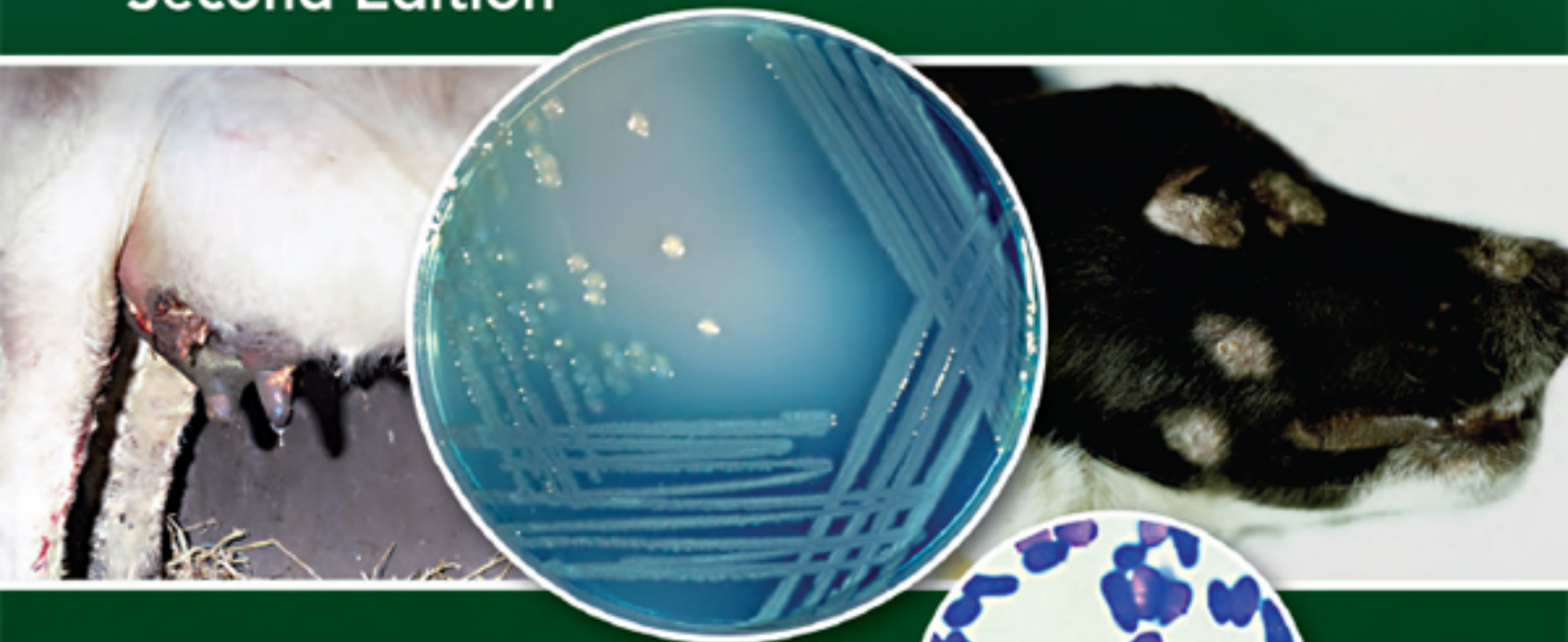
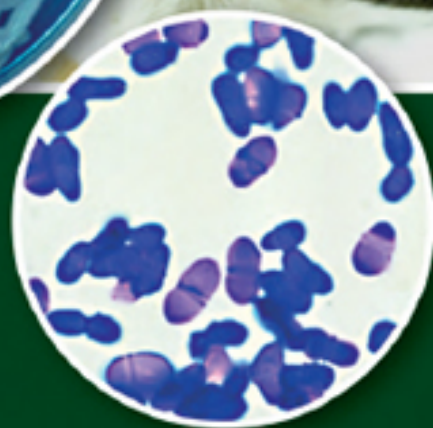


# Concise Review of Veterinary Microbiology

Second Edition



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WILEY Blackwell

# Concise Review of Veterinary Microbiology

**Second Edition**

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## Preface

The first edition of this book provided undergraduate veterinary students with a brief introduction to veterinary microbiology and diseases caused by pathogenic microorganisms. Since its publication in 2003, there have been many changes in veterinary microbiology, some related to the classification of pathogenic microorganisms and others associated with the increased understanding of the pathogenesis of infectious diseases. Developments in molecular aspects of microbiology have broadened the scope of diagnostic methods and have improved our understanding of the epidemiological characteristics of many infectious diseases. New developments relating to the emergence of antibacterial resistance are of particular importance in veterinary therapeutics and in public health.

