Textbook of Obesity
Biological, Psychological and Cultural Influences

Edited by Sharon R. Akbas, Sally Ann Lederman and Barbara J. Moore
Textbook of Obesity
Companion website: Textbook of Obesity

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www.wiley.com/go/akabas/obesity

The website includes:
• Extensive bank of Questions and Answers
• All figures from the book for downloading
• Note-taking outline for each chapter
• Webliography
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While I served as U.S. Surgeon General from 1981 to 1989, the data from the National Health and Nutrition Examination Survey (NHANES) and the Behavioral Risk Factor Surveillance System (BRFSS) documented a surge in obesity prevalence in America. The data spurred me to found the nonprofit organization, Shape Up America! in 1994, to raise awareness of obesity as a health issue. The prevalence of obesity has continued to climb with upsurges documented in adults and children in all walks of life, with the problem more severe among America’s poor and uninsured.

Progress in raising awareness of obesity as a health issue has certainly been made, but there has been little progress in stemming the epidemic. We now have nearly 75 million Americans categorized as “obese” and more than 17 million are categorized as “severely obese.” Of greatest concern, an estimated 12 million children are obese with 2.5 million severely obese.

Now we are learning that the offspring of obese and severely obese parents are at greater risk of obesity, introducing a new understanding of the way the obesity epidemic is self-propagating through epigenetic pathways. With so many millions of Americans of childbearing potential entering pregnancy and parenthood in the obese condition, this represents a deepening of the crisis.

A broadly increased understanding of the many causes and consequences of obesity is urgently needed. The field has made remarkable strides enlightening us about the endocrine function of fat cells and how leptin—a protein synthesized by fat cells—crosses the blood-brain barrier to mediate the communication between body fat depots and regulatory centers in the brain that influence appetite and energy balance. But much more work needs to be done, particularly to develop effective prevention and treatment approaches.

The publishing world is highly competitive and up to now, a comprehensive textbook such as this one did not exist. The editors and authors of this volume have labored for more than 3 years to create a textbook suitable for college level students and those who are beginning their graduate education. Their goal was to attract bright new minds to the field of obesity to help us devise innovative research, invent new medical devices, discover new therapeutic agents for treatment, and develop public health solutions to help us stop and reverse the epidemic. I am proud to support their effort as I share their hope that making information about the complex nature of obesity more accessible to students will increase the likelihood of finding urgently needed answers to these highly perplexing problems.

Now I am calling upon you, the reader, to help us move the field forward and make America a healthier place to live, learn, work and play. There is no doubt that it takes a nation to stem obesity and regardless of your chosen career path, we call upon you to be a part of the solution.

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Sharon R. Akabas, Barbara J. Moore and Sally Ann Lederman

A major theme of this book is to understand the complexity of the factors that underlie energy balance and weight, with the goal of understanding the overweight or obese person. Understanding is an attribute I have had modeled for me my whole life, by my parents, Eli and Rebecca Freedman, and my siblings, Karen Jimmerson, Jay Freedman, Barry Freedman, Beth Rosen, Jayne Quinn, Judy Fask, and Barbara Freedman. This modeling has been continued in my own family by my husband, Myles, and children, Sam, Leor, and Reuben. I am grateful to all of them for their love, humor, support, and patience during this arduous process.

Sharon R. Akabas

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Sally Ann Lederman

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Barbara J. Moore

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Glossary

α-melanocyte-stimulating hormone(s); alpha-MSH
A set of peptide hormones secreted by the anterior pituitary gland. In the brain, release increases appetite.

2003 Rotterdam criteria Criteria used to define PCOS established during a conference of experts who met in Rotterdam in May 2003 and indicate that PCOS can be diagnosed (once certain other conditions are excluded) when two of three conditions are present: infrequent or no ovulation, indications of hyperandrogenism, or polycystic ovaries. These criteria expand the definition of PCOS established by an April 1990 expert conference sponsored by NIH.

95% confidence interval An estimate, determined from the standard error, of the range of values for a given variable that would include the true mean 95% of the time. It is used to indicate the reliability of the estimate of the mean provided by a particular sample. Greater sample sizes reduce the range of the confidence interval, making the estimate of the mean more reliable.

acanthosis nigricans A darkening and thickening of the skin usually seen at the nape of the neck and in areas where opposing skin surfaces can touch and rub, such as in the groin, underarms, and beneath pendulous breasts; associated with insulin resistance.

accelerometers An instrument for measuring acceleration, used in some methods that determine energy expenditure. Initiation of movement in a part of the body involves an acceleration, which can be counted, if registered on the accelerometer. Complex models are used to convert these counts into calories expended, using a variety of estimates and assumptions.

activity thermogenesis Energy expenditure above that used when at rest.

acute phase reactants Proteins whose concentration in the plasma are changed significantly during inflammation.

ad libitum An amount of food freely chosen by an individual; unrestricted food intake.

adaptive immune responses An immune response dependent on action of antigen-specific lymphocytes. This response can result in lifelong protection from reinfection with the same antigen.

adipocyte A connective tissue cell containing one or more fat droplets. The adipocyte is the defining cell type within adipose tissue; also known as “fat cell.”

