

BIOLOGY

of Women



THERESA M. HORNSTEIN



JERI LYNN SCHWERIN

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FIFTH EDITION

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Lake Superior College
Duluth, MN

JERI LYNN SCHWERIN

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Revised from the original text by Ethel Sloane



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Biology of Women, 5th Edition

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Dedication

I would like to dedicate this book to my children—Kasha, Nikoli and Elyse—who believed I could do this; my parents, Barb and Hugh; and my sister, Anita. T.H.

I would like to dedicate this book to my family—parents, Frank and Joanne and siblings, Paul, Carolyn, and Jay; my friend, Paul Chang; and my academic advisors, Dr. Francesca J. Cuthbert and Dr. Alan C. Kamil. J.S.

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PREFACE

Ten years have passed since the publication of the fourth edition of *Biology of Women*. Significant developments in scientific research during that time have changed current understanding of many aspects of women's biology and its implications for women's health. Some highlights include:

- The Women's Health Initiative published surprising findings linking hormone replacement therapy (HRT) to breast cancer, stroke, and heart disease in women.
- A new vaccine has been developed to protect women from the human papilloma virus (HPV), a virus that has been linked to both cervical cancer and genital warts.
- New methods of birth control have become available.

Each chapter of the fifth edition presents updated information that reflects current scientific research. This edition has been significantly expanded and re-organized to make the content more accessible to readers, and new features have been added to address a broader range of cultural and social factors in women's experience.

This book balances the needs of students who are science majors with those of students who do not have a strong scientific background. It is accessible to entry levels students, but offers enough detail and critical thinking opportunities to challenge students who already have some understanding of human

anatomy and physiology. In addition, this book can serve as a useful reference for any woman throughout her lifetime.

CONCEPTUAL APPROACH

While anatomy and physiology books cover the body systems, most of the early research that formed the foundation of those texts viewed women simply as a subcategory of men, identical in every way except their reproductive systems. Newer research has found that there are significant differences outside of their reproductive systems between men and women, and that these differences can affect everything from physiological functioning to social interactions. This book explores many of these differences. In addition, social and biological sciences are primarily taught as separate and unrelated disciplines. Many students in the social sciences do not have a strong background in biology, just as many biology students lack an understanding of the interplay between social, cultural, and historical factors and biology. This book brings the biological and social factors together, providing students a foundation for making informed decisions, both in their personal lives and in their chosen fields of study.

ORGANIZATION

The fifth edition is arranged into 18 chapters, most of which are focused on a specific aspect of women's biology or health. Exceptions include

Chapter One and Chapter Two, which present introductory information that provide a foundation for the subsequent chapters. Chapter One introduces students to the scientific method and outlines basic guidelines for evaluating scientific information on the Internet or in the media. Chapter Two gives a general overview of human anatomy and physiology, and serves as an introduction to the body systems.

- **Chapter One: Why Biology of Women?**
This chapter provides an introduction to the book as well as an introduction to the scientific method and evaluating scientific research.
- **Chapter Two: Anatomy and Physiology**
This chapter gives a general overview of human anatomy and physiology and serves as an introduction to the body systems.
- **Chapter Three: Reproductive Anatomy**
The structures and functions of the organs, glands, and tissues of the male and female reproductive systems are examined with an emphasis on the female system.
- **Chapter Four: Reproductive Cycle**
The menstrual cycle is examined with an emphasis on the hormones that influence and orchestrate female reproductive function.
- **Chapter Five: Menstrual Problems: Causes and Treatments**
Disturbances to the menstrual cycle are explored including discussion about their origins and potential treatments.
- **Chapter Six: Reproductive Tract Infections**
This chapter examines the role of the normal flora and their interplay with pathogens of the reproductive tract.
- **Chapter Seven: A Woman's Breasts**
This chapter explores the anatomy of breasts, the physiology of lactation, and breast-feeding. Non-cancerous disorders of the breasts, their treatments, and methods of detecting abnormalities are also described.
- **Chapter Eight: Cancer and other Diseases of the Reproductive System**
This chapter addresses a range of conditions including endometriosis, fibroids, and cancer.
- **Chapter Nine: The Biology of Sex**
This chapter explores the physiology of the female response and discusses sexuality throughout the lifetime. Disorders that affect female sexual function are also addressed.
- **Chapter Ten: Genetics and Fetal Development**
The genetic and developmental processes that take place during pregnancy are discussed in this chapter.
- **Chapter Eleven: A Woman's Body during Pregnancy, Labor, and Delivery**
This chapter explores the physiology of a typical pregnancy, labor, and delivery.
- **Chapter Twelve: Pregnancy Complications**
Conditions and complications that can arise during pregnancy and labor are outlined in this chapter. Methods for monitoring fetal development and potential interventions in case of complications are also discussed.
- **Chapter Thirteen: Birth Control**
This chapter outlines birth control methods with regard to their effectiveness, advantages, and disadvantages.
- **Chapter Fourteen: Infertility: Causes and Treatments**
Causes of infertility and procedures to overcome infertility are discussed in this chapter.
- **Chapter Fifteen: Menopause**
This chapter focuses on menopause as a normal physiological process. Hormone replacement therapy (HRT) and alternatives to HRT are examined.
- **Chapter Sixteen: Nutrition: Fuel for a Woman's Body**
This chapter examines the impact of nutrition on maintaining health. This includes the current nutritional guidelines as well as phytonutrients, antioxidants, and fatty acids.
- **Chapter Seventeen: Women and Stress**
The chapter examines the physiological effects of stress on women.
- **Chapter Eighteen: The Biology of Appearance**
This chapter focuses on the anatomy and physiology of the skin and hair and addresses how and why women alter their appearance.

FEATURES & NEW TO THIS EDITION:

The fifth edition has undergone significant updating, rearrangement, and revision to address the new research from the Women's Health Initiative (WHI) and other research, new options for the prevention and treatment of women's health concerns, and the recognition of other factors that affect women.

The evaluation of scientific information has been added to Chapter 1. A new anatomy and physiology chapter (Chapter 2) provides a system-by-system framework for understanding the body's biological functions and the role of homeostasis in maintaining health. This acts as a foundation for future chapters. The pregnancy chapter from the fourth edition has been divided into three chapters with Chapter 10 addressing genetics, fetal development, and sexual differentiation; Chapter 11 discussing the physiology of a typical pregnancy; and Chapter 12 addressing complications of pregnancy and medical interventions. The fourth edition combined most sexually transmitted infections and reproductive cancers into a single chapter, presented HIV in another, and information on breast cancer in a third. In the fifth edition, sexually transmitted infections, HIV, and normal flora are combined into a single chapter (Chapter 6). Gynecological pathologies and breast cancer are discussed a single chapter (Chapter 8) because of the genetic, hormonal, and treatment similarities. Information from the fourth edition's Health and the Working Woman chapter has been updated and integrated into several of the other chapters. Finally, a chapter which specifically addresses stress and its biological impacts on women has been included. Other significant new features of this edition include:

