

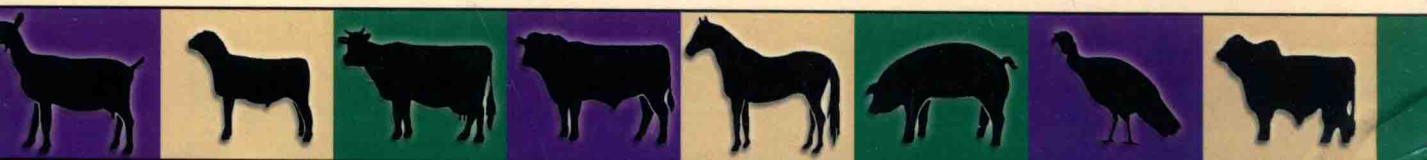
S C I E N T I F I C **F A R M A N I M A L** **P R O D U C T I O N**

AN INTRODUCTION TO ANIMAL SCIENCE



SEVENTH
Edition

Robert E. Taylor & Thomas G. Field



SEVENTH EDITION

Scientific Farm Animal Production

**AN INTRODUCTION TO
ANIMAL SCIENCE**

**ROBERT E. TAYLOR
THOMAS G. FIELD**

Colorado State University

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Aquaculture:

Center for Tropical and Subtropical Aquaculture	Library.kcc.hawaii.edu/ctsa
North Central Regional Aquaculture Center	ag.ansc.purdue.edu/aquanic/ncrac
Northeastern Regional Aquaculture Center	www.usmassd.edu/specialprograms/nrac/
Southern Regional Aquaculture Center	www.msstate.edu/dept/srac/
Western Regional Aquaculture Center	www.fish.washington.edu/wrac/

Beef Cattle:

Beef Home Page	www.beef.org
Beef New Zealand	www.beef.org.nz
Beef Today	www.farmjournal.com
Breeds	www.ansi.okstate.edu/BREEDS/index.htm
Cattle-Fax	www.cattle-fax.com
Chicago Mercantile Exchange	www.cme.com
Livestock Marketing Information Center	Http://lmic1.co.nrcs.usda.gov
Morgan's Forage Site	www.forage.com
Noble Foundation	www.noble.org

Dairy Cattle:

Animal Improvement Programs Laboratory	www.aipl.arsusda.gov
Dairy Breeds	www.ansi.okstate.edu/BREEDS/index.htm
Dairy Management, Inc.	www.dairyinfo.com
Dairycenter	www.dairycenter.com
Dairy Today	www.farmjournal.com
National Dairy Council	www.nationaldairycouncil.com
National DHIA	www.DHIA.org
The Babcock Institute	http.babcock.cals.wisc.edu
U.S. Dairy Export Council	www.usdec.org
World Dairy Expo	www.world-dairy-expo.com

General Statistics/Demographic Data:

Agricultural Marketing Service	www.ams.usda.gov
American Farm Bureau	www.fb.com
American Farmland Trust	www.farmland.org
Economic Research Service	www.econ.ag.gov
Farm Economy Issues	http://isufarmeconomyteam.org
Food and Agriculture Organization	www.fao.org
Foreign Agriculture Service	www.ffas.usda.gov
International Food Policy Research Institute	www.cgiar.org/ifpri
National Agricultural Statistics Service	www.usda.gov/nass
United States Department of Agriculture	www.usda.gov
Winrock International	www.winrock.org
World Trade Organization	www.wto.org

Goats:

American Boer Goat Association	www.abga.org
American Dairy Goat Association	www.adga.org
Animal Improvement Programs Laboratory	www.aipl.arsusda.gov
Dairy Goat	www.ics.uci.edu/~puzzani/4H/dairygoats.html
Goat Breeds	www.ansi.okstate.edu/BREEDS/index.htm
The Goat Farmer	www.caprine.co.nz

Horses:

American Association of Equine Practitioners	www.aaep.org
American Horse Council	www.horsecouncil.org
American Horse Publications	www.americanhorsepubs.org
Blood Horse	www.bloodhorse.com
Chronicle of the Horse	www.chronofhorse.com
Cyber Steed	www.cybersteed.com
Horse Breeds	www.ansi.okstate.edu/BREEDS/index.htm
Horse Country	www.horsecountry.com
United States Pony Club	www.ponyclub.org
Western Horseman	www.westernhorseman.com

