Inquire for iPad: Bringing Question-Answering AI into the Classroom

Aaron Spaulding
SRI International
spaulding@ai.sri.com

C. Adam Overholtzer
SRI International
overholtzer@ai.sri.com

John Pacheco
SRI International
pacheco@ai.sri.com

Jing Tien
SRI International
tien@ai.sri.com

Vinay Chaudhri
SRI International
vinay.chaudhri@ai.sri.com

Debbie Frazier
SRI International
deborah.frazier@sri.com

Dave Gunning
Vulcan Inc.
daveg@vulcan.com

Peter Clark
Vulcan Inc.
peterc@vulcan.com

Inquire

Inquire is a new type of electronic textbook that integrates a reasoning system and a rich biology knowledge base, allowing it to answer a wide variety of biology questions.

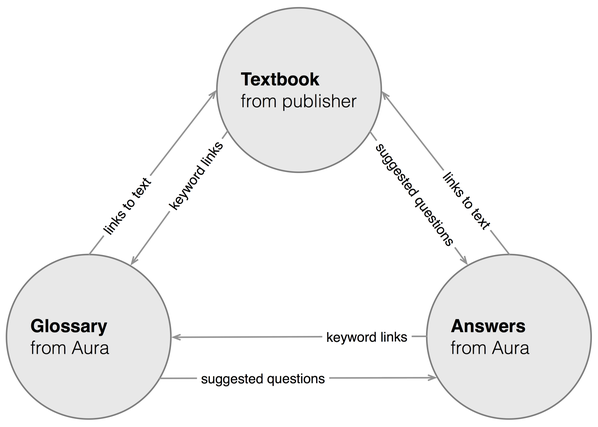
Inquire offers new ways for students to explore and interact with educational materials, and ultimately, improve their understanding of a domain.

The question answering capability is provided by our Aura system, which runs on a remote server, allowing the Inquire app to take advantage of the iPad's light form factor and rich interactivity.

Aura

Aura uses a knowledge representation and reasoning system that combines description logics and logic programs.

The reasoning mechanisms in Aura include inheritance, backward chaining, subsumption and classification. It also includes specialized reasoning modules to deal with under-specified knowledge bases, and property values. Aura embeds in it a knowledge management environment for editing knowledge bases and includes error checking and truth maintenance capabilities.



Design & Principles

Inquire's three interlinked components move beyond the linearity of conventional textbooks:

1. Electronic version of the *Campbell Biology* textbook with links to 4000+ concepts in our glossary.

2. Answers generated by Aura. Like the text, the answers contain links to key concepts and related questions.

3. Detailed glossary pages for key concepts. These are also generated by Aura, and contain links to related concepts and questions.

Inquire's design is derived from three main principles:

Don't get in the way
- Answers should be concise, precise, and understandable
- Provide clear ways to ask questions and drill down to more detail

Be proactive
- Suggest questions and resources based on context

Attract and engage
- Draw in the students and encourage them to interact with content

Active Reading

Active reading is a strategy that emphasizes continuous direct engagement with a text during the reading process, in order to help students extracting meaning from a written text and improve critical thinking skills.

Inquire facilitates active reading through support for note taking, looking up unfamiliar terms, posing questions, and exploring answers and explanations.