- Educational research indicates that actively engaging students improves retention and understanding of new information. To that end, critical thinking boxes, case studies, and end-of-chapter questions have been added. To further support active engagement, a separate lab manual is now available with activities that provide hands-on application of information in the text.
- New to this edition, the chapters contain a series of boxes with all new content, many of which were written by sociologists. These include:
 - **Historical Considerations boxes** designed to provide a glimpse into the past and placing the current state of women's biology in context with its historic past.
 - **Social Considerations boxes** that recognize the biological implications of social factors.
 - **Economic Considerations boxes** that address the impact of money on women, especially in regards to health.
 - **Cultural Considerations boxes** seek to broaden the students' view of the world and how culture influences women.
 - **Focus on Exercise boxes** that recognize the influence of exercise on maintaining health and preventing disease.
 - **Focus on Nutrition boxes** that examine the role of nutrition on specific topics related to women's biology.
 - **Evidence Based Practice boxes** focus on new research and current events that are shaping women's biology.
 - **Case Study boxes** provide students with the opportunity to test their understanding of concepts from the chapter by applying them to a scenario.
 - **Critical Thinking boxes** challenge students to think about specific issues related to women's biology and draw informed conclusions.
- Each chapter now concludes with a series of review questions to allow students to check their comprehension.
- The fifth edition contains new, full-color images and graphics designed to support the text.
- The chapters have been reworked and contain new content including:
 1. Why Biology of Women?
 - the importance of studying women's biology
 - the importance of taking an active role and responsibility for one's own health
 - how to evaluate information presented in the media
 - an introduction to the scientific method
 2. Anatomy & Physiology: An Overview of a Woman's Body
 - an entirely new chapter addressing the basics of anatomy and physiology
 - an introduction to hormone physiology
 - how the body maintains homeostasis

- o differences between male and female anatomy other than the reproductive system
3. Reproductive Anatomy
 - o updated with new information
 - o a revised and updated section on gynecological exams
 - o examines both the male and female reproductive systems and the common origins of homologous structures
 4. Reproductive Cycle
 - o extensively rewritten to focus on the integrated nature of reproductive hormones
 - o expanded information on the role of reproductive hormones on other body systems
 5. Menstrual Problems: Causes and Treatments
 - o focuses on irregularities of the reproductive cycle
 - o presents the latest information gleaned from scientific literature
 6. Reproductive Tract Infections
 - o extensively rewritten and updated
 - o new focus on the role of normal flora in maintaining vaginal health
 - o updated information on identification of sexually transmitted infections
 - o updated information on prevention
 - o explanation of expedited partner therapy
 7. A Woman's Breasts
 - o updated information
 - o extensively rewritten and reorganized
 - o increased emphasis on the biology of lactation and breast-feeding
 8. Cancer and other Diseases of the Reproductive Tract
 - o updated information concerning diagnosis and testing
 - o focuses on the role of reproductive hormones and genes on cancers of the breasts and the reproductive tract
 9. The Biology of Sex
 - o updated information concerning the physiology of sex
 - o expanded information on the biological costs and benefits of sexual activity
 - o expanded and updated information on sexuality through the lifespan
 10. Genetics and Fetal Development
 - o explains the process of mitosis and meiosis
 - o follows development from fertilization through fetal development
 - o expanded information on the influences of teratogens and endocrine disruptors during embryonic development
 11. A Woman's Body during Pregnancy, Labor, and Delivery
 - o extensively rewritten
 - o describes the physiology of normal pregnancy and delivery
 - o examines delivery options including midwives and doulas
 12. Pregnancy Complications
 - o a new chapter which addresses the complications that can arise during pregnancy and delivery
 - o examines medical interventions during pregnancy, labor, and delivery
 13. Birth Control
 - o completely updated
 - o includes information on new options including the ring, menstrual suppression, and emergency contraceptives
 - o identifies new information on the safety of contraceptives
 - o contains updated information on abortion
 14. Infertility: Causes and Treatments
 - o extensively rewritten
 - o examines newly identified causes and treatment options
 15. Menopause
 - o focuses on menopause as a normal physiological process
 - o completely rewritten and updated with new information from WHI studies
 - o provides information on alternatives to hormone replacement therapy

16. Nutrition: Fuel for a Woman's Body
 - o extensively rewritten
 - o new information on phytonutrients, antioxidants, and fatty acids
 - o updates the information relating diet to osteoporosis and cardiovascular disease
 - o updated with the latest dietary recommendations
17. Women and Stress
 - o all new chapter recognizing the role stress plays on women
 - o examines the physiological changes that occur with stress
 - o examines the differences between the male and female stress response
 - o explores methods for coping with stress
18. The Biology of Appearance
 - o extensively rewritten
 - o examines multiple forms of body art ranging from cosmetics to tattoos and scarring
 - o examines the chemical composition of common cosmetics

ANCILLARY PACKAGE

The complete supplements package for *Biology of Women* fifth edition was developed to achieve two goals:

1. To assist the student in learning the information presented in the text.
2. To assist instructors in planning and implementing their courses for the most efficient use of time and other resources.

Student Resources

Laboratory Manual to Accompany Biology of Women

ISBN 10: 1-4354-0035-6

ISBN 13: 978-1-4354-0035-1

A valuable companion to the core book, this student resource provides 17 lab exercises that coordinate with and reinforce the text. Covering topics ranging from lab safety and the scientific method, to skeletal

system differences between women and men, and a sexually transmitted infections lab, this resource provides everything needed for a successful lab experience. Objectives and materials are outlined, followed by explanation and activities for students to participate in, and concluding with laboratory report questions including multiple choice, matching, and long answer response questions.

Instructor Resources

Instructor's Resource to Accompany Biology of Women

ISBN 10: 1-4354-0034-8

ISBN 13: 978-1-4354-0034-4

The Instructor's Resource CD-ROM has four robust components to assist the instructor and enhance classroom activities and discussion.

Instructor's Manual

An electronic Instructor's Manual provides excellent tools to help the instructor create a dynamic and engaging learning experience for the student. The Instructor's Manual contains the tools listed here but can be downloaded and modified to meet individual instructional goals.

- Teaching Tips & Strategies: This section provides engaging ideas and tips for the instructor to use in conjunction with the chapter topics.
- Discussion Topics: These excellent and provocative discussion topics can be used to challenge critical thinking and to create an interactive classroom experience.
- Assignments and Activities: These additional ready-to-use activities and assignments provide more opportunities to challenge students and assess their understanding of chapter concepts.
- Additional Resources: With more great resources to help deliver lectures, additional resources include weblinks as well as topic specific additional sources such as journals, books, and organizations.
- Answers to Case Studies and End-of-Chapter Questions: Answers and intended outcomes for chapter case studies and review questions are provided to assist the instructor in grading and evaluation.

XVIII PREFACE

- Answers to the *Laboratory Manual to Accompany Biology of Women*: To help instructors make the most of their time, answers and rationales for the student labs are provided.

Computerized Testbank in Exam View™

- Includes a rich bank of over 700 multiple choice, matching, and fill-in-the-blank questions that test students on retention and application of material in the text.
- Answers are provided for all questions, letting instructors focus on teaching, not grading.
- Allows instructors to create custom tests by mixing questions from each of the 18 chapters of questions, modifying existing questions, and even adding additional questions to meet individual instructional needs.

Instructor Slides Created in PowerPoint

- A comprehensive offering of over 500 instructor slides created in PowerPoint outlines concepts

from the text to assist the instructor with lectures is included.

- Ideas are presented to stimulate discussion and critical thinking.