Poultry:

American Egg Board	www.aeb.org
Egg Nutrition Center	www.enc-online.org
Goldkist	www.goldkist.com
Pilgrim's Pride	www.pilgrimspride.com
Poultry Breeds	www.ansi.okstate.edu/BREEDS/index.htm
Poultry Information Network	www.wattnet.com
Poultry Internet Information Resources	www.oneglobe.com/agrifood/aginform/poultry
Ross Breeders	www.rossbreeders.com
Tyson Foods, Inc.	www.tyson.com
USA Poultry and Egg Association	www.poultryegg.org

Sheep:

American Sheep Industry Association	www.sheepusa.org
Australian Wool Exchange	www.dev.inter-serv.com.au/awex-corp
Land's End, Inc.	www.landsend.com
Livestock Marketing Information Center	http://lmic1.co.nrcs.usda.gov
National Sheep Improvement Program	www.nsip.org
Pendleton Woolen Mills	www.pendleton-usa.com
Sheep Breeds	www.ansi.okstate.edu/BREEDS/index.htm
Woolmark Company	www.wool.com.au

Swine:

Iowa Pork Industry Center	www.extension.iastate.edu/ipic
Livestock Marketing Information Center	http://lmic1.co.nrcs.usda.gov
National Pork Producers Council	www.nppc.org
National Hog Farmer	www.homefarm.com/nhf
National Swine Registry	www.nationalswine.com
Purdue Pork Page	www.anr.ces.purdue.edu/anr/anr/swine/porkpage.htm
Swine Breeds	www.ansi.okstate.edu/BREEDS/index.htm
Swine Information Network	www.swine.net
Swine Testing and Genetic Evaluation System	www.ansc.purdue.edu/stages/index.htm

Scientific Farm Animal Production

AN INTRODUCTION TO
ANIMAL SCIENCE

ROBERT E. TAYLOR

THOMAS S. FIELD

University of Tennessee

London, Ontario

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Dedication

This book is dedicated to the many teachers and students who have invested themselves in the process of improving animal agriculture so that humanity might one day be free of hunger. Since the first edition, this book has been inspired by the marvelous relationships that exist when teachers and students are motivated to learn and discover.

Robert Taylor was my teacher and mentor. He was the embodiment of good stewardship. He was a great stockman who took care of the land, the herds, the people, and the abundant natural resources God has bestowed upon us. He nurtured his students while challenging them to always strive for excellence. He was a source of wisdom, a builder of community, and a visionary leader.

This book is a compilation of our work as students of livestock management systems. We hope that readers will benefit from this book and be inspired to a life of continual learning and service.

Preface

Scientific Farm Animal Production is distinguished by an appropriate combination of both breadth and depth of livestock and poultry production and their respective industries. The book gives an overview of the biological principles applicable to the Animal Sciences, with chapters on reproduction, genetics, nutrition, lactation, consumer products, and other subjects. The book also covers the breeding, feeding, and management of beef cattle, dairy cattle, horses, sheep, swine, poultry, goats, and aquaculture. Although books have been written on each of these separate subjects, the authors have highlighted the significant biological principles, scientific relationships, and management practices in a condensed but informative manner.

TARGET AUDIENCE

This book is designed as a text for the introductory Animal Science course typically taught at universities and junior or community colleges. It is also a valuable reference book for livestock producers, vocational agriculture instructors, and others desiring an overview of livestock production principles and management. The book is basic and sufficiently simple for urban students with limited livestock experience, yet challenging for students who have a livestock production background.

KEY FEATURES

Chapters 1–9 cover animal products and give an overview of the livestock and poultry industries, Chapters 10–22 discuss the biological principles, while livestock, poultry, and aquaculture management practices are presented in Chapters 23–38.

The glossary of the terms used throughout the book has been expanded so students can readily become familiar with animal science terminology. The bold-lettered words in the text are included in the glossary.

Many illustrations in the form of photographs and line drawings are used throughout the book to communicate key points and major relationships. If “a picture is worth a thousand words,” the numerous photographs and drawings expand the usefulness of the book beyond its pages.

Selected references are provided for each chapter to direct students into greater depth and breadth as they become intrigued with certain topics. Instructors can also use the references to expand their knowledge in current background material. Also included in the selected-references sections are references to visuals that relate to the specific chapter. Instructors are encouraged to review these visuals and use those that will enrich their courses.

