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Biology

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Of Life

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At a time of
unprecedented
expansion in the
life sciences,

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evolution is the one theory that transcends all of biology. Any observation of a living system must ultimately be interpreted in the context of its evolution.

Evolutionary change is the consequence of mutation and

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natural selection,
which are two
concepts that can
be described by
mathematical
equations.

Evolutionary
Dynamics is
concerned with
these equations of
life. In this book,
Martin A. Nowak
draws on the
languages of

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biology and mathematics to outline the mathematical principles according to which life evolves. His work introduces readers to the powerful yet simple laws that govern the evolution of living systems, no matter how

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complicated they
might seem.

Chapter 11
Evolution has
become a
mathematical
theory, Nowak
suggests, and any
idea of an
evolutionary
process or
mechanism should
be studied in the
context of the
mathematical

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equations of
evolutionary
dynamics. His book
presents a range of
analytical tools
that can be used to
this end: fitness
landscapes,
mutation matrices,
genomic sequence
space, random
drift, quasispecies,
replicators, the
Prisoner's

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Dilemma, games in finite and infinite populations, evolutionary graph theory, games on grids, evolutionary kaleidoscopes, fractals, and spatial chaos. Nowak then shows how evolutionary dynamics applies to critical real-world problems,

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including the progression of viral diseases such as AIDS, the virulence of infectious agents, the unpredictable mutations that lead to cancer, the evolution of altruism, and even the evolution of human language. His book makes a

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clear and compelling case for understanding every living system—and everything that arises as a consequence of living systems—in terms of evolutionary dynamics.

Reading Essentials provides an

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interactive reading experience to improve student comprehension of science content. It makes lesson content more accessible to struggling students and supports goals for differentiated instruction.

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take notes right in
the book!
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General biology
text with National
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features in each
unit and test-taking
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Biology: The
Dynamics of Life,
Laboratory Manual
Concepts of Biology
is designed for the
single-semester
introduction to
biology course for
non-science majors,
which for many
students is their only
college-level science

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course. As such, this course represents an important opportunity for students to develop the necessary knowledge, tools, and skills to make informed decisions as they continue with their lives. Rather than being mired down with facts and vocabulary, the

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typical non-science
major student needs
information

presented in a way
that is easy to read
and understand. Even
more importantly,
the content should
be meaningful.

Students do much
better when they
understand why
biology is relevant to
their everyday lives.

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For these reasons,
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is grounded on an
evolutionary basis
and includes exciting
features that
highlight careers in
the biological
sciences and
everyday
applications of the
concepts at hand. We
also strive to show
the

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interconnectedness
of topics within this
extremely broad
discipline. In order to
meet the needs of
today's instructors
and students, we
maintain the overall
organization and
coverage found in
most syllabi for this
course. A strength of
Concepts of Biology
is that instructors can

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customize the book,
adapting it to the
approach that works
best in their
classroom. Concepts
of Biology also
includes an
innovative art
program that
incorporates critical
thinking and clicker
questions to help
students
understand--and

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reviewing
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important concepts.
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students
understand the role
mathematics has
played in
breakthroughs in
epidemiology,
genetics, statistics,
physiology, and

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**other biological
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AND
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with a thorough**

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**grounding in
mathematics, the
language, and 'the
technology of
thought' with
which these
developments are
created and
controlled. The text
teaches the skills of
describing a
system, translating**

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**appropriate aspects
into equations, and
interpreting the
results in terms of
the original
problem. The text
helps unify biology
by identifying
dynamical
principles that
underlie a great
diversity of**

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**biological
processes. Standard
topics from
calculus courses
are covered, with
particular
emphasis on those
areas connected
with modeling such
as discrete-time
dynamical systems,
differential**

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**equations, and
probability and
statistics.**

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Models of Life

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**Population
Dynamics of the
Reef Crisis**

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This book presents current meta-ecosystem models and their derivation from classical ecosystem and metapopulation theories. Specifically, it reviews recent modelling efforts that have emphasized the role of nonlinear dynamics on spatial and food web networks, and which have cast their implications within the

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context of spatial synchrony and ecological stoichiometry. It suggests that these recent advances naturally lead to a generalization of meta-ecosystem theories to spatial fluxes of matter that have both a trophic and non-trophic impact on species. Ecosystem dynamics refers to the

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cycling of matter and energy across ecological compartments through processes such as consumption and recycling. Spatial dynamics established its ecological roots with metapopulation theories and focuses on scaling up local ecological processes through the limited movement of individuals and matter.

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Over the last 15 years, theories integrating ecosystem and spatial dynamics have quickly coalesced into meta-ecosystem theories, the focus of this book. The book will be of interest to graduate students and researchers who wish to learn more about the synthesis of ecosystem and spatial dynamics, which form the

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foundation of the theory
of meta-ecosystems.
The growing impact of
nonlinear science on
biology and medicine is
fundamentally changing
our view of living
organisms and disease
processes. This book
introduces the
application to
biomedicine of a broad
range of
interdisciplinary

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concepts from nonlinear dynamics, such as self-organization, complexity, coherence, stochastic resonance, fractals and chaos. It comprises 18 chapters written by leading figures in the field and covers experimental and theoretical research, as well as the emerging technological possibilities such as

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nonlinear control
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techniques for treating
Chapter 1
pathological
biodynamics, including
heart arrhythmias and
epilepsy. This book will
attract the interest of
professionals and
students from a wide
range of disciplines,
including physicists,
chemists, biologists,
sensory physiologists
and medical researchers

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such as cardiologists,
neurologists and
biomedical engineers.