Image Library

- Over 160 photos and figures from the text are provided in a searchable database, allowing instructors to incorporate visual support in their lectures, assignments and exams.

AVENUE FOR FEEDBACK

For comments, questions, or suggestions, please feel free to contact:

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ABOUT THE AUTHORS

Theresa Hornstein earned an AS from Muskegon Community College, a BS from Michigan Technological University, and an MS from the University of Wisconsin, Superior. After several years working in labs and field research positions, she moved into teaching both online and in a traditional classroom in the biology department at Lake Superior College in Duluth, MN. Courses she has taught include cell biology, microbiology, general biology, botany, science skills, pathophysiology, anatomy and physiology, student research, and biology of women. In addition, she has taught a number of workshops for GirlTech, a local program designed to get 10-14 year old girls interested in science. She has been awarded four Awards for Excellence grants through the Minnesota State Colleges and Universities, as well as serving on the state wide Task Force for Thinking Assessments and as Center for Teaching and Learning coordinator at Lake Superior College. In 1992, the Minnesota State Board for Community Colleges named her an Outstanding Faculty Member. Her research interests include vermicomposting projects on campus, comparisons of online and on ground student success, applications of the FIRE critical thinking model, edible landscaping, and natural dye projects. She has presented at both regional and national conferences including Fusion2010, I-Teach, the National Science Teachers Association, NISOD, and Women's Lives, Women's Voices, Women's Solutions: Shaping a National Agenda for Women in Higher Education.

Jeri Schwerin earned a B.S. in biology at the University of Minnesota, Duluth; and an M.S. in biology from the University of Massachusetts, Amherst. As a graduate student, she served as a National Science Foundation Teaching Fellow at Hampshire College in Hadley, Massachusetts, and as a program coordinator at the Sigurd Olson Environmental Institute at Northland College in Ashland, Wisconsin. She currently holds a position as a biology instructor at Lake Superior College in Duluth, Minnesota, where she teaches anatomy and physiology, biology and society, and biology of women. In addition to teaching, she serves on the college's Academic Affairs and Standards Council and on the Environmental Council. She has been awarded seven Awards for Excellence by the office of the Chancellor of the Minnesota State Colleges and Universities. In addition to teaching, she currently provides public outreach education with the Lake Superior Research Institute of the University of Wisconsin, Superior onboard their research vessel, the LL Smith Jr.

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social, economic, and cultural boxes and provided a sociological perspective to complement our biological ones. Our reviewers who made valuable comments and suggestions that greatly improved our early drafts. Dan Kodatsky who asked the question, “Would you consider writing?” Maureen Rosener who looked at our first proposal and liked it enough to take a chance on us. And, finally, Juliet Steiner, our editor, who played midwife to this project. Your encouragement kept us going. T.H. & J.S.

FOREWORD TO THE FOURTH EDITION OF BIOLOGY OF WOMEN

During the final preparation of the fourth edition of *Biology of Women*, Ethel Sloane died of an illness she had lived with and fought for many years. In the last months of her life, she was working diligently at her computer to update this book. When that no longer was easy for her, a group of extraordinary colleagues from the University of Wisconsin-Milwaukee stepped in to help her, making contributions to several chapters to ensure that the information covered was accurate and up to date. This edition of *Biology of Women* could not have been completed without the expert assistance and great generosity of the following people at the University of Wisconsin-Milwaukee: Rene Gratz, professor, Department of Health Sciences; Donna Van Wynsberghe, professor, Department of Biological Sciences; Ruth E. Williams, assistant vice chancellor; Leslie Schulz, professor, Clinical Laboratory Sciences program; and Reinhold Hutz, professor, Department of Biological Sciences. Later, after Ethel Sloane's death, Rene Gratz, Donna Van Wynsberghe, and Ruth E. Williams put in hours of work to make sure the manuscript was complete and prepared exactly as Ethel would have wished it to be. Cathy Esperti, executive

editor at Delmar Cengage Learning, was committed to making sure this edition would be published without a hitch, and marshaled all the resources at her disposal to bring it to print.

After her death, a generation of Ethel Sloane's students wrote or spoke to us, members of her family, to describe the powerful impact this book and the course it was written for had on their development as healthcare professionals or as healthcare consumers. All of them described the feeling of empowerment it gave them, a consequence of learning how to better understand their bodies in sickness and in health, and how to better communicate with healthcare providers. Many of them shared stories of how that knowledge changed their lives or helped them bring about change in the lives of their mothers, sisters, or daughters.

Ethel's friends, family, colleagues, and editor wanted to ensure that the fourth edition of this book would be available to yet another group of students, instructors, and readers. It is a testimony to Ethel that *Biology of Women* continues to enrich people's lives.

The family of Ethel Sloane

HOW TO USE THIS TEXT

This text is designed with you, the reader, in mind. Special elements and boxes appear throughout the text to guide you in reading and to assist you in learning the material. Following are suggestions for how you can use these features to increase your understanding and mastery of the content.

Chapter 2

ANATOMY AND PHYSIOLOGY: AN OVERVIEW OF A WOMAN'S BODY

CHAPTER COMPETENCIES
Upon completion of this chapter, the reader will be able to:

- Explain the importance of homeostasis
- Explain the general mechanisms that the body uses to maintain homeostasis
- Summarize the organ systems of the body
- Summarize the primary functions of each of the organ systems
- Discuss how the organ systems are interdependent on each other and how changes in one organ system can affect the other systems

KEY TERMS

anatomy	exocrine gland	non-specific defense	physiology
central nervous system	homeostasis	parasympathetic	positive feedback loop
electrolyte	hormone	nervous system	specific defenses
endocrine gland	inflammation	peripheral nervous system	sympathetic nervous system
endocrine system	negative feedback loop		

OWNER'S MANUAL FOR THE BODY
In spite of their many differences, females and males share a common body plan. In order to understand the differences that make females and males unique from each other, it is important to first understand the foundation of understanding the biology of the human body.

Introduction to Homeostasis
In order to function properly, a person must maintain homeostasis. Homeostasis refers to the main-

Critical Thinking

Risks Associated with Using Hormonal Forms of Birth Control to Treat Menstrual Irregularities

Hormonal forms of birth control such as oral contraceptives are often used to regulate the menstrual cycle and to treat abnormal menstrual symptoms. Scientific studies have shown that using hormonal forms of birth control can carry some serious health risks, and at the same time, may impart important health benefits. What are the factors that a woman would need to consider as she contemplates using hormonal birth control as a means for treating menstrual problems?

CHAPTER COMPETENCIES AND KEY TERMS

Competencies list the core concepts you should master after reading and studying each chapter. These are a good way to introduce the chapter content and are a great review tool. Key Terms introduce you to the terminology covered in the text, and accompanying definitions can be found in the end of book glossary.

CRITICAL THINKING

Read the information in these boxes and consider the questions. Use your critical thinking skills to answer these complex questions.



Historical Considerations


BIOLOGY IS NOT DESTINY: UNDERSTANDING 'SEX' AND 'GENDER' AND CHANGING GENDER NORMS

In the natural and social sciences, 'sex' and 'gender' do not mean the same thing. 'Sex' refers to the biological distinction as to whether one is female or male. 'Gender,' on the other hand, refers to the social attributes associated with being male or female in a given society. Gender is by definition a relational concept, because it deals with the relationships between women and men and how these relationships are socially constructed. Importantly, gender is not biological. Girls and boys are not born knowing how they should look, how they should relate to others, or what they should be when they grow up. Rather, girls' identities in a social context means to be a woman through a process of learning roles, and expectations, and important things to know about social roles and expectations that differ from culture to culture and across periods in history.

