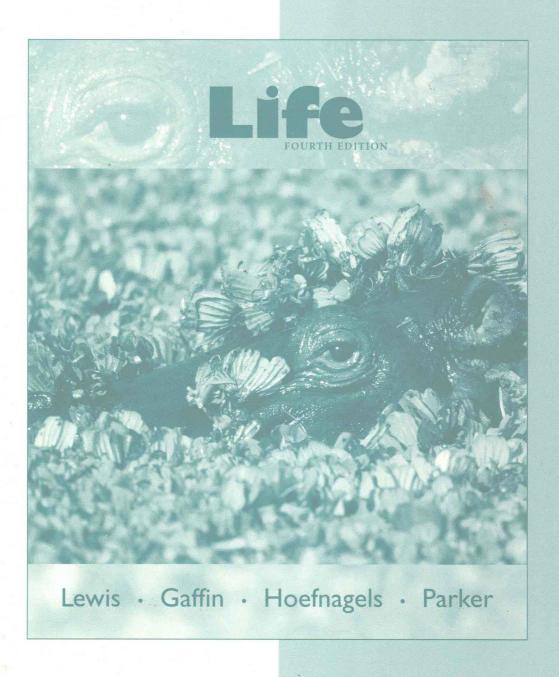
Student Study Guide

to accompany



Prepared by Sandra Latourelle

Student Study Guide

to accompany

Life

Fourth Edition

Ricki Lewis
The University at Albany

Douglas Gaffin
The University of Oklahoma

Mariëlle Hoefnagels
The University of Oklahoma

Bruce Parker
Utah Valley State College

Prepared by Sandra Latourelle SUNY Plattsburgh



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Student Study Guide to accompany LIFE: FOURTH EDITION LEWIS/GAFFIN/HOEFNAGELS/PARKER

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Preface

Teaching and learning biology today is both exhausting and exhilarating. Every day there is an announcement about new knowledge. Ricki Lewis, Douglas Gaffin, Mariëlle Hoefnagels, and Bruce Parker have provided students with a knowledge base to reflect on these new announcements with a perspective allowing for appreciative and objective analysis.

This study guide has been designed to appeal to multiple learning styles. The addition of chapter extensions provides students with avenues of learning that should appeal to their varied means of expression. The vocabulary segments are not all inclusive but rather a compilation of terms that, judging by this author's thirty-one years of teaching, are difficult or confusing for students to remember. The URLs chosen for student perusal are ones the author feels will be there for a few years. Should they become inactive, students are encouraged to seek their own.

The author wishes students success in the journey through *Life* and hopes that the exercises and information provided will allow for mastery of the material needed to learn.

There are some things that can be done to insure mastery.

- Don't cut classes.
- Read the text selections several times and not when tired.
- Take notes both during class time and while reading.
- Use the Study Guide.
- Budget time for studying each day. Biology cannot be crammed in the night before an
 examination.
- Ask the instructor or teaching assistant for help when there is difficulty understanding a concept.
- Keep a positive attitude.
- Work with the concept maps and build your own.
- Join a study group, or better still, form one.
- Take time to celebrate life!

Acknowledgments

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And thanks to Jim Reid of Woodbury Forest School and Jim Blankenship of Cornell University for providing ideas and examples of questions in the DNA transcription and translation section. Finally, a special thanks to you, the students, for <u>your</u> future contributions to the biological sciences.

Where Do All Those Words Come From?

Biology is the study of life. To fully understand the discipline, you may feel that you are learning a foreign language. You are! The derivation of most biological terms comes from Latin or Greek roots. The majority of new terminology can be easier understood if you spend some time with the prefixes and suffixes that comprise the vocabulary. Word attack skills can be most beneficial in all studies but particularly in the area of science. Spend some time studying these common roots and increase your word proficiency.

