

Nature Education

Principles of Science Interactive Textbooks


IDPF Digital Book 2012


Principles of Science by nature EDUCATION Textbooks for the 21st century

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Announcing Principles of Science Textbooks for the 21st Century

From the publisher of Nature and Scientific American, Principles of Science is a series of textbooks designed for the world we live in today. The first textbook in the program, **Principles of Biology**, is a research-oriented, affordable interactive textbook for university-level introductory biology courses.






Instructors

Principles of Biology contains more than 200 customizable modules, covering chemistry, genetics, cell biology, animal physiology, plant physiology, and ecology. Each module is self-contained learning experience combining textual instruction, high quality figures, simulations, interactive exercises, self-tests, and formal tests. Students can highlight and annotate each page in the textbook, download a printable copy of all material, and access the textbook from mobile devices. Includes more than 100 research papers from NPG journals with synopses, a test bank of 1000 questions, an Instructor Guide, and projectable slides containing all art.

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Students

Part of a class that is using Principles of Biology? Search here using your instructor's name or institution. You can purchase access online or redeem an access code from your bookstore.

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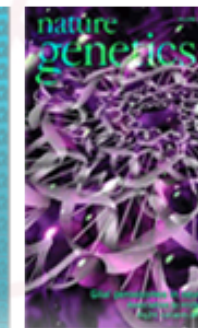
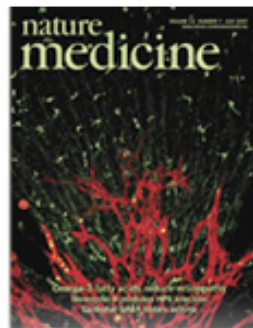


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Division of Macmillan Publishers Ltd.

60 journals from the flagship *Nature* to research journals such as *Nature Neuroscience* and *Nature Genetics*.

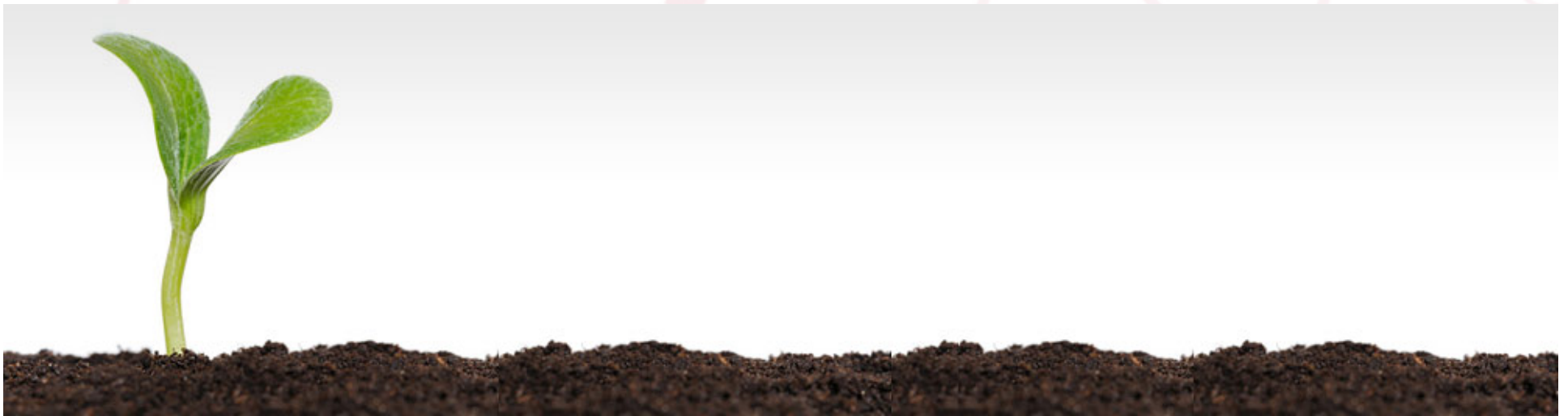
Created education division in 2007





Mission

1. Publish 21st century science textbooks for mature markets
2. Strengthen developing world capacity in science education





Science Publishing for the Developing World: Open Education

Content + tools + community

Supporting formal education systems

Collaboration with UNESCO and other international organizations





Scitable: A Collaborative Learning Space for Science

Content library with 2000+ standalone instructional pieces in the life sciences.

Community of faculty, students, tutors, scientists, and parents.

Classroom tools including reading lists, discussions, assessments.