We can look at our own country and see how gender roles have changed. A hundred years ago, the Senate or House of Representatives would not have women serving as judges on the Supreme Court or playing professional sports, or in military operations, or in

state. Gender roles from the time of your great-grandparents are not what they are today. Things have certainly changed.

One interesting thing about gender is that it is often easier to see it when one is looking back through history, or outside of one's own society. That's because entrenched social norms like those related to gender are often so conventional and treated as normal that people do not question them. But think about the way that gender affects decisions that people make every day. How does gender influence the way you think about yourself, your



Cultural Considerations


MARRIAGE AND HIV

According to the latest global estimates provided by the World Health Organization and UNAIDS, women comprise 50 percent of people living with HIV. While the numbers are equitable, the situation for women is far from it, and the fight for gender equality is increasingly understood as one of the vital components of an effective fight against this pandemic. As the Global Coalition on Women and AIDS has noted: "In some parts of the world, women and girls are infected with HIV almost as soon as they start having sex. Almost everywhere, traditions tolerate and even encourage men to have multiple sexual partners. On the other hand, are expected to be faithful. In many places, they are expected to be faithful, uninformed" (GCWA, 2009).

The traditional 'Abstinence-only' approach to HIV prevention (Abstinence from sex with a single partner, Condom use) has been shown to be not take into account women and girls, and is typically successful in practice. In practice, violence is high, abstinence is not an option for women and young women coerced into sex who are at risk. Women are at risk of HIV regardless of whether they are faithful because where monogamy does not exist, women are becoming infected. A

to ask their partners to use condoms or to refuse unprotected sex.

In Cambodia, which has the highest proportion of HIV-positive adults in Southeast Asia, married women now account for almost half of all new HIV infections in the country (Kaiser, 2005). In Zambia, only 11 percent of women believe that a woman has the right to ask her husband to use a condom—even if he has proven himself to be unfaithful and is HIV-positive (GCWA, 2009). In Zimbabwe, researchers revealed that the majority of HIV positive women were infected by their



Economic Considerations

ECTOPIC PREGNANCY IN INSURED WOMEN

In recent years, insurance data has become a method of estimating the rates of ectopic pregnancies, at least in populations of women with health insurance. Two studies—one covering 1997 to 2000 (van den Eeden et al., 2005) and a second covering 2002 to 2007 (Hover et al., 2010)—used claims information from United States commercial insurance companies to determine that rates of ectopic pregnancy remained unchanged over the sample periods. However, treatments changed. While the

rates between 1997 and 2000 indicated that the frequency of ectopic pregnancy did not increase, the number of women who received medical treatment for the condition did (van den Eeden et al., 2005). The nonsurgical methotrexate treatment, usually an outpatient treatment, increased from 11 percent of cases in 2002 to 35 percent by 2007. This corresponded with a decrease in more expensive surgical treatment from 40 percent to 33 percent (Hover et al., 2010).

Case Study

It is not Appendicitis

Gina is 23 years old. She and her partner have been trying to get pregnant, and she is delighted when her period is finally late. She is concerned, however, because she has been experiencing occasional sharp pain on the left side of her abdomen. Her first concern is that she may be having an appendicitis attack, but then she remembers that pain from appendicitis usually occurs on the right side of the body. She decides to ignore the pain, but a couple of hours later she finds herself doubled over on the bathroom floor experiencing excruciating pain and nausea. Her partner rushes her to the hospital, where an ultrasound identifies

ectopic pregnancy. The doctor tells her that it is a good thing that she was brought to the hospital when she was because her fallopian tube was beginning to rupture, and if that had occurred, she could easily have died of severe hemorrhage.

1. Which treatment is most common for an ectopic pregnancy?
2. Why can't the embryo continue to grow in the fallopian tube?
3. What factors may be contributing to the increased frequency of ectopic pregnancies?

CONSIDERATIONS...

Four unique boxes have been provided to connect biological science with the experience of being a woman. Historical Considerations examine woman's experience in a historical context to foster understanding of women's biology today. Social Considerations recognize the biological implications of social factors. Cultural Considerations broaden your understanding of the world and how culture influences women. Economic Considerations explore the impact of money on women, particularly in regards to women's health.

CASE STUDY

Case Study boxes present a fictionalized individual's experience, then ask you to synthesize information read in the chapter to develop your own educated responses to the case study questions.

additional types of accessory structures such as horns, antlers, tusks, and even scales in the case of armadillos. People probably have more awareness of their integument than of any other organ system of the body because it is the most visible. There is a popular misconception that the skin is the largest organ. However, in terms of surface area, the lungs, the circulatory system, and the digestive tract are larger. The skin functions as the primary barrier between the outside environment and the body inside, protecting against thermal, chemical, and physical injury. Relatively waterproof, the skin allows the body to exist in dry air without losing too much water by evaporation and to be immersed in water without appreciably swelling. Because it is abundantly supplied with nerve endings, the skin acts as an enormous sense organ, constantly receiving information from its surface for transmission to the brain. Finally, the skin and the accessory structures serve the important function of creating a person's individual appearance, which makes a person recognizable and distinguishable from others.

focus on
NUTRITION

Vitamin D, Sun Exposure, and Health

The skin plays a role in the body's ability to make vitamin D. When exposed to UVB rays, the skin converts a form of cholesterol into the precursor of Vitamin D3. The amount of vitamin D a person's body can manufacture depends on season, latitude, sun exposure, and age. It has now been recognized that more than 50 percent of the world's population is vitamin D deficient, fueling a collection of disease conditions affecting nearly every system in the body. Low levels of vitamin D lead to inadequate bone growth, osteoporosis, cardiovascular disease, increased risk of common cancers, and autoimmune conditions (Holick, 2008). There is evidence that vitamin D-fortification of foods is not meeting the nutritional needs of consumers, and it also appears that many people are not manufacturing as much vitamin D as they would be if they were getting more sun exposure. A moderate amount of sun, not enough to produce a sunburn, can have beneficial effects that go far beyond just strong bones and teeth.



lar skeleton includes all of the other bones and it is primarily involved in the movement of the limbs. The major bones of the skeleton are identified in Figure 2.8.

Skeletal System
The skeletal system consists of the bones and cartilage that support the body. The skeleton is made up of the skull, spine, and ribcage. The bones are made of calcium and phosphorus. The red bone marrow in the center of the bones produces red blood cells. The axial skeleton includes the skull, spine, and ribcage. The appendicular skeleton includes the arms and legs. The skeleton is essential for protecting internal organs and supporting the body.



focus on
EXERCISE

Exercise for Bone Health

Aging can bring with it a loss of bone mineral density causing bones to become more fragile. This condition, called osteoporosis, is a major cause of disability in older women, although men can be affected too. Compression fractures in the spine that result from bones becoming too weak to support the body can lead to a stooped posture, and lack of flexibility. Exercise throughout the lifetime, including into old age, is important to maintain and preserve adequate bone density. There are several types of exercise that are beneficial for maintaining bone density. Weight-bearing exercises including aerobic activities such as walking, dancing, gardening, and low impact aerobics put a strain on the bones of the skeleton which stimulates the osteoblasts to deposit more minerals to reinforce the bones. These types of exercises also provide benefits to the cardiovascular system and help to prevent heart disease. Swimming, although it does provide cardiovascular benefits, is not a weight-bearing exercise so it does not benefit the bones directly.