- **a-**, **an-** [Gk. *an-*, not, without, lacking]: anaerobic, abiotic, anemia, asexual
- **ad-** [L. *ad-*, toward, to]: adrenalin, adhesion
- **amphi-** [Gk. *amphi-*, two, both, both sides of]: amphibian
- ana- [Gk. ana-, up, up against]: anaphase, anabolism, anatomy
- andro- [Gk. andros, an old man]: androgen
- **anti-** [Gk. *anti-*, against, opposite, opposed to]: antibiotic, antibody, antigen, antidiuretic hormone
- **arthro-** [Gk. *arthron*, a joint]: arthropod, arthritis
- **auto-** [Gk. *auto-*, self, same]: autoimmune, autotrophy, autosome
- **bi-**, **bin-** [L. *bis*, twice; *bini*, two-by-two]: binary fission, binocular vision, bicarbonate
- **bio-** [Gk. *bios*, life]: biology, biomass, biome, biosphere, biotic
- blasto-, -blast [Gk. blastos, sprout; pertains to embryo]: blastula, trophoblast, osteoblast

- **broncho-** [Gk. *bronchos*, windpipe]: bronchus, bronchi, bronchiole, bronchitis
- **carb-** [L. *carbo*, coal]: carbon, carbohydrate
- **carcino-** [Gk. *karkin*, a crab, cancer]: carcinogen
- **cardio-** [Gk. *kardia*, heart]: cardiac, myocardium
- **cat-** [Gk. *kata*, down, downward]: catabolism
- **chloro-** [Gk. *chloros*, green]: chlorophyll, chloroplast
- **chromo-** [Gk. *chroma*, color]: chromosome, chromatin
- **coelo**, **-coel** [Gk. *koilos*, hollow, cavity]: coelom
- **com-**, **con-**, **co-** [L. *cum*, with, together]: coenzyme, covalent, community
- **cranlo-** [Gk. *kranios*, L. cranium, skull]: cranial, cranium
- cuti- [L. cutis, skin]: cutaneous, cuticle

- **cyto-**, **cyte** [Gk. *kytos*, vessel or container; now, "cell"]: cytoplasm, cytokinesis, cytology
- **de-** [L. *de-*, away, off, removal, separation]: deciduous, decomposer, dehydration
- **derm-**, **dermato-** [Gk. *derma*, skin]: dermis, epidermis, ectoderm, endoderm
- **di-** [Gk. *dis*, twice, two, double]: disaccharide, dioxide
- **dia-** [Gk. through, passing through, thorough, thoroughly]: diabetes, dialysis, diaphragm
- diplo- [Gk. diploos, two-fold]: diploid
- **eco-** [Gk. *oikos*, house, home]: ecology, ecosystem
- ecto- [Gk. ektos, outside]: ectoderm
- **endo-** [Gk. *endon*, within]: endoderm, endometrium, endoskeleton
- **epi-** [Gk. *epi*, on, upon, over]: epidermis, epididymis, epiglottis, epithelium
- equi- [L. aequus, equal]: equilibrium
- **eu-** [Gk. *eus*, good; *eu*, well, true]: eukaryote, eutrophic
- **ex-**, **exo-**, **ec-**, **e-** [Gk., L. out, out of, from, beyond]: ectoderm, ejaculation, excretion, exergonic
- **extra-** [L. outside of, beyond]: extracellular, extraembryonic

- **fer-, -fer** [L. *ferre*, to bear]: fertile, fertilization, conifer
- gam-, gameto- [Gk. gamos, marriage; now usually in reference to gametes (sex cells)]: gametogenesis
- **gastro-** [Gk. *gaster*, stomach]: gastric, gastrovascular cavity
- gen- [Gk. *gen*, born, produced by; Gk. genos, race, kind; L. genus, generare, to beget]: polygenic, genotype, glycogen, heterogenous
- **gluco-**, **glyco-** [Gk. *glykys*, sweet; now pertaining to sugar]: glycolysis, glucose, glycogen, glycoprotein
- hemo-, hemato-, -hemia, -emia [Gk. haima, blood]: hemophilia, hematology, hemoglobin
- **hepato-** [Gk. *hepar*, *hepat-*, liver]: hepatic portal system
- **hetero-** [Gk. *heteros*, other, different]: heterozygote
- **histo-** [Gk. *histos*, web of a loom, tissue; pertains to biological tissues]: histology, histamine
- **homo-**, **homeo-** [Gk. *homos*, same; Gk. *homios*, similar]: homeostasis, homologous, homozygous
- **hydro-** [Gk. *hydor*, water; pertains either to water or to hydrogen]: dehydration, carbohydrate
- **hyper-** [Gk. *hyper*, over, above, more than]: hypertonic

