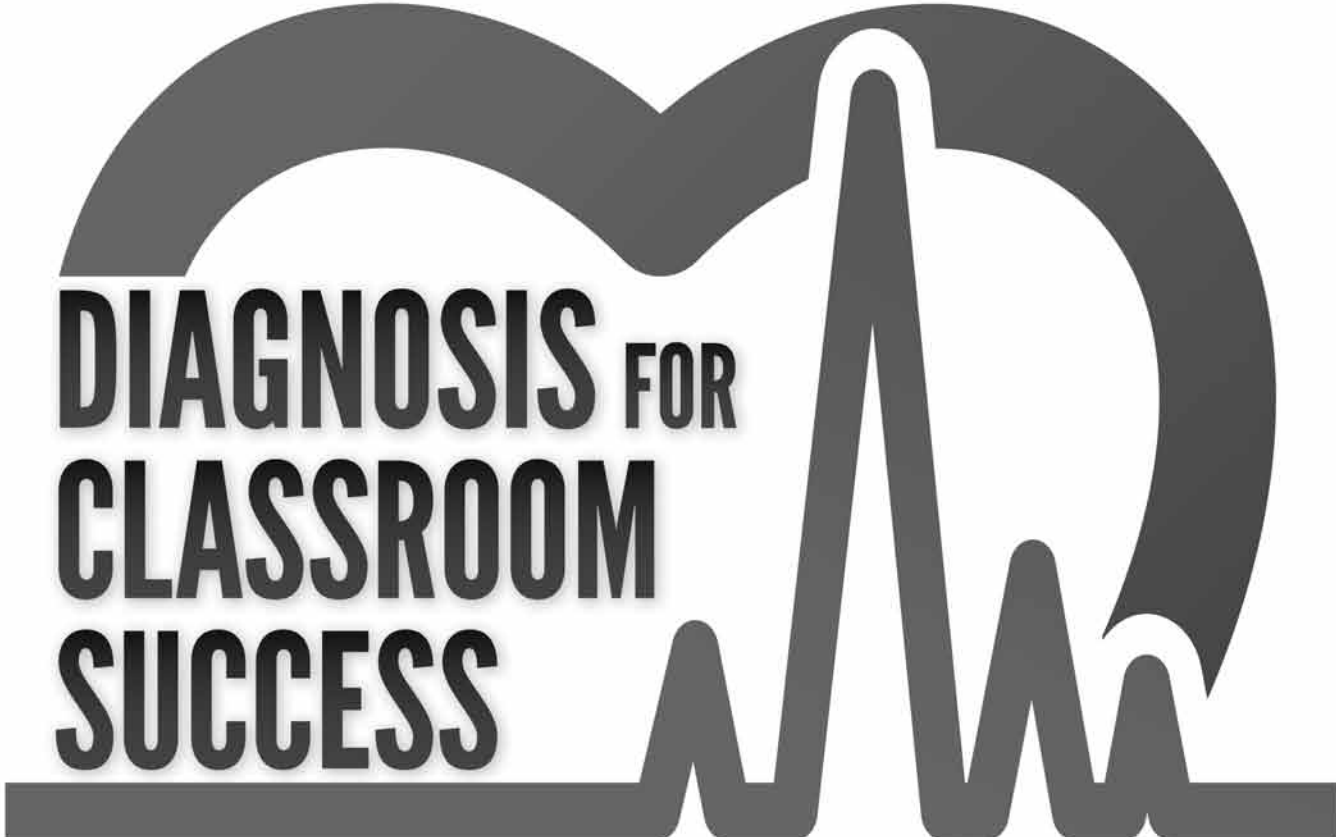
Nicole H. Maller

DIAGNOSIS FOR CLASSROOM SUCCESS

Making Anatomy + Physiology Come Alive

Teacher
Edition

NSTApress
National Science Teachers Association

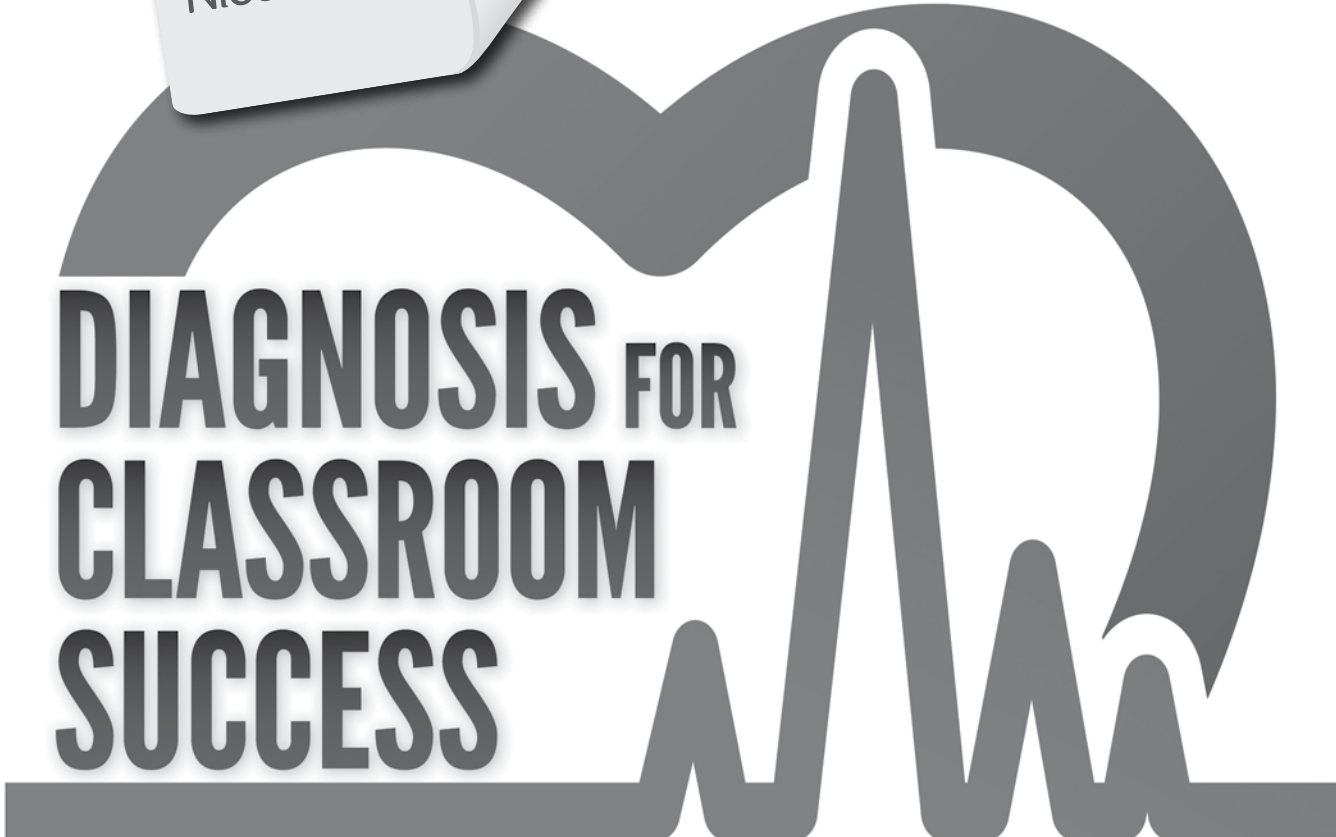
A large, stylized graphic in dark gray. The top half is a heart shape, and the bottom half is an ECG (heart rate) line. The text 'DIAGNOSIS FOR CLASSROOM SUCCESS' is overlaid on the heart portion.

DIAGNOSIS FOR CLASSROOM SUCCESS

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A stylized graphic featuring a dark gray heart shape on the left and a white ECG line on the right, both set against a light gray background. The ECG line starts at the bottom left, goes up to the top of the heart, then down and across the bottom, with several peaks and valleys. A white rectangular tag with a folded corner is attached to the top left of the heart shape.

Nicole H. Maller

DIAGNOSIS FOR CLASSROOM SUCCESS

Making Anatomy + Physiology Come Alive

A dark gray, stylized graphic of a pencil, angled diagonally from the top left towards the bottom right.