Strength training, which includes using free weight, weight machines, resistance bands, or weight-bearing exercises can stim-

work or exercise is another factor that affects bone growth and maintenance. Increased mechanical stress in the form of weight-bearing exercise increases the activity of the osteoblasts, resulting in increased bone density. Bone density decreases over time, especially after menopause. Osteoblasts respond strongly to estrogen. One reason women are, on average, shorter than men is their difference in estrogen levels. The epiphyseal plates, which are also called growth plates, in a girl's bones grow faster and seal much earlier than those in boys because of the higher concentrations of estrogen in her blood. Consequently, she will complete her growth earlier while her bones are still somewhat shorter. At menopause, decreased estrogen initially slows osteoblast activity for a time period of about five years. After that, the body compensates for the decrease in estrogen, and the rate of bone loss decreases.

Mechanical stress caused by work or exercise is another factor that affects bone growth and maintenance. Increased mechanical stress in the form of weight-bearing exercise increases the activity of the osteoblasts, resulting in increased bone density. Bone density

males, body frame weight, in bone larger age. To women exercise, to a level of the osteoporosis, debilitated for men, after 15.

EVIDENCE BASED PRACTICE

Childbirth Fever

Childbirth fever, also known as puerperal fever, is a bacterial infection most often caused by the bacteria *Streptococcus pyogenes*. Throughout history, this disease was a common cause of mortality in women following delivery. In 1795, Alexander Gordon documented an outbreak of the disease in Aberdeen, Scotland. Gordon's data linking transmission of the disease from patient to patient via nurses and physicians was published in *A Treatise on the Epidemic Puerperal Fever in Aberdeen* in which he proposed several methods of controlling the spread

of the disease. He compared the data from two obstetrical wards in the Allgemeine Krankenhaus, a hospital in Austria. His careful research found that while equal numbers of deliveries were carried out at each ward of the hospital, there were vast differences in the rates of childbirth fever between them. In the ward in which deliveries were attended only by midwives, only 60 deaths from childbirth fever occurred per 3,000 deliveries. Women in the second ward of the hospital who were attended by doctors and medical students suffered over 100 deaths per 3,000 deliveries.

control over urination or incontinence. In some cases, childbirth can damage the sphincters causing a condition called stress incontinence in women. Medical procedures such as episiotomy and delivery

Testosterone has effects on muscle development and on the integument. None of the body systems can exist by themselves and all have an important role in maintaining homeostasis.

REVIEW QUESTIONS

1. What is homeostasis, and how does the body maintain homeostasis?
2. Explain the differences between a negative and a positive feedback loop?
3. Which two organ systems exert the most regulating influence over the other systems?
4. How would you differentiate between the central and the peripheral nervous systems?
5. What is the autonomic nervous system, and what does it control?
6. Explain the difference between the sympathetic and parasympathetic nervous systems.
7. What is a hormone, and how do hormones work?
8. Explain how osteoclasts and osteoblasts influence bone growth and bone density.
9. Why are some types of muscle in the body voluntary, while other types are involuntary?
10. Explain the difference between arteries, veins, and capillaries. How are these vessels similar; how are they different?
11. What are some differences between specific immunity and nonspecific immunity?
12. In the digestive system, where does the majority of nutrient absorption into the bloodstream occur?
13. List at least two functions of the urinary system.
14. What skeletal differences exist between men and women or are they identical?
15. What is the function of the integumentary system?

CRITICAL THINKING QUESTIONS

1. Why do most organs in the body have both parasympathetic and sympathetic innervation?
2. If a woman had a tumor on her pituitary gland that caused the gland to secrete excess thyroid stimulating hormone, what effect would this have on her thyroid gland's production of thyroid hormone? How would it effect the production of thyroid releasing hormone from the hypothalamus?
3. What might be the long term effects for a woman of taking a medication that inhibits the activities of osteoclasts? Are the long term effects different from the short term effects?

FOCUS ON...

The Focus on Nutrition and Focus on Exercise boxes provide a deeper examination of how specific issues relate to women's biology. They go beyond general information to provide you with a richer understanding of the role of nutrition and exercise in women's issues.

EVIDENCE BASED PRACTICE

This feature box presents current research on a topic covered in the chapter and demonstrates how it has impacted practice or policy surrounding women's issues. These boxes emphasize how continual research can change our understanding of women's health and well-being.

REVIEW QUESTIONS AND CRITICAL THINKING QUESTIONS

Test your understanding of information covered in the chapter with the end of chapter review and critical thinking questions. These questions encourage a synthesis of information and are an excellent way to challenge your comprehension.

WHY BIOLOGY OF WOMEN?

CHAPTER COMPETENCIES

Upon completion of this chapter, the reader will be able to:

- Identify biological differences between women and men
- Describe an overview of the history of women's biology
- Explain the necessity of understanding the language of science as it relates to women's biology
- Discuss guideline for analyzing and evaluating scientific information

KEY TERMS

basic research
cardiovascular disease
Civil Rights Act
clinical investigations
control group
double-blind study

hormone replacement
therapy
midwifery
myocardial infarction
(MI)
observational study

peer-reviewed
placebo
primary care
physician
prognosis
pseudoscience

randomized clinical
trial
randomized sample
sample size
Title IX
wise woman

Women are biologically unique from men. While all humans carry out similar metabolic functions and have a similar body structure, interactions between hormones and genes in a woman modify the undifferentiated human into an organism with anatomical and physiological characteristics distinct from her male counterpart (Figure 1-1).

Exploring the differences between men and women from a scientific standpoint is not something new. Consider these comments by Albert H. Hayes from his 1869 *Sexual Physiology of Woman and her Diseases*.

“Never, at any period in the history of the world, was Woman such an object of interest and discussion, in speech and in print, as the present time. The press teems with works on woman, - works sociological, physiological, ... It is high time that this knowledge were popularized, and placed within the reach of the entire female sex of the United States, so that, in all the junctures and crises of life, they may have the knowledge that will make them equal to the emergency.” (pg. 25)

Research presented in *Exploring the Biological Contributions to Human Health: Does Sex Matter?* (Wizemann & Pardue, 2001) identifies a number



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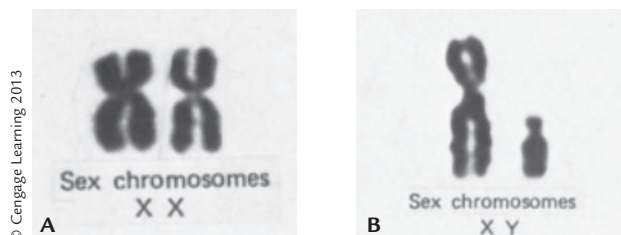
FIGURE 1-1: While structurally and metabolically similar, women are anatomically and physiologically distinct from men.

of biological differences between men and women, differences not limited to the reproductive system. For example, women and men respond differently to pain (Paller et al., 2009). Some brain functions are different between women and men. Women and men recruit different areas of the brain for both motor and memory tasks and to differing degrees (Bell et al., 2006). In addition, blood flow to the brain through the external carotid arteries is greater in women (Yazici, Erdoğan, & Tugay, 2005). Women metabolize many medications more quickly than men (Miyazaki & Yamamoto, 2009) indicating that dosages may need to be adjusted for sex. Under physiological stress, women have a more active immune system (Timmons et al., 2006) which should make them better at fighting infections, but may also explain their higher rates of autoimmune conditions, in which the immune system turns against the body. Women build muscle more slowly during strength training, but they are also slower to lose muscle mass when they stop training (Ivey et al., 2000). Research continues to identify other sex-based differences based on biological factors.