Launched in Dec 2008, currently 500,000 users per month, supported by corporate sponsorship



The screenshot shows the Scitable website interface. At the top, it says "Scitable by NATURE EDUCATION" and "A Collaborative Learning Space for Science". Below this is a navigation bar with links for HOME, TOPICS, PEOPLE, GROUPS, and BLOGS. There are also links for "Sign In / Register" and "Search Scitable". The main content area is divided into several sections: "What Is Scitable?" which describes the platform as a free science library and personal learning tool; "Inside Scitable" which lists features like "Browse & Search Science Articles", "Get Help or Connect with Peers", "Build an Online Classroom", and "Contribute & Share Your Content"; "Genetics" and "Cell Biology" sections with editors Hana Miko and Sara Tenney; and "NEW! AFFORDABLE INTERACTIVE SCIENCE TEXTBOOKS" featuring "Nature Educator's Principles of Biology" and "Essentials of Cell Biology".

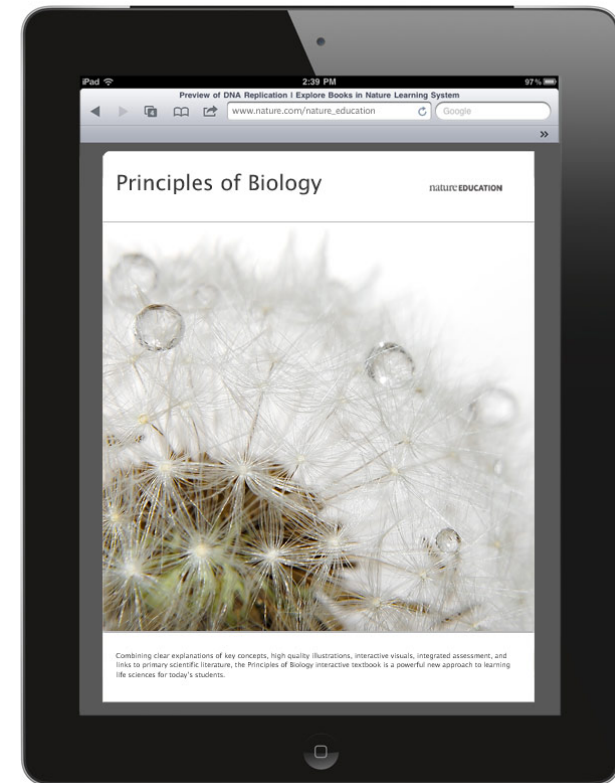
Interactive Textbooks . . . Science Education for Mature Markets

Current challenges of textbook

- Poor sell-thru through apathy
- Complicated user experience
- Cost and difficulty of keeping up with digital innovation
- Lost opportunities for measurable, effective instruction

Textbooks moving forward

- Born digital
- User-friendly
- Skills-oriented
- Affordable





Born Digital

Designed creatively for the special characteristics of digital media

Easy to customize
Multimedia
Interactive
Intertextual
Social
Brief
Adaptive
Flexible

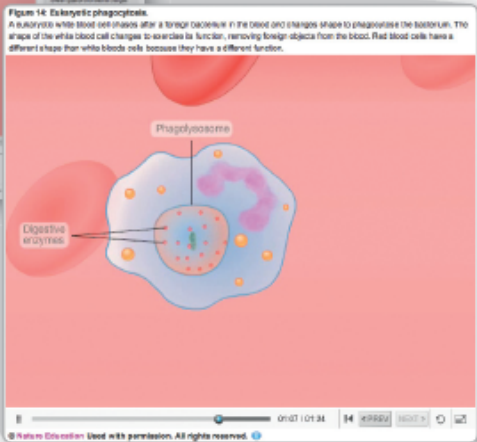




User Friendly

Seamless workflow

Anytime / anywhere



Skills-Oriented

Connected with primary literature and data sets

Active learning

Case-based



Principles of Biology
NATURE EDUCATION

PRIMARY LITERATURE SYNOPSIS

Classic paper: The idea of the DNA double helix (1953)

BASED ON: A structure for deoxyribose nucleic acid. *Nature* 171, 737-738 (1953).

AUTHORS: J. D. Watson / F. H. C. Crick

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Principles of Biology
NATURE EDUCATION

Classic paper: The idea of the DNA double helix (1953)

BACKGROUND

Modern genetics traces its roots to the 19th century monk, Gregor Mendel, who performed experiments breeding peas. Mendel postulated that there were internal factors that specified external characteristics. Today we know these factors are genes. By the late 19th century, scientists were postulating that a cellular material called chromatin/acid was the physical carrier of heredity. In 1944, a group of scientists led by Oswald Avery isolated the active material in bacterial extracts that carried genetic information and identified it as DNA.