- **hypo-** [Gk. *hypo*, under, below, beneath, less than]: hypoglycemia, hypothalamus, hypothesis, hypotonic
- ion- [Gk. ion, small]: ionic
- inter- [L. inter, between, among,
 together, during]: intercellular,
 intercostal
- **intra-**, **intro-** [L. *intra*, within]: intracellular, intrauterine
- **-itis** [L., Gk. –*itis*, inflammation of]: arthritis, bronchitis, dermatitis
- **leuko-**, **leuco-** [Gk. *leukos*, white]: leukocyte, leukodystrophy
- lip- [Gk. lipos, fat]: lipid, liposome
- **-logy** [Gk. *-logia*, the study of, from logos, word]: biology, embryology
- -lysis, lys-, lyso-, -lyze, -lyte [Gk. lysis, a loosening, dissolution]: hydrolysis, catalysis, lysosome
- **macro-** [Gk. *makro-*, great, large]: macromolecule, macrophage
- mega, megalo-, megaly [Gk. megas, large, great, powerful]: acromegaly
- -mere, -mer, mero- [Gk. *meros*, part]: centromere, polymer, telomere
- **meso-**, **mes-** [Gk. *mesos*, middle, in the middle]: mesoderm, mesophyll
- meta-, met- [Gk. *meta*, after, beyond; denotes change]: metabolism, metastasis metamorphic

- **micro-** [Gk. *mikros*, small]: microbe, microscope
- **mono-** [Gk. *monos*, one, single]: monomer, monosaccharide
- **myo-** [Gk. *mys*, mouse, muscle]: myocardium, myoglobin, myosin
- **neuro-** [Gk. *neuron*, nerve sinew, tendon]: neuron, neurotransmitter
- -oma [Gk. -oma, tumor, swelling]: carcinoma
- oo- [Gk. oion, egg]: oogenesis,
- -osis [Gk. -osis, a state of being, condition]: arteriosclerosis
- osteo-, oss- [Gk. osteon, bone; L. os, ossa, bone]: ossification, osteoblast, periosteum
- patho-, -pathy, -path [Gk. pathos, suffering; refers to disease or the treatment of disease]: pathogen, pathology
- **peri-** [Gk. *peri*, around]: pericardial, periosteum, pericycle
- **phago-, phage** [Gk. *phagein*, to eat]: phagocytosis, bacteriophage
- plasm-, -plasm, -plast, -plasty [Gk. plasm, something molded or formed]: plasma, plasma membrane, plasmid, cytoplasm, chromoplast
- **-pod** [Gk. *pod*, foot]: cephalopod, pseudopod
- **poly-** [Gk. *poly-*, *polys*, many]: polygenic, polymer, polypeptide, polymorphism

- pro- [Gk. pro, before]: prokaryote
- **prot-** [Gk. *protos*, first, original]: protein, proton, protista, protosome
- **-rrhea** [Gk. *rhoia*, flow]: diarrhea, gonorrhea
- **-some**, **somat-** [Gk. *soma*, body: Gk. *somat-*, of the body]: chromosome, ribosome
- -stat, -stasis, stato- [Gk. stasis, stand]: metastasis, hydrostatic, homeostasis
- **sub-** [L. *sub*, under, below]: subatomic, subdural
- **sym-**, **syn-** [Gk. *syn*, with together]: symbiosis, symmetry, synapsis, synthesis
- taxo-, -taxis [Gk. taxis, to arrange, put in order; refers to ordered movement]: taxonomy, chemotaxis
- tomo-, -tome, -tomy [Gk. tome, a cutting; Gk. tomos, slice]: anatomy
- **tropho-**, **-troph**, **-trophy** [Gk. *trophe*, nutrition]: trophic level, autotroph, heterotroph
- **ur-**, **-uria** [Gk. *ouron*, urine]: uracil, urea, ureter, phenylketonuria

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Chapter One

An Overview: Textbook Reference

1.1 What Are the Characteristics of Life?

A distinctive set of characteristics distinguishes the living from the nonliving. Together, they enable an organism to acquire energy to support its growth and functioning, and to reproduce, perpetuating life.

Organization
Energy Use and Metabolism
Maintenance of Internal Constancy
Reproduction, Growth, and Development
Irritability, Adaptation and Natural Selection

1.2 How Is Life Diverse?

Organisms carry out the same basic functions, but in different ways. Evolution explains the fundamental similarity of all life; biodiversity reveals the many variations on that theme.