Reasons for these differences range from physiological variations due to the genes on the X chromosome to hormonal influences on gene expression. Body cells in a woman have two X chromosomes, one received from her mother, the other from her father. The cells in a man, on the other hand, contain an X from his mother and a Y from his father (Figure 1-2). The X chromosome contains 1100 genes that are not found on the Y chromosome (Migeon, 2007). In a woman's cells, one of the X chromosomes is deactivated, leaving only one X chromosome per cell to express its genes. Deactivation appears to be random, so the maternal X chromosome is deactivated in some cells and the paternal X chromosome is deactivated in others. Because of this, women are a genetic mosaic with some cells expressing the maternal X chromosome, and others expressing the paternal. This provides greater genetic variability and adaptability in women.

Cultural and social structures also play a role in the expression of biological differences and, equally as important, the understanding of those differences. Social customs may lead to sexual differences that are interpreted as being biological in origin. Dietary differences and differences in activities can also produce physiological differences. Is the higher rate of osteoporosis currently seen in women in some cultures due to women doing less weight-bearing exercise (a cultural factor) or to a difference in hormones that influence bone formation (a biological factor)? Is it due to a combination of these factors or something yet unrecognized? How much gender influences biology varies from one cultural to another depending on what is considered encouraged or acceptable behaviors for a woman in that culture.

This leads to a need to clarify some terms. Sex and gender are not the same thing. From a genetic



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FIGURE 1-2: A. Karyotype of a human female B. Karyotype of a human male.

basis, there are two sexes. Those individuals with two X chromosomes are genetically female while those individuals with an X and a Y chromosome are genetically male. However, gender depends on both the genetic sex, biological factors other than chromosomes, and social influences. The American Medical Association (AMA), the World Health Organization (WHO), and Committee on Understanding the Biology of Sex and Gender Differences follow these definitions (Wizemann & Pardue, 2001).

Women have always had a presence in scientific study and, by extension, healing and medicine. The acknowledgement of their contributions, however, has fluctuated over the centuries, primarily due to cultural or religious views of acceptable roles for women. The traditional **wise woman**, the herbalist who treated the illnesses of friends, neighbors, and family, appears in nearly every culture. **Midwifery**, the practice of attending women during childbirth, in particular, became the realm of women in many cultures. Both the Bible and the Torah mention female midwives who were respected medical professionals. However, in early history, a lack of scientific understanding of anatomical structure and the physiology of reproduction spawned myths and misconceptions which still haunt women today.

The rise of the Christian Church in Europe coincided with a decline in rights, position, and education of women. This is not to say women completely vanished from the scientific world. For example, in the 1100s, Abbess Hildegard von Bingen compiled her *Physica* which covered topics ranging from natural history to medicine to metals. She included information on women's health in particular, including detailed information on menstruation, childbirth, and abortion (Throop, 1998). During the Renaissance period, medicine took several important leaps forward, as did the understanding of

focus on

EXERCISE

Recommendations Concerning Exercise and Activity Levels for Women: A Historical Perspective

What is considered to be good exercise for women? Throughout time and place, that has changed. Consider the following recommendation from *The Young Woman's Guide* written in 1846 by William Alcott, a progressive educator in his day and the uncle of Louisa May Alcott. "Two hours of active walking a day are worth a great deal... I must omit, of course, in a work like this, intended for young women, the mention of any motion more rapid than walking. Running, to those who have passed their teens, would be unfashionable... Who could risk the danger of being regarded as a romp?" (p. 212) At the time, light gardening was also considered a questionable activity for young women, although housekeeping, skating, and riding horseback were encouraged. Riding in an open carriage was also considered acceptable exercise.



human anatomy and physiology. Increased interest in dissections of human cadavers led to anatomical works by DaVinci and Vesalius which illustrated the internal anatomy of the human body. Despite these improvements in knowledge, women still faced a relatively high risk of death from infection and complications of pregnancy, and populations as a whole suffered from high death tolls from infectious disease. This period also saw an increasing divide between those with formal medical training and the folk practitioners, many of whom were women. Midwives and wise women continued to be the primary practitioners to help women through childbirth.

The development of the first microscopes and other technologies opened the way for scientific discoveries about how the body works at a cellular level. The new technologies began to uncover the workings within the human body. Improvements in microscopes led to histological research that identified structures that had never been seen before, and allowed scientists to identify bacteria and other



Historical Considerations

BIOLOGY IS NOT DESTINY: UNDERSTANDING 'SEX' AND 'GENDER' AND CHANGING GENDER NORMS

In the natural and social sciences, 'sex' and 'gender' do not mean the same thing. 'Sex' refers to the biological distinction as to whether one is female or male. 'Gender,' on the other hand, refers to the social attributes associated with being male or female in a given society. Gender is by definition a relational concept, because it deals with the relationships between women and men and how these relationships are socially constructed. Importantly, gender is not biological. Girls and boys are not born knowing how they should look, how they should relate to others, or what they should be when they grow up. Rather, girls and boys develop their gender identities in a social context, and they learn what it means to be a woman, or what it means to be a man through a process of 'socialization'. Socialization is a process of learning one's cultural norms, social roles, and expectations about behavior. One of the important things to know about gender is that these social roles and expectations can and do change. They differ from culture to culture and at different periods in history.

We can look at our own history in the United States and see how gender roles have changed. A hundred years ago, there were no women in the Senate or House of Representatives. There were no women serving as judges, and no women sitting on the Supreme Court. There were no women playing professional sports, no women directing military operations, and no women governing any

state. Gender roles from the time of your great-grandparents are not what they are today. Things have certainly changed.

One interesting thing about gender is that it is often easier to see it when one is looking back through history, or outside of one's own society. That's because entrenched social norms like those related to gender are often so conventional and treated as normal that people do not question them. But think about the way that gender affects decisions that people make every day. How does gender influence the way you think about yourself, your life's ambitions, your relationships to others, your interests, and your personal experiences? Is there anything about the way gender operates in our society that you would like to change?

Gender norms and roles are also shaped by historical forces. Take the simple example of women wearing pants. You may enjoy wearing your favorite pair of jeans and think little of it, but in the past, a woman wearing pants was seen as something of a provocation, certainly unfeminine, and not respectable or socially appropriate attire for a woman. Pants did not come into popular use among women until World War II, when women entered the paid workforce in unprecedented numbers. Women entering the factory labor force to support the war effort made wearing pants a practical necessity. Even Rosie the Riveter got into the action and was depicted on posters wearing overalls to work!

microscopic organisms. By the 1800s, this research led to the link between microbes and disease.