Although ecologists
have long considered
morphology and life
history to be important
determinants of the
distribution, abundance,
and dynamics of plants
in nature, this book
contains the first theory
to predict explicitly both
the evolution of plant

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traits and the effects of these traits on plant community structure and dynamics. David Tilman focuses on the universal requirement of terrestrial plants for both below-ground and above-ground resources. The physical separation of these resources means that plants face an unavoidable tradeoff. To obtain a higher

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proportion of one
resource, a plant must
allocate more of its
growth to the structures
involved in its
acquisition, and thus
necessarily obtain a
lower proportion of
another resource.

Professor Tilman
presents a simple theory
that includes this
constraint and tradeoff,
and uses the theory to

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explore the evolution of
plant life histories and
morphologies along
productivity and
disturbance gradients.

The book shows that
relative growth rate,
which is predicted to be
strongly influenced by a
plant's proportional
allocation to leaves, is a
major determinant of
the transient dynamics
of competition. These

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dynamics may explain the differences between successions on poor versus rich soils and suggest that most field experiments performed to date have been of too short a duration to allow unambiguous interpretation of their results.

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Transformation and
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**(SMS). It includes
new and
significant
contributions in
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Dynamical
Systems and
their applications
in Biology,
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wide range of
mathematical
methods and
biological
applications.**

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process of
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modelling of
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systems with**

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methods from
dynamical
systems theory, -
present many
examples of the
use of
mathematical
modelling to gain
biological insight**

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- discuss
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innovative
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methods for the
analysis of
biological
processes, -
contain extensive
lists of
references, which
allow interested
readers to
continue the

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research on their
own. Integrating
the theory of
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book will appeal
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topics that will appeal to postgraduates and researchers in marine biology, fisheries science, ecology, zoology and biological oceanography. Chapters in this new release cover SCTL disease and coral population dynamics in S-Florida, Spatial

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dynamics of juvenile
corals in the
Persian/Arabian Gulf,
Surprising stability in
sea urchin populations
following shifts to
algal dominance on
heavily bleached
reefs, Biophysical
model of population
connectivity in the
Persian Gulf,
Population dynamics

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of 20-year decline in clownfish anemones on coral reefs at Eilat, northern Red Sea, and much more. Reviews articles on the latest advances in marine biology Authored by leading figures in their respective fields of study Presents materials that are widely used by

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basic concepts
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Dynamics

*This book develops
the mathematical
tools essential for
students in the life
sciences to describe*

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*interacting systems
and predict their
behavior. From
predator-prey
populations in an
ecosystem, to
hormone regulation
within the body, the
natural world
abounds in dynamical
systems that affect us
profoundly. Complex
feedback relations*

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and counter-intuitive responses are common in nature; this book develops the quantitative skills needed to explore these interactions.

Differential equations are the natural mathematical tool for quantifying change, and are the driving force throughout this

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book. The use of Euler's method makes nonlinear examples tractable and accessible to a broad spectrum of early-stage undergraduates, thus providing a practical alternative to the procedural approach of a traditional Calculus curriculum.

Tools are developed within numerous, relevant examples, with an emphasis on the construction, evaluation, and interpretation of mathematical models throughout.

Encountering these concepts in context, students learn not only quantitative

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*techniques, but how
to bridge between
biological and
mathematical ways of
thinking. Examples
range broadly,
exploring the
dynamics of neurons
and the immune
system, through to
population dynamics
and the Google
PageRank algorithm.*

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Each scenario relies only on an interest in the natural world; no biological expertise is assumed of student or instructor. Building on a single prerequisite of Precalculus, the book suits a two-quarter sequence for first or second year undergraduates, and

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*meets the
mathematical
requirements of
medical school entry.
The later material
provides opportunities
for more advanced
students in both
mathematics and life
sciences to revisit
theoretical knowledge
in a rich, real-world
framework. In all*

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*cases, the focus is
clear: how does the
math help us*

*understand the
science?*

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*Worksheets allow for
differentiated
instruction through a
wide range of
question formats.*

There are worksheets

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and study tools for each section of the text that help teachers track students' progress toward understanding concepts. Guided Reading Activities help students identify and comprehend the important information in each chapter.

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The aim of this book is to show how supramolecular complexity of cell organization can dramatically alter the functions of individual macromolecules within a cell. The emergence of new functions which appear as a

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*consequence of
supramolecular
complexity, is
explained in terms of
physical chemistry.*

*The book is
interdisciplinary, at
the border between
cell biochemistry,
physics and physical
chemistry. This
interdisciplinarity
does not result in the*

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use of physical techniques but from the use of physical concepts to study biological problems. In the domain of complexity studies, most works are purely theoretical or based on computer simulation. The present book is partly theoretical, partly

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experimental and theory is always based on experimental results. Moreover, the book encompasses in a unified manner the dynamic aspects of many different biological fields ranging from dynamics to pattern emergence in a young embryo. The volume

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*puts emphasis on
dynamic physical
studies of biological
events. It also
develops, in a unified
perspective, this new
interdisciplinary
approach of various
important problems
of cell biology and
chemistry, ranging
from enzyme
dynamics to pattern*

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*formation during
embryo development,
thus paving the way
to what may become a
central issue of future
biology.*

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the Dynamics and
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