FULL TEXTBOOK

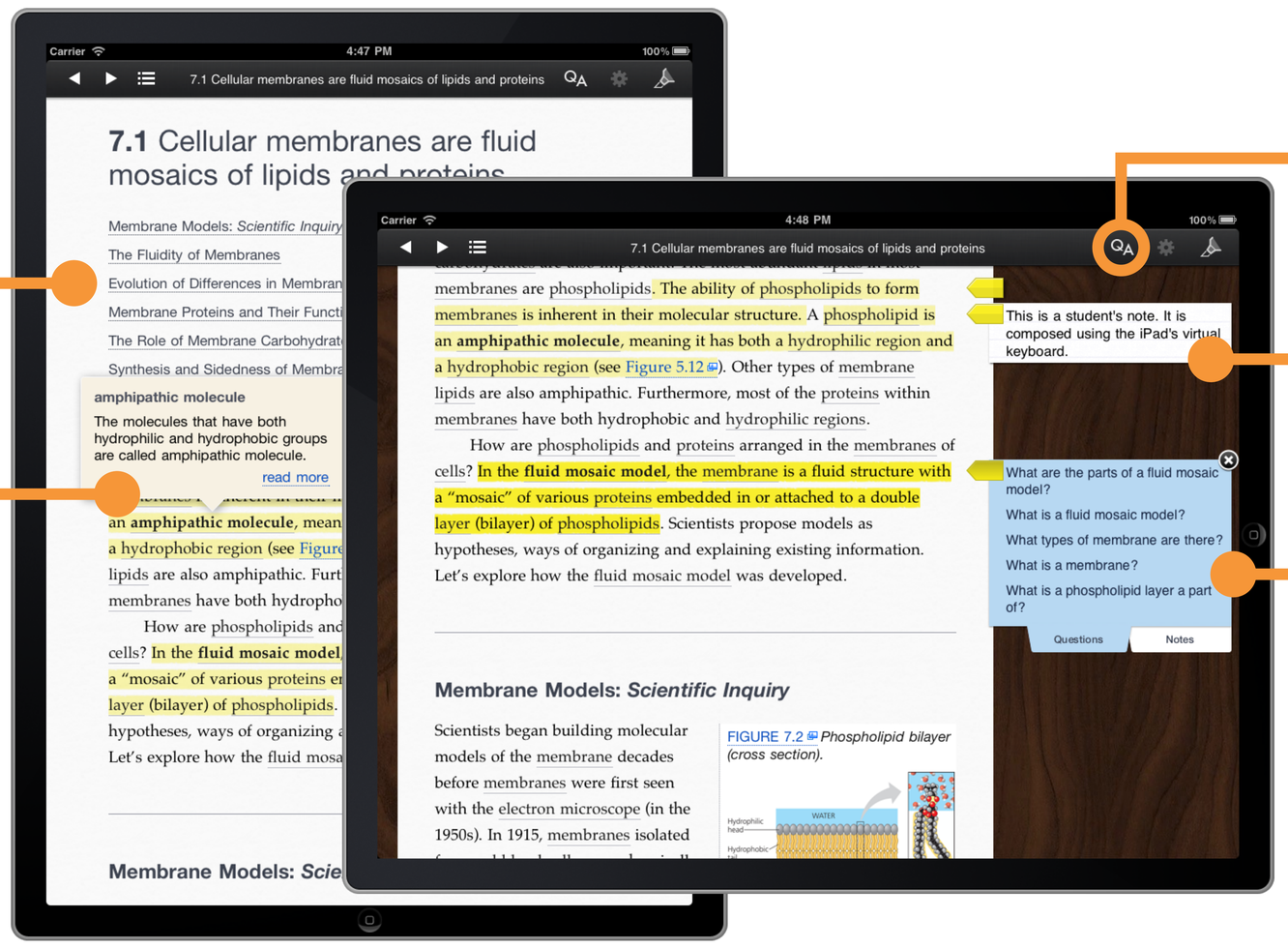
Inquire contains the entire content of the popular *Campbell Biology* textbook, including graphics.

GLOSSARY LINKS

Key terms from our knowledge base are hyperlinked; tapping a link shows a brief definition. Tapping "read more" opens the full glossary page.

PORTRAIT & LANDSCAPE

In portrait orientation, Inquire's screen is filled with content, allowing you to read without distraction. Rotate to landscape to reveal a side margin containing notes and suggested questions.



QUESTION-ASKING MODE

Students can ask free-formed questions or select from a list of suggested questions related to the current section of the textbook.

HIGHLIGHTS & NOTES

Students can easily highlight text and write notes.