Domains and Kingdoms Describe Life Evolution is the Backbone of Biology

1.3 How Do Scientists Study the Natural World?

The scientific method is a thinking process that guides our evaluation of what we observe. Curiosity, questioning, and systematic testing enable scientists, and others, to learn how nature works.

How Do Theories Explain Nature? How Do Scientists Design Experiments? What are the Limitations of Scientific Inquiry?

What Is Life?

"The very commonplaces of life are components of its eternal mystery." - Gertrude Atherton

The natural world has unity and diversity; order and disorder; simplicity and complexity; energy use and energy release; birth and death; change and sameness. But above all there is life and the whole is greater than the sum of its parts. And so we embark on a venture of gaining an insight into the paradox of life.

Employing scientific inquiry allows us to investigate the aspects of living organisms- form, function, classification schemes and interrelationships as well as many other biological principles. We have limitations imposed on us in this venture, our senses, which enable us to observe phenomena directly and indirectly. We uncover information in pure research and use it in applied research, all the while making serious efforts to be objective and not subjective.

Ricki Lewis has used her passion for knowledge and love of biology to weave a tapestry of principles and real world applications. Enjoy your textbook, do your initial readings once for the flavor, twice for the concepts, spend time working in your study guide and finally go back to your text a third time for real understanding. For a broader perspective take advantage of the Online Learning Center (OLC) to visualize the concepts, go on line to increase your information pool, pull things together using the case studies as markers to your learning and attack knowledge with a fervor and purpose because *Life* is what we're all about.

Provide a context for these terms.

adaptation

Domain

Biology has a language, words that are tools for explanation. To help you become proficient in using these tools, each section of your Study Guide will have a list of terms for which you will provide a context. Your textbook provides a more complete listing whereas the guide will focus on those terms that seem to give students problems. It is always a wise idea to define new vocabulary terms but for true comprehension you must <u>use</u> them correctly in a written or oral manner. Some words are problems because we may use them differently in the "real" world. Construct sentences for the terms below, indicating your knowledge of their biological context. You can reference your glossary to check your answers. Remember it is hard to walk the walk if you can't talk the talk!

emergent properties

experimental control

homeostasis

metabolism

Ν	hat do I remember?
l.	Organisms found living in nature's extreme environments are termed How do we use these organisms?
	List four extremes of environmental conditions in which organisms with extremozymes carry out their life functions.
	• • •
	•

	The living world has a hierarchy of parts made of parts. Using the following terms, place these parts in an order from smallest to largest. As you reflect on your choices, keep in mind that each new part is unlike its predecessor it is emerging somewhat as a butterfly from its chrysalis.						
		biosphere community tissue	organelle organ cell	biochemical organism Population	system ecosystem		
	The pattern of life de directions?	pends on a blu	ueprint of inst	ructions. What n	najor macromolecule contains the		
	Synthetic and degrad acquire and use				organisms are collectively termed tant in that they allow the organism to		
•	There is a strong interdependency in the scheme of life. The major players can be classified as producers, consumers and decomposers. Briefly describe the relationship shared among the three, giving concrete examples.						
i.	Homeo means "same constantly maintain l				lance". Living organisms must it difficult to do?		
c	What are advantages	and disadvan	tages of asexu	al and sexual rep	production?		
	What is the primary	necessity for r	eproduction?				
,		once reproduct Distir			nts occur. They are and		
	rather immediate, wl	nich life functi	on is being er	nployed?	responses to occur. If a response is erational, they are referred to as		
		·					

. D - -	iscuss	the statement, "Nature selects for characteristics or against them".						
. T	Bacteria, Archaea, and Eukaryota are broad classification schema. Collectively they are known as Taxonomically speaking, what is the significance of this pneumonic device? King Philip came over from Greece Saturday.							
		dividual we have a first and a last name. As a member of a species we also have a two name What is the scientific name of a human?						
How is a species defined?								
A	rapid	fying theme of biology is It is a change over time. change in DNA, is termed a(n)						
V	Vhat do	DES daughters and Apopka alligators have in common?						
	a.	Considering the answer to question 22 and scientific inquiry, what general observation was made regarding Apopka alligators?						
	b.	What is the significance of the correlation that human sperm counts are decreasing and pesticide use is increasing?						
	c.	Why was researching known information important to the Apopka alligator/DES problem?						
V	Vhy is	it <u>not</u> advisable to use the expression "science has <u>proven</u> "?						
<u>C</u>	Compos	te a short paragraph using the following terms: prediction, hypothesis, experiment, supported						
_								
	Iypothe levated	eses that have been repeatedly tested and yielded similar results, time after time, may be status.						
		the importance of sample size, experimental controls, and one variable testing?						
-								
-		dentification variance and a manufactor framewhilm its. Tourish have recommended						
. 5	ome so	cientific discoveries are a result of serendipity. Explain how, using an example.						
_								
-								