Dr. Ignác Semmelweis working at the Allgemeine Krankenhaus in Vienna, Austria, is credited with instituting a series of procedures designed to minimize contamination during childbirth and publicizing the role of simple hand washing in preventing the spread of the disease. While the recognition of contamination by bacteria during childbirth as the cause of puerperal fever and the need for more sterile

conditions to prevent it saved lives, it also ushered in the era of viewing childbirth as an "illness" to be managed by physicians.

The late 1800s brought much more research into women's health. Dr. Albert Hayes published a book titled *Sexual Physiology of Woman and her Diseases* (1869), one of the earliest texts examining health issues specific to women from both a scientific and a social point of view. Some of this research led to curious conclusions about women and their anatomy

EVIDENCE BASED PRACTICE**Childbirth Fever**

Childbirth fever, also known as puerperal fever, is a bacterial infection most often caused by the bacteria *Streptococcus pyogenes*. Throughout history, this disease was a common cause of mortality in women following delivery. In 1795, Alexander Gordon documented an outbreak of the disease in Aberdeen, Scotland. Gordon's data linking transmission of the disease from patient to patient via nurses and physicians was published in *A Treatise on the Epidemic Puerperal Fever in Aberdeen* in which he proposed several methods of controlling the spread of the disease. Unfortunately, Gordon's ideas were met with skepticism at a time when microbes had not yet been identified as potential causes of disease. It took another 50 years before the next major breakthrough regarding this disease occurred.

Other researchers continued to explore the causes of childbirth fever. Ignaz Semmelweis took Gordon's information and expanded upon it, conducting studies of several thou-

sand deliveries and comparing the data from two obstetrical wards in the Allgemeine Krankenhaus, a hospital in Austria. His careful research found that while equal numbers of deliveries were carried out at each ward of the hospital, there were vast differences in the rates of childbirth fever between them. In the ward in which deliveries were attended only by midwives, only 60 deaths from childbirth fever occurred per 3,000 deliveries. Women in the second ward of the hospital who were attended by doctors and medical students suffered over 600 deaths from childbirth fever per 3,000 deliveries over the same time period. Semmelweis noted that many of the doctors and medical students worked on cadavers immediately before attending their maternity patients. In 1847, Semmelweis ordered all medical attendants to scrub with chloride of lime, a mild disinfectant, before attending any woman in labor. Within weeks, the death rate dropped to a little over 1 percent, a dramatic decrease (Nuland, 2003).

and physiology. Women's mental health was defined in terms of the social and cultural expectations of the times, and their illnesses were frequently perceived as psychosomatic, a trend that can still be problematic today. During the 1800s, for example, the uterus was blamed as the "starting point for hysteria" in women, with symptoms ranging from paleness and yawning to palpitations and seizures, sadness and sullenness to "immoderate laughter". Socially unacceptable behaviors were treated medically with opium, emetics, and other drugs (Hayes, 1869).

Hayes and others recognized and promoted the use of contraceptives and a woman's right to make her own decisions about her health. However, these ideas were not universally accepted. During 1873, the Act for the Suppression of Trade in, and Circulation of, Obscene Literature and Articles of Immoral Use, more commonly known as the Comstock Law, made it illegal to distribute information relating to conception or to bring contraceptives into the United

States (American Law and Legal Information, 2009). Many individuals argued against the Comstock Laws and encouraged increased knowledge of women's biology and health. Perhaps best known is Margaret Sanger who, in 1916, opened a birth control clinic in Brooklyn, New York (Planned Parenthood Federation of America [PPFA], 2009). Sanger and other women who promoted greater access to birth control were jailed for their activities.

Women in Medicine

As medicine became more formalized, most women were pushed further from the ranks of physicians and into the realm of patient. However, women did not vanish entirely from the medical field. In 1849, Dr. Elizabeth Blackwell graduated from the Geneva Medical College, becoming the first recognized female doctor. In 1846, William Alcott, a social reformer and educator, wrote that "Females are better qualified – other things being

the same – for attending the sick, than males” (p. 302) and encouraged women to gain a broad education in the sciences. During the mid-1800s, medical schools were opened exclusively for women. The Congressional Medal of Honor was awarded in 1865 to Dr. Mary Walker for her work as a physician during the Civil War. However, the Flexner Report of 1900 resulted in the closing of many medical schools and the narrowing of medical opportunities in the United States for women and minorities. As the Women’s Rights Movement of the 19th century gained momentum, control over contraception and reproductive rights became a major point of contention. Against the backdrop of the Comstock Laws, pioneers like Margaret Sanger and Mary Ware Dennett continued to provide contraceptives to women. Their continued efforts and the public outcry against the suppression of contraception knowledge lead to changes in the laws which allowed physicians to prescribe contraceptives to their patients. These changes demonstrated the need for trained female healthcare providers to work with female patients, many of whom would never broach such issues as “female complaints” with a male doctor. In spite of this need, women continued to be underrepresented as physicians and continued to face obstacles to receiving training.

In recent decades, the proportion of women in medical schools has been increasing. In 1972, **Title IX** of the Education Amendments to the **Civil Rights Act** stated that:

“No person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance.” (20 U.S.C. §§ 1681–1688)

This legislation initiated a process of leveling the playing field for admission to higher education institutions, including medical schools, that continues today. As a result, change is occurring. In 2005, of the 68,343 students actively enrolled in American medical schools, 49 percent (33,380) were women, up from 31 percent in 1982 (AAMC Fact Sheet, 2008). Currently, 49 percent of pharmacists are women, compared to only 30 percent just twenty years ago (DPE Fact sheet, 2008). Another area of major advancement occurred in dentistry where women in 2003 earned

42 percent of the dental degrees compared to less than one percent in 1960 (U.S. Department of Education National Center for Education Statistics, 2008).

The Last Century

The increased attention to women’s health since the 1800s came with some costs. Normal physiological events in a woman’s life such as menstruation, pregnancy, and menopause were increasingly treated, at least in the West, as illnesses to be managed through medications and medical procedures. Women have been prescribed hormones for birth control, for menopause, or to prevent miscarriage, and have often not been informed about the potential risks of such treatments. Many healthcare providers have simply treated “problems” without treating the patient as a whole, resulting in women being subjected to unnecessary or excessive surgery without the opportunity to consider alternatives. In addition, recent revelations concerning the risks of **hormone replacement therapy (HRT)**, differing treatment of men and women suffering from heart disease and other conditions, and attempts to control the distribution of information about reproductive options further tarnished the state of women’s healthcare.

The increased attention to women’s health issues and public frustration with the shortcomings of medicine as it was being practiced has resulted in change. Federal guidelines now protect human subjects from being used without their knowledge or consent in **clinical investigations**, for diseases or conditions, of drugs or medical devices. In response to the demands of pregnant women, birthing centers and certified midwives and doulas are providing alternatives to hospital-based delivery of infants in some cities. Armed with greater knowledge of how their bodies work, many women are becoming active partners in their healthcare, reserving the right to reject advice or to seek a second opinion. There are now more doctors and other healthcare professionals who treat women with greater respect and sensitivity and who explain more to the patient about procedures and therapies (Figure 1-3). For many women, however, underlying health concerns are unchanged. The problems in the areas of reproductive rights, hormonal therapy, unnecessary surgery, prescription drug abuse, pregnancy and childbirth interventions, domestic violence,



FIGURE 1-3: Lack of knowledge can make a woman feel vulnerable and afraid. Knowing how the body functions in health and disease can give women the self-confidence to participate in the decisions concerning their own healthcare.

and mental health treatment remain unsolved. For example, while the rates of some potentially dangerous childbirth procedures have decreased in recent decades, the rates of others, namely cesarean sections, have increased dramatically in many parts of the world.