SUGGESTED QUESTIONS

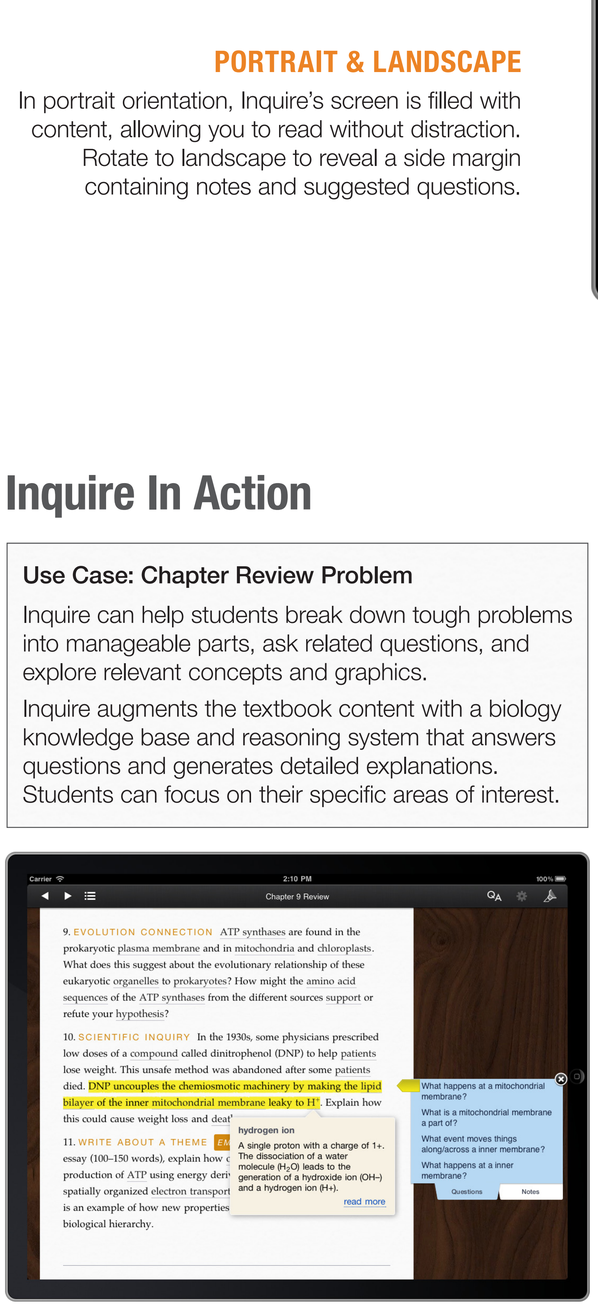
As the student highlights, Inquire suggests questions related to the highlighted material. Students can use these questions to test their own understanding, to recall previous material, or to explore related concepts. Tapping a question opens the question-asking mode.

Inquire In Action

Use Case: Chapter Review Problem

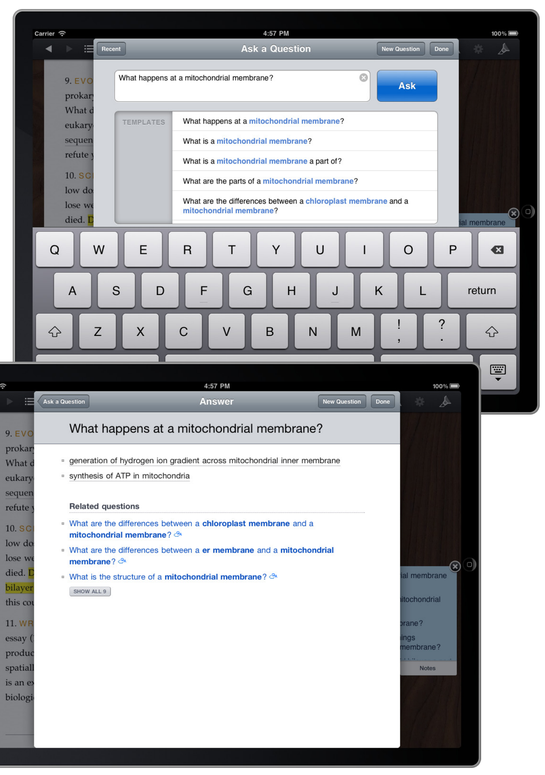
Inquire can help students break down tough problems into manageable parts, ask related questions, and explore relevant concepts and graphics.

Inquire augments the textbook content with a biology knowledge base and reasoning system that answers questions and generates detailed explanations. Students can focus on their specific areas of interest.