You will find more quiz questions available when you visit: $\underline{www.mhhe.com/life}$

Extensions

Of Interest

By the way, from an historical perspective and if you'd like to read an interesting article, check out "Life's Last Domain" by Virginia Morell. It is found in Science, volume 273, August 23, 1996 on pages 1043-1045. See what you think of the last sentence!

In My Opinion

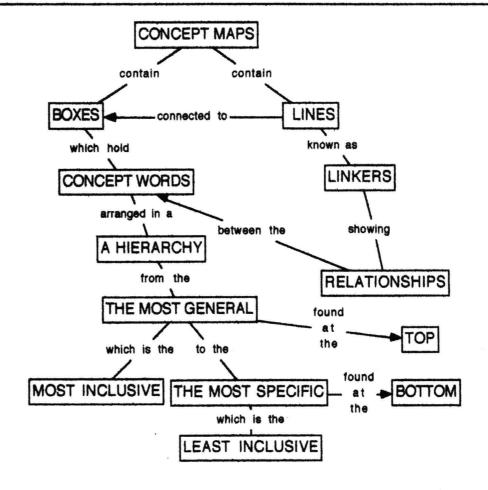
Bioethics is a field of philosophy that examines principles of morality, individual rights, justice, and values as they apply to medical technologies and research activities. Individuals are pressed into making judgements when confronted with bioethical issues. What are your feelings about the information found at: www.inmotionmagazine.com/tootall.html

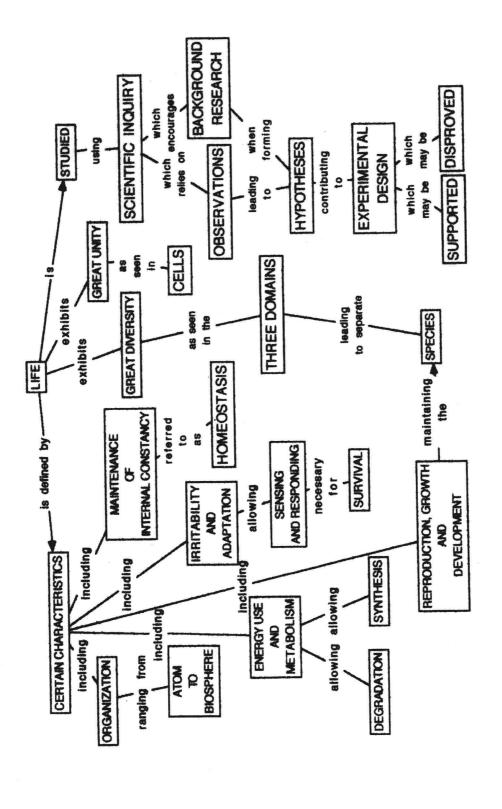
Now let's go back to the paradox of life, the whole is greater than the sum of its parts. Emergent properties arise as the levels of organization increase and are the consequences of physical and chemical laws. Wood and nails and wire are separate entities, but when thoughtfully and skillfully fashioned they can supply a home. Learning about biology may also benefit from the use of tools. We will try to pull together the essence of Chapter 1, *What is Life?* through the use of a tool called concept mapping.

Concept Maps, A Tool For Learning

Just as we have daily planners to keep track of our comings and goings in life, so too can we have mental organizers keeping track of newly acquired information. Memorization is a very inefficient way to master concepts. New terms need to be connected to the already known. New information can become meaningful when it is linked to knowledge one has already acquired. A variety of methods such as the graphic organizer known as a concept map can be powerful tools used to clarify and develop a personal conceptual framework. As you use this study guide, you will find concept maps that are completed, partly finished and waiting for you to supply the missing concepts or linkers and blank pages where you become the map maker. It is these blank pages that allow you to organize the concepts and develop personal conceptual frameworks for studying Life.

A CONCEPT MAP





Revisiting your list of context terms, circle the map area where experimental control would best fit. Put a square around the concept that includes emergent properties.