Teacher
Edition

NSTApress
National Science Teachers Association

Arlington, Virginia

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C O N T E N T S

About the Author.....vii

Acknowledgments.....ix

1 B E F O R E

Chapter 1: Overview3

Chapter 2: Aligning to Standards.....9

Chapter 3: Teacher Prep Made Easy19

2 D U R I N G

Chapter 4: Teacher Guide for
Earning Your White Coats: Medical School Research.....31

Chapter 5: Teacher Guide for
What's Wrong With Me, Doc? Analyzing Medical Records.....43

Chapter 6: Teacher Guide for
Let's Diagnose Them, Lab 1: Urinalysis59

Chapter 7: Teacher Guide for
Let's Diagnose Them, Lab 2: Digestive By-Products and Body Mass Index Analysis.....67

Chapter 8: Teacher Guide for
Let's Diagnose Them, Lab 3: Blood Smears.....79

Chapter 9: Teacher Guide for
Let's Diagnose Them, Lab 4: HIV Test.....87

C O N T E N T S

2 D U R I N G

Chapter 10: Teacher Guide for	
<i>Let's Diagnose Them, Lab 5: Lung Capacity</i>	<i>97</i>
Chapter 11: Teacher Guide for	
<i>Let's Diagnose Them, Lab 6: Hormone Test</i>	<i>107</i>
Chapter 12: Teacher Guide for	
<i>Emergency! Lab 7: Performing Surgery</i>	<i>115</i>
Chapter 13: Teacher Guide for	
<i>The Ominous Phone Call and Evaluating the Docs</i>	<i>125</i>

3 A F T E R

Teacher Survey	141
----------------------	-----

Index	143
-------------	-----

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.

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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/ μ L/cu mm Male RBC count = 4.7–6.1 million/ μ L/cu mm	Shaped like a sickle, indicating a genetic disorder called sickle cell anemia . If <i>lower</i> than normal, could indicate anemia, such as sickle cell anemia . However, anemia is also common during the first six months of pregnancy . If <i>higher</i> than normal, could indicate polycythaemia, a disorder of the bone marrow.
White blood cells (WBC)	Help fight infections by (A) Phagocytosis of foreign agents (B) Producing antibodies against foreign agents	WBC count = 4,300–10,800 cells/ μ L/cu mm	If <i>lower</i> than normal, could indicate viral infections like HIV , low immunity and bone marrow failure. If <i>higher</i> 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)

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

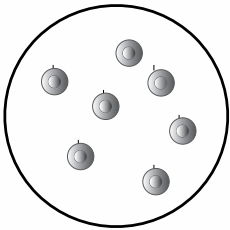
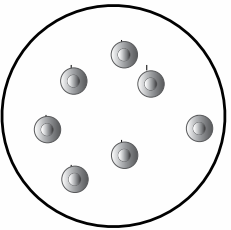
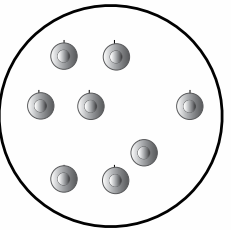
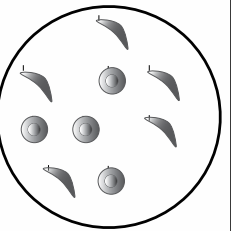
Materials

- 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/ μ L/cu mm Normal, high, or low?	$\frac{4.4}{\text{Normal}}$	$\frac{3.0}{\text{Low}}$	$\frac{5.1}{\text{Normal}}$	$\frac{3.2}{\text{Low}}$
# of WBCs / μ L/cu mm Normal, high, or low?	$\frac{7,004}{\text{Normal}}$	$\frac{11,300}{\text{High}}$	$\frac{2,029}{\text{Low}}$	$\frac{9,001}{\text{Normal}}$

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.

A

*A Framework for K–12 Science Education:
Practices, Crosscutting Concepts, and
Core Ideas*, 6, 10
Abortion by minor, parental involvement and, 113
Alveoli, 104
Arsenault, A., 5
Arteries, 83, 121
Assessment. *See* Evaluating doctors'
performance
Asthma, 104–105

B

Bacterial infections, 81, 87, 94
Birth control, **37**
Blood smears (Lab 3), 33, 79–85
conclusion of, 84–85
critical thinking question related to, 84
lab roles for team members, 80, 81
after the lesson, 80
before the lesson, 79–80
during the lesson, 80
materials for, 22, 79–80, 82
medical school notes regarding red and white
blood cells, 81
PowerPoint slide on, 129
procedure for, 82
recall questions related to, 83–84

recording results for each patient, 80, **83**, 84
role-play comparison chart for, 26
Body mass index (BMI), 73
chart for adults, 67, **74**
ranges for, **74**
recording value for each patient, **75**
relation to health status, 76
significance of high BMI, 75–76
Body systems, 133
Bruner, J., 3

