

# **One World, Many Worlds: Searching for Life on Earth and on Other Planets**

## **A 2004-2005 Fall/Winter Program for Secondary (Middle and High School) Massachusetts Teachers Sponsored by NASA**

### **The Program:**

The goal of this program is to increase teachers' own understanding of key topics in the field of astrobiology and to provide a practical context in which science can be taught with an interdisciplinary approach. The program consists of 14 weekly meetings, starting on October 18, 2004 and ending on March 7, 2005. During the program, educators will engage in a variety of hands-on activities complemented by lectures that address some of the research areas recommended in the NASA Astrobiology Roadmap. Time will be especially devoted to the discussion of the results of activities run by the participants in their classrooms. Scientists from the Harvard-Smithsonian Center for Astrophysics will bring to the program the latest news in the fields of astrobiology and the search for planets in other solar systems and will be available for interaction with the participants. A highly integrated science, astrobiology offers a rich venue for life science, physical science, and earth and space science teachers to engage students with intriguing questions and ideas that introduce them to scientific inquiry out of curiosity. At the same time, astrobiology allows teachers to meet many science content learning standards, as described, for example, in the National Science Education Standards. As an integral part of the program, teachers of the same discipline will work together to identify the science content learning standards in the Massachusetts Science and Technology/Engineering Curriculum Framework that they will be able to address with the proposed set of astrobiology activities.

### **What is Astrobiology?**

Astrobiology is the study of the origins, evolution, distribution, and future of life in the universe. It requires fundamental concepts of life and habitable environments that will help us to recognize biospheres that might be quite different from our own. Astrobiology embraces the search for potentially inhabited planets beyond our Solar System, the exploration of Mars and the outer planets, laboratory and field investigations of the origins and early evolution of life, and studies of the potential of life to adapt to future challenges, both on Earth and in space. Interdisciplinary research is needed that combines molecular biology, ecology, planetary science, astronomy, information science, space exploration technologies, and related disciplines. Astrobiology addresses the following three basic questions that have been asked in various ways for generations:

- \* How does life begin and evolve?
- \* Does life exist elsewhere in the universe?
- \* What is the future of life on Earth and beyond?

**When:**

The 14 sessions will be held on:

October 18

November 1, 8, 15, 22

December 6, 13

January 10, 24, 31

February 7, 14, 28

March 7

From 3:00 PM to 6:00 PM

**Where:**

The program will be held at the **Harvard-Smithsonian Center for Astrophysics**, located at 60 Garden Street in Cambridge, Massachusetts.

**Cost/Credit:**

There is no cost for this program. 40 PDPs for certification renewal will be awarded upon completion of the program and submission of final paper.

**Questions?**

If you have questions about this program, please do not hesitate to contact

Dr. Irene Porro

Education and Public Outreach Scientist

MIT Center for Space Research

[iporro@space.mit.edu](mailto:iporro@space.mit.edu)

(617) 258-7481

## Application for Astrobiology Program – Fall/Winter 2004-5

If you are interested in applying for this opportunity, please complete the information that follows. We encourage pairs of teachers from schools/districts to apply, however will also accept applications from individual teachers.

Name: \_\_\_\_\_

Home Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip Code: \_\_\_\_\_

Home Phone Number: \_\_\_\_\_

School: \_\_\_\_\_

School Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip Code: \_\_\_\_\_

School Phone Number: \_\_\_\_\_

Grade Level/Subject Taught: \_\_\_\_\_

E-mail address: \_\_\_\_\_

Best way to contact you (circle one):

e-mail (preferred)    phone    regular mail

Other (specify) \_\_\_\_\_

**Brief Response:**

In **at least 250 words**, please tell us how this program will fulfill personal/professional goals and needs that you have identified for yourself and goals or needs for your school/district. Please attach your response to your application and mail them to:

Dr. Irene Porro  
Education and Public Outreach Office  
MIT Center for Space Research  
77 Massachusetts Avenue, NE80-6095  
Cambridge, MA 02139

## National Science Education Standards addressed in the program:

<b>Unifying Concepts and Processes:</b>	<ul style="list-style-type: none"> <li>•System, Order, and Organization</li> <li>•Evidence, Model, and Explanation</li> <li>•Constancy, Change, and Measurement</li> <li>•Evolution and Equilibrium</li> <li>•Form and Function</li> </ul>
<b>Science as Inquiry:</b>	<ul style="list-style-type: none"> <li>•Abilities Necessary to do Scientific Inquiry</li> <li>•Understandings about Scientific Inquiry</li> </ul>
<b>Physical Science:</b>	<ul style="list-style-type: none"> <li>•Structure &amp; Properties of Matter, Objects, &amp; Materials</li> <li>•Chemical Reactions</li> <li>•Interactions of Energy and Matter</li> </ul>
<b>Life Science:</b>	<ul style="list-style-type: none"> <li>•Biological Evolution</li> <li>•Matter, Energy, &amp; Organization in Living Systems</li> <li>•Behavior of Organisms</li> <li>•Earth and Space Science</li> </ul>
<b>Earth and Space Science:</b>	<ul style="list-style-type: none"> <li>•Energy in the Earth System</li> <li>•Origin and Evolution of Planetary Systems</li> <li>•Planetary Characteristics</li> <li>•Organization of the Solar System</li> </ul>
<b>Science and Technology:</b>	<ul style="list-style-type: none"> <li>•Abilities of Technological Design</li> <li>•Understanding Science and Technology</li> </ul>
<b>Science in Personal and Social Perspectives:</b>	<ul style="list-style-type: none"> <li>•Natural Resources</li> <li>•Risks and Benefits</li> </ul>
<b>History and Nature of Science:</b>	<ul style="list-style-type: none"> <li>•Science as a Human Endeavor</li> </ul>
<b>Mathematics Standards:</b>	<ul style="list-style-type: none"> <li>•Problem Solving</li> <li>•Communication</li> <li>•Reasoning</li> <li>•Connections</li> <li>•Computation and Estimation</li> <li>•Patterns and Functions</li> <li>•Probability</li> <li>•Measurement</li> </ul>
<b>Science Process Skills:</b>	<ul style="list-style-type: none"> <li>•Observing</li> <li>•Measuring</li> <li>•Communicating</li> <li>•Collecting Data</li> <li>•Inferring</li> <li>•Predicting</li> <li>•Making Models</li> <li>•Hypothesizing</li> <li>•Interpreting Data</li> <li>•Controlling Variables</li> <li>•Defining Operationally</li> <li>•Investigating</li> <li>•Extrapolating</li> <li>•Synthesizing</li> </ul>