Subsequent discussions by many eminent scientists led to the identification of chromosomes and heredity. In parallel, research on enzymes was evolving into what we know today as biochemistry. By the late 1940s, scientists widely believed that genes were the carriers of heredity, and DNA was a candidate genetic material. However, scientists still did not know the structure of DNA.

WHAT WAS THE DISCOVERY?

Previously, researchers had proposed a structure of the DNA molecule having three intertwined chains with phosphates near a central axis and the bases on the outside. However, James D. Watson and Francis Crick realized that this three-chain structure did not fully conform to fresh data from the X-ray diffraction images of DNA by Rosalind Franklin and Maurice Wilkins. Based on these images a fresh approach to all available data, Watson and Crick instead proposed a structure with two helical chains that are coiled around the same central axis, with the bases on the inside of the helix and the phosphates on the outside. They hypothesized that the helical structure was open and had a high water content. The novel feature of the proposed structure was the manner in which the purines and pyrimidine bases held the two chains together. The basis for this structure was that the bases were aligned perpendicular to the central axis. Based on the chemical composition of the bases, the authors postulated that a base in one chain forms a hydrogen bond with a base in the second chain. As a result, both of the bases lie in the same plane and hold the two chains together.

In order for the bases to form hydrogen bonds, the authors argued that the nucleotides must be present in the keto form rather than in the enol form. In the keto form, the electronegative oxygen atom is an electron donor to the hydrogen bond. This allowed them to hypothesize that only specific pairs of bases can bond together. Based on the structure of the nucleotides, they were able to pair adenine (A, a purine) with thymine (T, a pyrimidine) and guanine (G, a purine) with cytosine (C, a pyrimidine). As a result, they suggested that if the sequence of one chain in the helical structure is known, then the sequence of the other chain could be automatically deduced because of this specific pairing. Erwin Chargaff's previous experimental observations that the ratio of A to T and G to C were always close to one in DNA backed this idea.

The observations reported by Watson and Crick in this seminal paper were mainly hypotheses on the structure of DNA. While acknowledging that more experimental X-ray data would have to be accumulated to test their ideas on the possible structure of DNA, they noted that the specific pairing that they suggested (A-T and G-C) could indicate a possible copying mechanism for genetic material.

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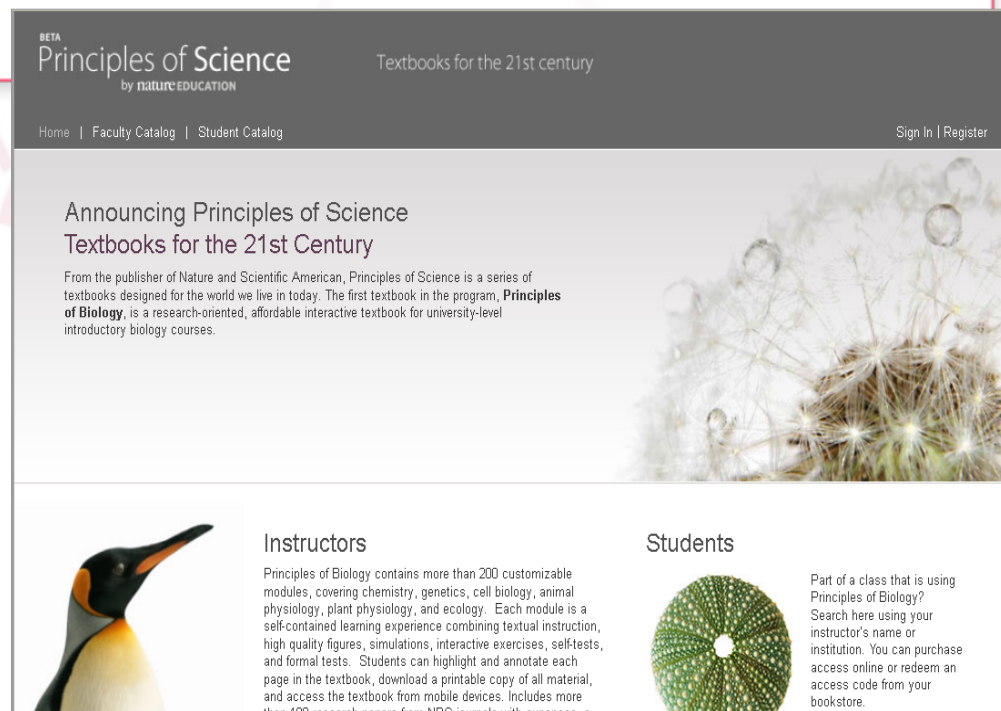


Principles of Science

Interactive textbooks in the life and physical sciences

First textbook *Principles of Biology*, \$49

100+ adoptions in Y1



The screenshot shows the homepage of the 'Principles of Science' website. The header includes the 'BETA' logo, the title 'Principles of Science by nature EDUCATION', and the tagline 'Textbooks for the 21st century'. Navigation links for 'Home', 'Faculty Catalog', 'Student Catalog', 'Sign In', and 'Register' are present. The main content area features a large image of a dandelion seed head and a headline 'Announcing Principles of Science Textbooks for the 21st Century'. Below this is a paragraph describing the textbooks as research-oriented and affordable. The footer is divided into two sections: 'Instructors' with a penguin image and 'Students' with a green circular graphic.