C

Carbohydrates, simple and complex, 75
Careers in science, 5–6
Circulatory system, 79, 83, 89, 115, 121–122, 132
Classroom simulations, 4
comparison chart for, 24–27
Classroom use of lessons, 6
Code of ethics, 39
Common Core State Standards, curriculum
alignment with, 4, 15–17
Core Curriculum State Standards (CCSS), 6, 7
Council of Chief State School Offices (CCSSO), 15
Cowan, B. M., 5
Craciun, D., 4
Cultural relevance and pop culture, 5
Curriculum alignment with state standards, 6, 7,
9–17

Index

Common Core State Standards, 15–17
Next Generation Science Standards, 6, 7, 9–14

D

Diabetes (patient #1), 31, 34
glucose tolerance test for, 11, 16, 25, 27, 108, 109, 111, **111**, **112**, 114
information collected on causes, symptoms, and treatments for, **38**
lung capacity and breathing difficulty in, 99, 104
medical record for patient with, 46–47, **54**
PowerPoint slides on, 129–130
study group assignment for, 34
type 1 and type 2, **39**, 107, 113
Diagnosis, 33
evaluating doctors' performance, 6–7, 33–34, 125–137
final, 127
mystery diagnosis rubric, 134–137
PowerPoint slides on, 129–131
Diagnostic tests, 33
blood smears (Lab 3), 33, 79–85
digestive by-products and body mass index analysis (Lab 2), 67–77
HIV test (Lab 4), 33, 87–95
hormone test (Lab 6), 33, 107–114
lung capacity (Lab 5), 33, 97–105
materials for, 19–23
urinalysis (Lab 1), 59–65
Dialysis, 64
Digestive by-products and body mass index
analysis (Lab 2), 33, 67–77
body mass index, 73
chart for adults, **74**
ranges for, **74**
recording for each patient, **75**
chemical observations for, 71–72
conclusion of, 76–77
critical thinking question related to, 76
lab roles for team members, 68–69, 70
after the lesson, 69
before the lesson, 67–68
during the lesson, 68–69
materials for, 21, 68, 70–71

meaning of nutrient indicator results, **73**
nutrition content found in patients' digestive by-products, **72**
physical observations for, 71
PowerPoint slide on, 128
procedure for, 71–73
recall questions related to, 75–76
recording results for each patient, 69, 77
role-play comparison chart for, 25
setup for, 71

Digestive system, 67, 69, 75, 115, 118–119, 132
Dissection lab. See Organ donation surgery

E

Earning your white coats, 31–40
Hippocratic oath, 39–40
discussion questions related to, **41**
information collected on diabetes, **38**
information collected on HIV infection, **36**
information collected on pregnancy, **37**
information collected on sickle cell anemia, **35**
after the lesson, 32
before the lesson, 31
during the lesson, 31–32
medical school attendance and graduation, 32, 34, 39
resources for, 31
study group assignments, 34
study group at the library, 34
task overview, 33–34
Endocrine system, 107, 112, 115, 116, 132
Evaluating doctors' performance, 6–7, 33–34, 125–137
filling out a prescription, 127
after the lesson, 126
before the lesson, 125–126
during the lesson, 126
mystery diagnosis rubric for, 134–137
oral/visual assessment options for, 125, 128–132
recruiting an authentic audience for, 126
resources for, 125
written assessment options for, 125, 132–133
Excretory system, 59, 61, 64, 69, 115, 119–120, 132

Exhalation, 103

F

Feedback, 17, 34

Fertilization, **37**

Filling out a prescription, 127

Fungal infections, 81

G

Genetic disorders, 81, 133

Glucose tolerance test, 11, 16, 25, 27, 108, 109, 114

graphing results of each patient's test, **112**

medical school notes regarding normal and diabetic test results, **111**

procedure for, 111

recording results of each patient's test, **112**

Glycemic index (GI), 67, 75, 107

Glycogen, 107, 113

H

Hankes, J., 5

Hemoglobin protein on red blood cells, in sickle cell anemia, 26, **35**, **81**, 84, 99, 104