adipogenesis The formation of fat; fat cell proliferation.

adipokines Any of a variety of compounds secreted by adipose tissue; some play important roles as signaling molecules in energy balance and metabolism.

adiponectin An adipokine, a protein hormone secreted by adipose tissue. Has generally beneficial effects on insulin-sensitive tissues and the vascular system.

adjusted odds ratio An odds ratio statistically adjusted for other factors that might affect the chance of the disease. See odds ratio.

adrenal hyperandrogenism Excessive production of androgen hormones (testosterone, dehydroepiandrosterone, etc.) by the adrenal glands.

adrenalectomy Removal of the adrenal gland.

afferent centers Areas of the brain that integrate signals from the body and send outgoing (efferent) messages via neural pathways to other parts of CNS and to other parts of the body.

agouti protein A protein produced in the body (endogenous) that has a strong stimulating effect on appetite. It acts as an antagonist of the melanocortin receptors MC3R and MC4R.

air displacement plethysmography A method for determining body volume. It consists of two connected chambers in one of which the subject is placed, the other being a reference chamber that contains pressure-measuring instruments. A flexible diaphragm is mounted in the common wall between the chambers. The ratio of the pressures in the two chambers as the diaphragm is moved is inversely related to the ratio of the air volumes within the chambers, allowing calculation of body volume.

Akt One of a set of protein kinases with various functions, including apoptosis and insulin signaling.
alanine aminotransferase (ALT)  An enzyme found in the plasma, liver, and other tissues; it catalyzes the conversion of alanine to alpha-ketoglutarate by transfer of an amino group. Elevated blood levels are used as an indicator of liver damage.

alimentary limb  In bariatric surgeries, the portion of the remaining intestinal tract that carries food.

alkaline phosphatase  An enzyme made in liver, bone, intestine, and kidney. If levels are elevated in blood, it suggests liver disease or damage or bone problems.

alternative complement pathway  A part of the immune system that does not depend on the action of antibodies. It kills pathogens quickly, before antibody synthesis can occur. It operates by the binding of a protein, complement protein C3b, to the pathogen surface.

anatomical bony landmark  Protuberances on the bones that can be used to identify specific anatomical locations on the body surface.

androgen receptor  A receptor that is activated by binding androgen hormones (hormones that determine male secondary sex characteristics).

angiogenic  Relating to the formation of new blood vessels.

angina pectoris  A feeling of pain or pressure in the chest, often radiating to the arms, neck, or back, caused by inadequate oxygen delivery to part of the muscle of the heart.

angiotensinogen  A plasma precursor of angiotensin, a compound that causes blood vessels to constrict, raising blood pressure.

anorexiant  A substance that causes loss of appetite.

ANS tone  The level of activity in the autonomic nervous system.

anthropometry  Measurement of the physical characteristics of the body, such as its size, weight, shape and proportions.

antigen  Any substance foreign to the body that evokes an immune response.

antihyperglycemic agents  A substance that promotes the normalization of blood glucose levels.

apocrine odor  The odor emitted by the apocrine sweat glands, glands found mostly in the armpit and genital areas.

arcuate nucleus (ARC)  An area in the hypothalamus that contains neurons that secrete appetite-enhancing neuropeptide Y, and appetite-suppressing melanocortins, and many other substances.

area postrema (AP)  An area of the brain, on the base of the 4th ventricle, that is involved in feeding control and in vomiting.

associative learning  A learning process by which stimuli become linked together.

AST (aspartate aminotransferase)  An enzyme whose blood levels are used as a test of liver function.

attrition  The loss of participants in a study. It is usually expressed numerically as a percentage of those originally enrolled or assigned to a treatment.

autocrine  A type of cell signaling in which a cell secretes signal molecules that act on itself or other neighboring cells of the same type.

autonomic systems  The part of the nervous system that controls involuntary visceral functions such as the heartbeat, digestion, and glandular secretions. Includes the sympathetic and parasympathetic components.

autosomal  Related to any chromosome other than a sex chromosome.

autosomal genetic disorder  A genetic condition that results from a gene on an autosome (i.e., not sex-chromosome linked).

autosomal recessive disorder  A disorder that appears only in people who have two mutated copies of an autosomal gene, one from each parent.

bariatric surgery  Surgical procedures designed to reduce body weight. Different approaches will reduce nutrient absorption or decrease the amount of food that can be eaten at one sitting, or both.

beta-blockers  Drugs that decrease the heart rate and lower blood pressure by blocking cellular beta-receptors. These receptors normally are responsive to epinephrine and norepinephrine; the interaction with the drug affects heart rate and contractility, vasodilation, blood pressure and other physiological activities.

binge-eating disorder  An eating disorder involving repeated episodes of excessive overeating, feelings of loss of control and worthlessness. These are not balanced with compensatory actions to correct the excess intake, such as by fasting, vomiting, using laxatives, or exercising excessively.

bioelectrical impedance; bio-impedance analysis (BIA)  A method for estimating body composition (total body water, extracellular water) from the conductance and resistance of the body, determined by applying a small