The second edition of this book includes new chapters on bacterial genetics, antibacterial resistance, immunology, antifungal chemotherapy, biosecurity and vaccination. Topics of particular importance in veterinary medicine are given extended coverage. Important changes which have occurred in veterinary microbiology in recent years are presented in relevant chapters. There are five sections in this book and the Appendix includes a list of relevant websites to facilitate readers requiring additional information on topics referred to in the book. Colour has been used to enhance the quality of the illustrations and to facilitate interpretation of complex diagrams.

## Acknowledgements

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*Dublin, January 2015*

# Abbreviations and definitions

## **AGID**

agar gel immunodiffusion

## **ATP**

adenosine triphosphate

## **BCG**

bacille Calmette-Guérin

## **bp**

base pairs

## **cAMP**

cyclic adenosine monophosphate

## **CD**

cluster of differentiation

## **CFT**

complement fixation test

## **CNS**

central nervous system

## **cELISA**

competitive enzyme-linked immunosorbent assay

## **DNA**

deoxyribonucleic acid

## **ELISA**

enzyme-linked immunosorbent assay

**EU**

European Union

**FA**

fluorescent antibody

**Fc**

crystallizable fragment, portion of an immunoglobulin without an antigen combining site

**IFA**

indirect fluorescent antibody

**IFN**

interferon

**Ig**

immunoglobulin

**LPS**

lipopolysaccharide

**KOH**

potassium hydroxide

**MBC**

minimal bactericidal concentration

**MHC**

major histocompatibility complex

**MIC**

minimal inhibitory concentration

**MLST**

multi-locus sequence typing

**mRNA**

messenger RNA

**MRSA**

methicillin-resistant *Staphylococcus aureus*

**MZN**

modified Ziehl-Neelsen

**nm**

nanometre,  $10^{-9}$  metre

**NK cells**

natural killer cells

**OIE**

Office International des Épizooties (World Organization for Animal Health)

**ORF**

open reading frame

**PAS**

periodic acid-Schiff

**PCR**

polymerase chain reaction

**PFGE**

pulsed-field gel electrophoresis

**RFLP**

restriction fragment length polymorphism

**RNA**

ribonucleic acid



**rRNA**

ribosomal RNA

**RT-PCR**

reverse transcriptase-polymerase chain reaction

**RTX**

repeats-in-toxin

**SMEDI**

stillbirth, mummification, embryonic death, infertility

**V factor**

nicotinamide adenine dinucleotide

**VP**

viral protein

**UK**

United Kingdom

**µm**

micrometre or micron,  $10^{-6}$  metre

**USA**

United States of America

**UV light**

ultraviolet light

**X factor**

haemin

**ZN**

Ziehl-Neelsen

**°C**

degrees Celsius

## About the companion website

This book is accompanied by a companion website:

[www.wiley.com/go/quinn/concise-veterinary-microbiology](http://www.wiley.com/go/quinn/concise-veterinary-microbiology)

The website includes:

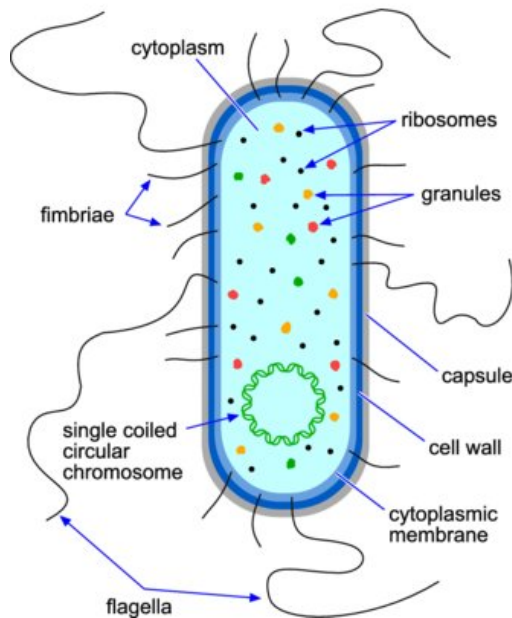
- PowerPoint figures from the book for downloading