USING THE BOOK

The book is designed to accommodate several instructional approaches to teaching the introductory course: (1) the life-cycle biological principles approach, including such areas as consumer products, reproduction, breeding, nutrition, and animal health; (2) the species approach (teaching the course primarily in reference to the various species); or (3) a combination of the previous two. The latter appears to be the most popular teaching approach, covering principles in lecture and combining principles and species into laboratory exercises.

Some instructors will assign one or more papers on a topic selected by them or the students. The references at the end of each chapter are designed for students who want or need to explore certain topics in more depth.

Most instructors will not have sufficient time in their courses to assign all the chapters. Course outlines can be developed to include the chapters assigned and put them in the sequence that meets an instructor's preference.

CHANGES IN THIS EDITION

This edition has been updated with current technical and applied information. Whenever possible, tables and figures have been revised with current data. A chapter on aquaculture has been added to the text, and major revisions of the careers chapter (37), the species breeding and management chapters (25–36), and the reproduction chapter (10) have been made. This revision provides more detail in terms of selection strategies and tools, management benchmarks, endocrinology, and food safety issues. The emphasis on bioeconomics and global perspectives has been continued. A list of useful Web sites is provided to allow students and faculty the opportunity to explore a variety of information sources that complement the text. The addition of a CD-ROM that provides interactive study questions for each chapter also adds to the value of this edition.

About the Authors

Dr. Taylor was raised on an Idaho livestock operation where several livestock species were produced. He received his B.S. and M.S. degrees from Utah State University. This background, combined with a Ph.D. in animal breeding and physiology from Oklahoma State University, provided the foundations of his knowledge about livestock production. He worked with beef cattle, dairy cattle, horses, poultry, sheep, and swine during his career.

Dr. Taylor received teaching awards from Iowa State University, Colorado State University, the USDA National Excellence in Teaching program, and the American Society of Animal Science. Many of his concepts for effective teaching are utilized in this book. Dr. Taylor passed away in 1998.

Dr. Field was raised on a Colorado cow-calf and seedstock enterprise. He managed a seedstock herd of cattle after completing his B.S. degree. A competitive horseman as a youth, he has had practical experience with seedstock cattle, commercial cow-calf production, stockers, and horses. He has a B.S., M.S., and Ph.D. in animal science from Colorado State University.

Dr. Field has received teaching awards from the USDA National Excellence in Teaching program, the National Association of Colleges and Teachers of Agriculture, the Western Section of the American Society of Animal Science, and Colorado State University. Dr. Field is the teaching coordinator for the Department of Animal Sciences at Colorado State University and is responsible for coordinating the teaching herd.

Acknowledgments

Appreciation is expressed to those individuals and organizations that have reviewed all or part of the sixth and seventh editions and offered suggestions to strengthen the book. To Barbara Holst, who typed the seventh edition, special thanks for her professionalism and commitment.

Many instructors who teach the introductory animal science course completed a questionnaire and made numerous helpful suggestions. The following individuals were of particular help in the preparation of the seventh edition:

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Thomas G. Field

Scientific Farm Animal Production

CHAPTER

Animal Contributions to Human Needs

The animal products industry is a major contributor to the human food supply. It provides a wide variety of products, including meat, milk, eggs, and wool, which are essential for human nutrition. The industry is also a significant source of raw materials for the textile and leather industries. In addition, animals are used in a variety of other ways, such as for recreation, research, and as companions. The industry is a complex one, involving many different stages of production, from breeding and raising the animals to processing and distribution. It is a highly regulated industry, with strict standards for animal welfare and food safety. The industry is also a major employer, providing jobs for millions of people around the world. Despite the challenges it faces, the animal products industry remains a vital part of the human economy.

CONTRIBUTIONS TO FOOD NEEDS

The animal products industry is a major contributor to the human food supply. It provides a wide variety of products, including meat, milk, eggs, and wool, which are essential for human nutrition. The industry is also a significant source of raw materials for the textile and leather industries. In addition, animals are used in a variety of other ways, such as for recreation, research, and as companions. The industry is a complex one, involving many different stages of production, from breeding and raising the animals to processing and distribution. It is a highly regulated industry, with strict standards for animal welfare and food safety. The industry is also a major employer, providing jobs for millions of people around the world. Despite the challenges it faces, the animal products industry remains a vital part of the human economy.

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