BETA
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Textbooks for the 21st century

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Principles of Biology

nature EDUCATION





Contents

Unit 1: Chemistry



1. [Atoms, Elements, and Matter](#)



2. [Structure of Molecules and Compounds](#)



3. [Water](#)



4. [Acids and Bases](#)



5. [Carbohydrates](#)



6. [Lipids](#)



7. [Proteins](#)



8. [Enzymes](#)



9. [Nucleic Acids](#)

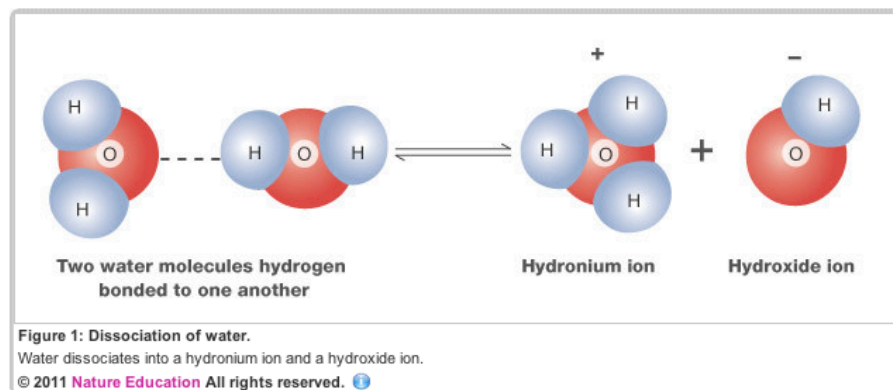
Understanding Hydrogen Ions

Most people recognize water as a neutral substance. Yet water can dissociate into ions that lead to the formation of acidic and basic solutions. Water, a polar covalent compound, consists of two hydrogen atoms and one oxygen atom. Each water molecule dissociates into two ions — a hydrogen-oxygen pair and a single hydrogen ion, or proton (Figure 1). The hydrogen-oxygen pair has a stronger electronegativity than the single hydrogen atom and therefore steals the electron from the single hydrogen, forming a **hydroxide ion** $[\text{OH}^-]$. The free **hydrogen ion** $[\text{H}^+]$ rarely occurs by itself in nature. In most cases, it combines with another water molecule to form a **hydronium ion** $[\text{H}_3\text{O}^+]$.

Test Yourself

Describe what happens when a water molecule dissociates.

Submit



All scientists use the same system to measure acids and bases.

What makes a solution acidic or basic? In pure water, the concentration of hydrogen ions (protons) and hydroxide ions is the same, approximately 10^{-7} molar (or moles/L). The product of the concentrations of these two ions is 10^{-14} molar. This product remains constant such that if the concentration of hydrogen ions increases, the concentration of hydroxide ions must decrease. The amount of change in ion concentrations is

Notes on

IN THIS MODULE

▶ Understanding Hydrogen Ions

- ▶ The Effect of Changes in Acidity on Living Things
- ▶ Ocean Buffering System
- ▶ Summary
- ▶ Test Your Knowledge

WHY DOES THIS TOPIC MATTER?



The Climate Connection

How is life on Earth reacting to climate change?



A Sea of Microbes Drives Global Change

Do floating microbes in the ocean's surface waters play an outside role in global climate?

PRIMARY LITERATURE

How elevated carbon dioxide levels affect coral reefs

Coral reefs are challenged by an increasingly more acidic environment due to elevated carbon dioxide levels in the water, accelerating the growth of macroalgae and seagrass, which alters the dynamics of the ecosystem

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The next generation of pipetting uses tiny droplet-making machines

An ingenious droplet-based microfluidic device, a type of "lab-on-a-chip," promises to replace not only the conventional pipette for making large-scale serial dilutions in chemistry and biological applications, but also robotic-based approaches.