In recent years, challenges to what was previously accepted about women's biology, scientific advances in cancer and reproductive biology, and the recognition of the sexual differences in the development, prognosis, and treatment of many diseases have brought a number of women's health issues to national and international attention. Beginning with the success of the original *Our Bodies, Ourselves* by the Boston Women's Health Book Collective in 1970, hundreds of books, articles, and websites have moved the discussion of women's health issues from the halls of medicine to the halls of offices and factories, markets and cafés, and the political arena. Globalization and the Internet have the potential to introduce women to practices and principles different from those they are familiar with.

The increased focus on breast cancer during the 1980s and 1990s illustrated how women could garner public attention and financial support for an important women's health issue. Women's experiences with the life-threatening illness of breast cancer, which in the past had been hidden and certainly not talked about publicly, were nationally spotlighted in the early 1980s when two presidents' wives, Betty Ford and Nancy Reagan, and other celebrities, revealed that they had survived breast cancer.

The Susan G. Komen Breast Cancer Foundation became a leader in breast cancer research funding, education, and legislative advocacy. The activism mustered to fight breast cancer has paved the way for directing public attention to other health issues that disproportionately affect women (Figure 1-4).



FIGURE 1-4: Activism to fight breast cancer, as in this walk for awareness, has led to an expanded focus on women's health at a governmental level.



Cultural Considerations

WHICH COUNTRY IS THE BEST FOR WOMEN'S HEALTH?

There are many ways to measure the quality of women's lives in countries around the world. Life expectancy is one measure. A girl born in Swaziland will be unlikely to see her 30th birthday. In Niger, women generally live to be about 45 years old. In Sweden, the average woman will live to be 83 years old and the average Japanese woman will live to be 86.

The World Economic Forum publishes a report each year titled the Gender Gap Report, which examines the lives of women and men in terms of political empowerment, educational attainment, economic participation and opportunity, and health. Each year they rank almost every country in the world according to the gender gap, or differences that they find between the lives of the country's women and men. Iceland was ranked number 1 as the best country for women in 2009. Other Nordic countries, Norway, Finland, and Sweden have ranked next within the top four countries since 2006. The gender gap in the United States has been increasing since 2005 when it ranked 17th in the world. In 2006, the United States dropped to 23rd and then dropped again to 31st by 2009. The country of Yemen ranked last in the Gender Gap Report (Hausmann et al., 2008).

The non-profit organization Save the Children publishes an annual State of the World's Mothers Report, where they compare countries by maternal deaths due to complications of pregnancy and childbirth, infant mortality, and access to healthcare. In their 2007 report, Sweden ranked first as the best country in which to be a mother, with only 1 in 29,800 women dying in childbirth. Children in

Sweden have only a 1 in 333 chance of dying within their first year of life. According to the report, nearly one hundred percent of births are attended by a skilled trained midwife in Sweden.

Save the Children's 2007 report ranks Niger as the worst country in which to be a mother, with 1 in 7 women dying as a result of pregnancy or childbirth. Only 16 percent of deliveries are attended to by a skilled healthcare worker, and 15 percent of babies die before their first birthday. In fact, according to the 2007 report, the risks for a woman dying due to complications of pregnancy are:

- 1 in 26 for all of Africa
- 1 in 120 for Asia
- 1 in 290 for Latin America
- 1 in 7,300 for developed countries

The United States ranked 27th out of 42 developed nations in terms of the Mothers Index in 2007, which was a slight drop from ranking 26th in 2006. In terms of infant mortality and children's health, the United States ranked 33rd out of 43 developed nations.

Save the Children also points out another concern, the difference in the amount of money spent on healthcare for girls versus boys in countries that strongly favor boys. In China, girls are 30 percent more likely to die before the age of 5, and in India they are 61 percent more likely to die in the same time frame. In some parts of India, it is estimated that families will spend 2.3 times as much on healthcare for boys than for girls during the first two years of life.

In the United States, public pressure has established women's health offices at the Department of Health and Human Services, the Federal Food and Drug Administration, and the Centers for Disease Control and Prevention, with the goal of expanding the focus

on women's health. Women's health issues are being recognized by governments world wide.

The Society for the Advancement of Women's Health Research, a nonprofit organization, was established in 1990 to advocate for increased

research of conditions affecting women exclusively, disproportionately, or differently than men (SWHR, 2008). This group continues to inform women, healthcare providers, policy makers, and the media about contemporary women's health issues. The Society was involved in the establishment of the *Journal of Women's Health* and sponsored the first symposium on sex-based biology.

In the United States, increased public attention to the inequities in research on women's health, and additional political pressure from the Congressional Caucus for Women's Issues and

the House Subcommittee on Health, motivated the National Institutes of Health (NIH) to take concrete action and began to include women and minorities in clinical studies. Another major change in 1992 was the establishment of the largest community-based clinical intervention and prevention trial ever conducted. Known as the Women's Health Initiative (WHI), it began as a multi-million dollar study that followed 161,808 healthy postmenopausal women over a fifteen year period. This groundbreaking project consisted of three components – a **randomized clinical trial**



Social Considerations

THE IMPORTANCE OF FOCUSING ON WOMEN'S STUDIES

Women and women's experiences have for too long been seen as somehow outside the 'human standard' which was typically seen as exclusively male. Men's lives, bodies, and experiences were most often the ones romanticized in literature, studied in medicine, and recorded in history. 'Women's studies as an area of scholarship challenged these very notions, emphasizing that women's lives are every bit as important as those of men, and that their contributions to history and to humanity no less significant. Indeed, the development of women's studies as an academic field went hand in hand with the rise of the second wave of feminism in the late 1960s and 1970s, when the women's liberation movement challenged many of the mainstream patriarchal ideas and privileges of the day.

Women's studies developed as a place within the academic community for the flourishing of feminist theory and explored the experiences and achievements of women across history and cultures. It is a discipline which takes the study of gender as a central theme, with the understanding that women's experiences, as well as men's, are profoundly shaped by the social universe in which they find themselves, and the social norms, values, and expectations of

their time. Women's studies served as an incubator for feminist thought and debate and helped to uncover what was once minimized by the academic community: women's intellectual, artistic, and historical accomplishments and triumphs.

The Biology of Women textbook draws on many of the proud traditions of women's studies. The book focuses on women's bodies and lives, looking at the intimate connections between women's individual experiences and their social realities, and the concept that a woman's knowledge has the power to change the future, both for herself and for the world she lives in. In many universities and colleges around the country, Biology of Women is taught as a women's studies course. Today, women's studies programs typically take an interdisciplinary approach, drawing on the insights of the social sciences, the natural sciences, the humanities, and the arts. Modern day women's studies programs can be found across the country and today incorporate an analyses of 'intersectionality,' a term which recognizes that people encounter distinct forms of discrimination due to the intersection of gender with such factors as race/ethnicity, age, sexual orientation, nationality, religion, disability, and economic class.