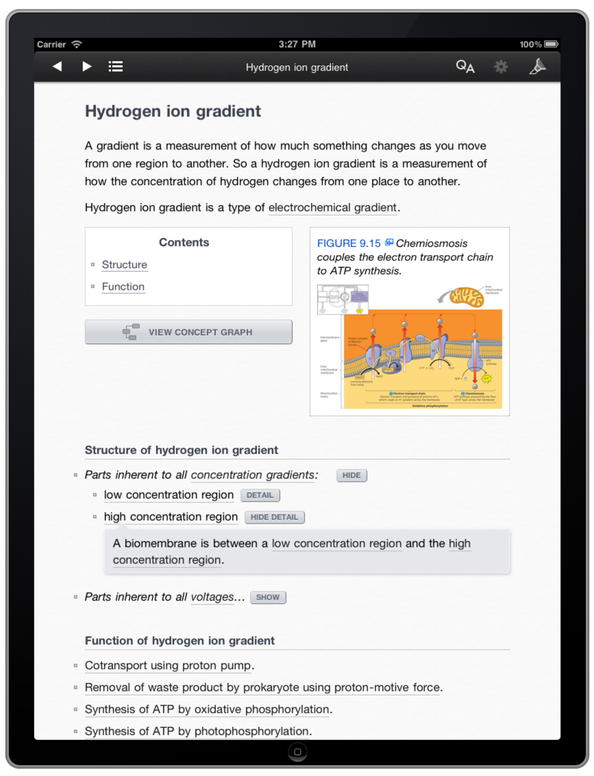
DECONSTRUCT THE PROBLEM

Inquire suggests questions related to the homework problem, including several about mitochondrial membranes. Glossary links provide quick reminders, like H+ means *hydrogen ion*.



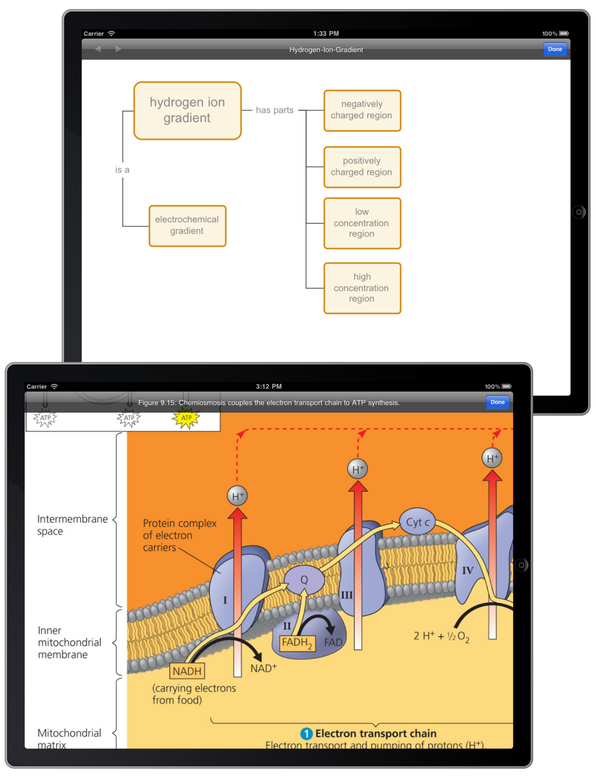
ASK QUESTIONS

Ask novel or suggested questions, such as this one about the functions related to mitochondrial membranes. Answers are generated by Aura, and contain links to the glossary just like the textbook. Inquire also suggests related questions for further exploration.



BROWSE GLOSSARY

Follow links to full glossary pages generated by Aura, which provide a comprehensive guide to the structure and function of every textbook concept. To provide context, Aura includes superclasses and inheritance.



EXPLORE VISUAL MEDIA

Biology is extremely visual; from the glossary, explore full-screen images and concept graphs. Like glossary content, concept graphs are generated from our knowledge base and have links from concept to concept.

This work has been funded by Vulcan, Inc. Text and figures from Biology (9th Edition) by Neil A. Campbell and Jane B. Reece. Copyright © 2011 by Pearson Education, Inc. Reprinted (used) by permission of Pearson Education, Inc.