Hippocratic oath, 32, 33, 39, 45, 64

discussion questions related to, **41**

modernized version of, 39–40

Homeostasis, 14, 59, 113, 122, 133

Hormone test (Lab 6), 33, 107–114

conclusion of, 113–114

critical thinking question related to, 113

lab roles for team members, 108, 110

after the lesson, 108

before the lesson, 107–108

during the lesson, 108

materials for, 23, 108, 110

medical school notes regarding hCG and insulin, **109**

PowerPoint slide on, 129

procedure for glucose tolerance test, 111

graphing results of each patient's test, **112**

medical school notes regarding normal and diabetic test results, **111**

recording results of each patient's test, **112**

procedure for pregnancy test, 110

meaning of hCG indicator results, **111**

recording results for each patient, **111**

recall questions related to, 112–113

role-play comparison chart for, 27

Howard, T. C., 5

Human chorionic gonadotropin (hCG), 27, **37**, 107, 108, **109**, 110, 112, 114

meaning of hCG indicator results, **111**

recording results of each patient's pregnancy test, **111**

Human immunodeficiency virus (HIV) infection (patient #3), 31, 34, 87

information collected on causes, symptoms, and treatments for, **36**

lung capacity and breathing difficulty in, 99–100, 104

medical record for patient with, 50–51, **56**

modes of transmission of, **36**

PowerPoint slides on, 130

preventing transmission of, 93

progression to AIDS, 93

study group assignment for, 34

susceptibility to other infections in, 93, 99–100

Human immunodeficiency virus (HIV) test (Lab 4), 33, 87–95

conclusion of, 94–95

critical thinking question related to, 94

lab roles of team members, 89, 90

after the lesson, 89

before the lesson, 87–88

during the lesson, 89

materials for, 22, 88, 90–91

PowerPoint slide on, 129

procedure for, 91–93

recall questions related to, 93–94

recording results for each patient, 89, **93**, 95

results from limited sex partner demonstration, **92**

results from multiple sex partner demonstration, **92**

role-play comparison chart for, 26

time after initial infection before HIV antibodies show up on, 94

Hypothesis generation, 10, 33, 44, 45

Index

I

Immune system, 87, 89, 93, 115, 132
Infectious diseases, 81, 87, 94
Inhalation, 103–104
Insulin, 27, **38**, 67, 107, 109, **109**, **112**, 113, 114

K

Kane, J. M., 5
Kidney dialysis, 64
Kidney function, 64, 119–120
Kids Health website, 31
Kirkland, K., 5

L

Ladson-Billings, G., 4
Lessons
 alignment with state standards, 6, 7, 9–17
 classroom use of, 6
 cultural relevancy of, 5
 materials for labs, 6, 7, 19–23 (*See also specific labs*)
 narrative approach of, 3–4
 pacing chart for, 24
 support for implementation of, 7
 use of role-play in, 4
 comparison chart for, 24–27
 use of Teacher Edition for, 7
Lifestyle choices, 133
Lung capacity (Lab 5), 33, 97–105
 acceptable value for height, weight, and gender, 102, **103**
 each patient's actual lung capacity compared to, **103**
 calculations for determination of, **101**
 conclusion of, 105
 critical thinking question related to, 104–105
 determining by balloon's diameter, **102**
 factors that may cause increase or decrease in, **99**
 lab roles for team members, 98, 100
 after the lesson, 98
 before the lesson, 97
 during the lesson, 98
 materials for, 23, 97, 100
 PowerPoint slide on, 129

 procedure for, 100–102
 recall questions related to, 103–104
 recording results for each patient, 98, 105
 role-play comparison chart for, 27

M

Materials for labs, 6, 7, 19–23. *See also specific labs*
Mayo Clinic website, 31
Medical records, analysis of, 43–53, **54–57**
 after the lesson, 44
 before the lesson, 43
 during the lesson, 43–44
 for patient #1 (diabetes), 46–47, **54**
 for patient #2 (pregnancy), 48–49, **55**
 for patient #3 (HIV), 50–51, **56**
 for patient #4 (sickle cell anemia), 52–53, **57**
 task overview for, 45
Medical school attendance and graduation, 32, 34, 39
Medicare, 64
Milne, C., 3, 5
Musculoskeletal system, 132
Mystery diagnosis rubric, 134–137

N

Narratives as teaching tool, 3–4
National Governors Association Center for Best Practices (NGA Center), 15
National Science Foundation's Project Synthesis, 6
Nervous system, 132
Next Generation Science Standards (NGSS),
 lesson alignment with, 6, 7, 9–14
 dimension I: practices, 10–12
 dimension II: crosscutting concepts, 12–14
 dimension III: disciplinary core ideas, 14
Nutrition terms, 67
Nutritional guidelines for school meals, 76