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PRIMARY LITERATURE SYNOPSIS

Manmade leaves may solve
energy crisis

BASED ON: A renewable amine for photochemical reduction of
CO₂. *Nature Chemistry* 3, 301–303 (2011). doi:10.1038/
nchem.1000

AUTHORS: Robert D. Richardson / Edward J. Holland / Barry K. Carpenter

Test Your Knowledge

1. An unidentified lipid is placed in front of you. It is liquid at room temperature. With this basic information, how was this lipid produced?

- By a plant
 - By a mammal
 - In the human liver
 - By the bonding of a carboxyl functional group with glycerol
 - None of the above
-

2. What characteristic of lipids accounts for the separation of oil into droplets in salad dressing even after shaking?

- Lipids combine with functional groups.
 - Lipids form ester links.
 - Lipids form double bonds between the carbon atoms on the fatty acid.
 - Lipids are hydrophobic.
 - Lipids are hydrophilic.
-

3. What materials can pass easily through a phospholipid bilayer?

- Carbon dioxide
- Glucose
- Water
- Sodium ion
- All of the above








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Gradebook

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Display Options

 Show scores as points as % Calculate total from Last Score

Student	HIDE MODULE NAMES					Grade to Date
	Module 1 (7) Evolution and Life on Earth	Module 2 (5) Energy and Matter	Module 3 (5) Biological Information and	Module 4 (5) Practicing Science	Module 5 (5) Atoms, Elements, and	
SHOW DUE DATES						
 Walrath Cassie	7	4	4	5	3	51%
 Purdy Katherine	7	5	5	5	5	87%
 Cholhan Remy	7	5	5	4	4	79%
 Mason Kevin	7	5	5	5	5	89%
 Shields Jennifer	7	5	5		5	89%
 Bates Jamie	7	5	5	3	4	55%
 Hartle Matthew	5	5				83%
Class Average	81%	91%	83%	78%	85%	
Site Average	81%	89%	82%	77%	86%	



9:41 AM

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Students



One of a kind, no one else has ever done this before. This is the only textbook that is designed to be used on a mobile device. It is the only textbook that is designed to be used on a mobile device.

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Navigation icons: back, forward, search, home, and refresh.

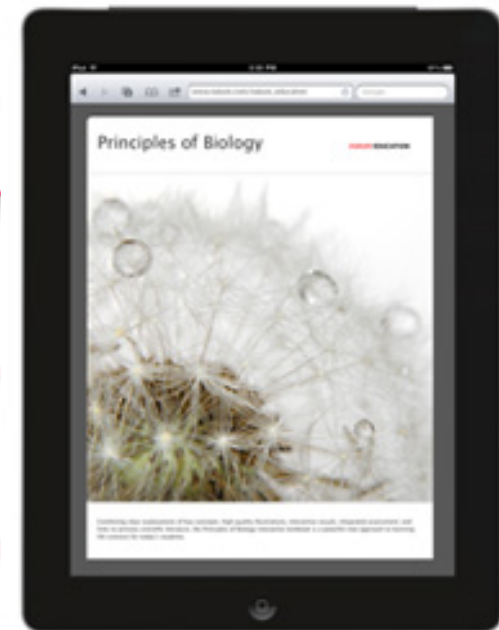
Case Study: Mobility

Apps are exciting . . . But a challenge for long-term supportability

Browser-based access is a wiser strategy

Solve crucial technical and content management challenges:

- Automatic transcoding of media / resizing of images
- Multiple HTML versions for different form factors
- Synch information across multiple formats
- Maximize aggregate SEO value

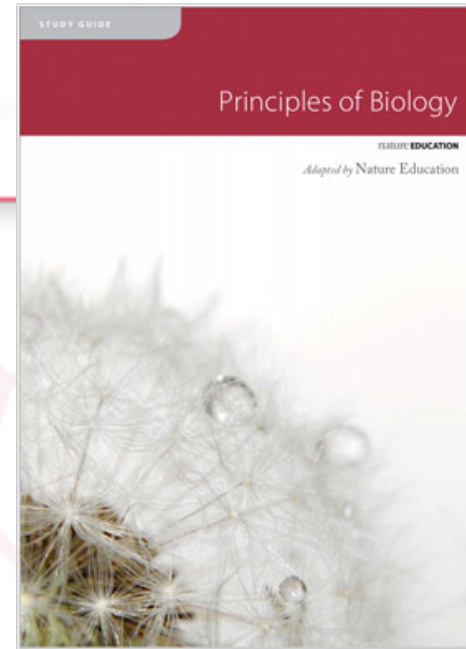


Case Study: DRM

Don't penalize "virtuous" students because of rule-breakers

Build essential value into full online access

Make it difficult to easily pirate whole books



Distribution

Familiar to customers

- Bookstores
- E-commerce
- But not Amazon or Apple

New to customers

- Site licenses





Questions?

