

Robofly Leader's Guide

Subjects: Science, Innovation & Creativity

Audience Level: Jr. High - College, Adult

Length: 26 mins.

Objectives: *After viewing, viewers should be able to:*

- outline the goals and major steps of the robotic fly project
- examine the creative thinking required to conceive of this project and the hard scientific research and innovation required to achieve it
- consider why people would want to build a robotic insect and some possible applications of this technology
- explore one's own thoughts about the merging of creativity and science
- be inspired to think outside of the usual parameters of creativity and science, and try to conceive their own imaginative scientific project

Content:

At UC Berkeley, a team of engineers and scientists are united in their firm dedication to build – the world's first robotic fly! The fly, which Professor Michael Dickinson calls "the fighter jet of the animal kingdom" is a natural marvel of sophisticated sensory, cognitive and mechanical design, extremely difficult to analyze and replicate. But a group of brilliant scientists stages ingenious high-tech experiments to crack the secrets of insect flight, while a team of engineers uses their findings to try to build a robotic fly. Their quirky quest, which they gleefully admit is a lot of fun, also raises questions about the field's practical applications and the possibility of unintended, even dangerous consequences. So often we see science and creativity as opposites, but here is a fascinating lesson in what happens when the scientific imagination and new age technology meet, merge and take flight.

Before viewing:

Try to find and enlarge a photo of a fly, or draw one on the board. Ask the audience to list some of the obvious attributes of the fly, such as wings, thorax, eyes, legs, proboscis, etc. Then ask them to consider what would be required to replicate that fly in a laboratory and if they think it's at all possible. Suggest they keep all these things in mind as they watch the following video.

After Viewing:

- Return to the "before viewing" activity and see whether the audience came up with the same issues the scientists and engineers did. Were there some ideas the audience didn't foresee? Consider how one can come up with questions and thoughts about something that doesn't even exist.
- What are the fly's physical mechanisms that the team needs to examine and duplicate? (the flight aerodynamics that allow the wings to sustain flight, the "gyroscope" equilibrium system, integration of information from different sources, intellectual and sensory functioning)



Robofly Leader's Guide

- What are the steps of this experimental process? (first, understand how a fly works, then build models and computer simulations, then make 3-D prototypes, finally design the production process)
- What does Kristopher Pister mean when he says that building a robotic fly is like going to the moon and seeing what technologies develop along the way?
- If you had to choose between a scientific project with mundane but obvious applications and another with vague but possibly far-reaching theoretical implications, and both projects cost a great deal of money, which would you choose? How would you justify your choice?
- Explore the words the scientists and engineers use to describe some of their research: the fly as a fighter jet, the rock and roll flight simulator, video games for flies, the Fly-o-Rama. What do these whimsical descriptions indicate about the researchers and the way they approach their work?
- What does Professor Pister's enjoyment of his wooden insect toy and a B-grade Hollywood movie about killer insects indicate about the kind of person he is and why he is working on the robotic fly project? What kind of personalities do you think the other researchers have? Is there any connection between the kinds of people they are and the work they do?
- What are some possible applications of the robotic fly? (search and rescue, pet, toy, "no-fly" picnic zone defenders, everyday companion, spy, killing machine. What about the autonomous sensor platform? (communications, weather sensor,) What, if anything, matters more: the application or the process?
- Discuss Professor Dickinson's statement that you can't demand that an idea never have a negative consequence; what's important is how the balance sheet turns out in the long run. Do you agree or disagree? What could this imply about research with stem cells, genetically-engineered foods, sophisticated weaponry, trans-species transplants, cloning and similar projects?
- Can and should society place limits on research, and should scientists take more responsibility for the consequences of their research?
- Professor Dickinson says this project is "pretty fun." Professor Pister calls it "playing," and Professor Fearing is obviously having a good time. How does attitude affect commitment, creativity, risk-taking, teamwork, goal-setting? In school and business, how does attitude affect the student? Teacher? Administrator?
- Divide the audience into small work groups and have each group conceive a creative science project. The project need not be developed, but should be outlined for structure, purpose and anticipated result. Encourage thinking outside the box and not being limited by the current state of knowledge or feasibility. Remind group members that just because they don't know how or whether an idea would work is no excuse for abandoning that idea.
- Dickinson calls flies a part of the "invisible world." We overlook many things which we take for granted, such as the complexity in a speck of dust or a drop of water. Take a close look at something from this invisible world and tell the audience what you found.

Pyramid Media
Po Box 1048
Santa Monica CA 90406
(310) 828-7577
(310) 453-9083 fax
(800) 421-2304
email: info@pyramidmedia.com