O

Obesity and overweight, 73, **74**, **75**, 76
Oral/visual assessment options, 125, 128–132
 PowerPoint presentation, 128–131
 public service announcement, 131–132
Organ donation surgery (Lab 7), 33, 115–123

- conclusion of, 123
- critical thinking question related to, 122
- lab roles for team members, 116, 117
 - after the lesson, 116
 - before the lesson, 115
 - during the lesson, 116
- materials for, 23, 115–116, 117
- procedure for, 118–122
 - organ preservation, 122
 - preparing for rat dissection, 118, **118**
- recall questions related to, 122
- Organ donor programs, 122
- Osmosis Jones*, 87
- Outdoor air quality, 105
- P**
- Pacing chart for lessons, 24
- Pappas, C. C., 5
- Pathogens, 81
- Pop culture and cultural relevancy, 5
- PowerPoint presentation, 128–131
- Pregnancy (patient #2), 31, 34
 - information collected on causes, symptoms, and treatments in, **37**
 - lung capacity and breathing difficulty in, 99, 104
 - medical record for patient during, 48–49, **55**
 - PowerPoint slides on, 130
 - study group assignment for, 34
- Pregnancy test, 27, 108
 - meaning of hCG indicator results, **111**
 - procedure for, 110
 - recording results for each patient, **111**
- Privacy of patients, 40, 45
- Prognosis, 33, 127
- Pub Med Health website, 31
- Public service announcement (PSA), 131–132
- R**
- Red blood cells (RBCs), 81, **81**, **83**
 - in sickle cell anemia, **35**, **81**, 99
- Reproductive system, 107, 112, 115, 116, 120, 132
- Research task, 33–34
 - evaluating doctors' performance on, 6–7, 33–34, 125–137
 - study group assignments for, 34, **35–38**
- Residency programs, 32, 45
- Respiratory system, 97, 103, 115, 116, 132
- Role-play, 4
 - comparison chart for, 24–27
- Rubric for evaluating doctors' performance, 134–137
- S**
- Safe sex, 90
- School meals, nutritional guidelines for, 76
- Science education
 - cultural relevancy of, 5
 - curriculum alignment with state standards for, 6, 7, 9–17
 - four needs in, 5–6
 - use of role-play in, 4
 - comparison chart for, 24–27
 - value of narratives in, 3–4
- Sexually transmitted diseases (STDs), 87, 90
- Sickle cell anemia (patient #4), 31, 34, 84
 - hemoglobin protein on red blood cells in, 26, **35**, **81**, 84, 99, 104
 - information collected on causes, symptoms, and treatments for, **35**
 - lung capacity and breathing difficulty in, 99, 104
 - medical record for patient with, 52–53, **57**
 - newborn screening for, 26
 - PowerPoint slides on, 131
 - study group assignment for, 34
- Sickle cell trait, 84
 - sports participation at high altitude and, 84
- Spirometer, 99
- State standards, curriculum alignment with, 6, 7, 9–17
 - Common Core State Standards, 15–17
 - Next Generation Science Standards, 6, 7, 9–14
- Storytelling as teaching tool, 3–4
- Study groups in library, 34
 - assignment of, 34
- Stylish Schooling, 7
- Super Size Me*, 67, 79
- Surgery. *See* Organ donation surgery
- Systems of the body, 133

Index

T

Tate, W., 4

Treatments, 127

for diabetes, **38**

for HIV infection, **36**

during pregnancy, **37**

for sickle cell anemia, **35**

U

Urinalysis (Lab 1), 33, 59–65

chemical observations for, 62–63

conclusion of, 64

critical thinking question related to, 64

lab roles for team members, 60

after the lesson, 60

before the lesson, 59

during the lesson, 60

materials for, 20, 59–60, 61–62

meaning of nutrient indicator test results, **63**

medical school notes regarding results of, **61**

physical observations for, 62

PowerPoint slide on, 128

procedure for, 62–63

recall questions related to, 64

recording results for each patient, 60, **63**, 65

role-play comparison chart for, 25

setup for, 62

V

Vaccines, 94

Varelas, M., 5

Veins, 83, 121

Viral infections, 81, 87, 94

W

White blood cells (WBCs), 81, **81**, **83**, 87, 93

in HIV infection, **81**, 90

Written assessment options, 125, 132–133

body systems, 133

how genes and lifestyle choices affect
homeostasis, 133



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