# **Section I**

## **Introductory Bacteriology**




# 1 Structure of bacterial cells

Structure of a typical bacterium



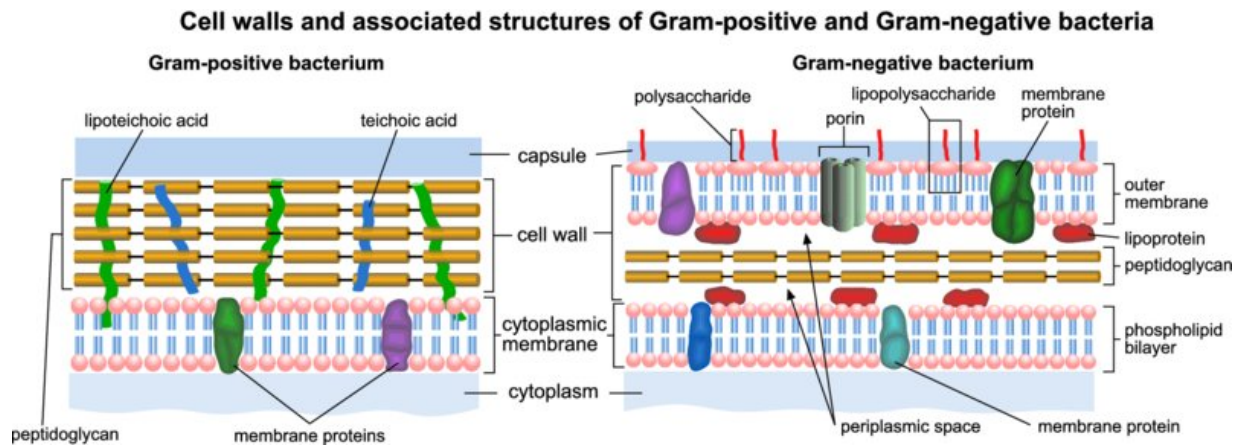
Common morphological forms of bacteria

Using bright-field microscopy, a magnification of 1,000x is required to observe most bacterial cells

Bacterium		Comments
Coccus	 1 $\mu\text{m}$	Spherical cells; often occurring in chains or in grape-like clusters, usually stained by the Gram method
Bacillus	 5 $\mu\text{m}$	Rod-shaped cells; usually stained by the Gram method
Spirochaete	 10 $\mu\text{m}$	Thin, helical bacteria. Dark-field microscopy (without staining) or special staining methods are required for demonstration of these unusual bacteria

Bacteria are unicellular organisms and usually occur in simple shapes such as rods, cocci, spiral forms and occasionally as branching filaments. They typically have rigid cell walls containing a peptidoglycan layer and multiply by binary fission. Bacteria are smaller and less complex than eukaryotic cells and do not contain membrane-bound organelles. Genetic information essential for organism survival, the core genome, is usually contained in a single circular chromosome; a nuclear membrane and a nucleolus are absent. Some bacteria have more than one chromosome and chromosomes in certain bacteria are linear. The accessory genome encodes non-essential cell functions and may include plasmids and bacteriophages (see Chapter 3). Despite their morphological diversity, most bacteria are between 0.5 and

5  $\mu\text{m}$  in length. Motile bacteria possess flagella by which they can move through liquids *in vivo* and *in vitro*.



Most bacteria found in nature are not harmful to humans, animals or plants. Some bacteria make an important contribution to the utilization of nutrients in soil, in water and in the digestive tracts of animals. Bacteria which cause disease in animals or humans are referred to as pathogenic bacteria.

A typical bacterial cell is composed of a capsule, cell wall, cell membrane, cytoplasm (containing nuclear material) and appendages such as flagella and pili. Some species of bacteria can produce dormant forms termed spores or endospores, structures which are resistant to environmental influences. The principal structural components of bacterial cells are presented in [Table 1.1](#). Some bacteria can synthesize extracellular polymeric material, termed a capsule, which forms a well-defined structure, closely adherent to the cell wall. In the body, capsules of pathogenic bacteria interfere with phagocytosis. The tough, rigid cell walls of bacteria protect them from mechanical damage and osmotic lysis. Differences in the structure and chemical composition of the cell walls of bacterial species account for variation in their pathogenicity and influence other characteristics, including staining properties. Mycoplasmas, an important