



National Institutes of Health
Office of Management

Biosafety for Kids: Creating a Safety Culture Among America's Youth

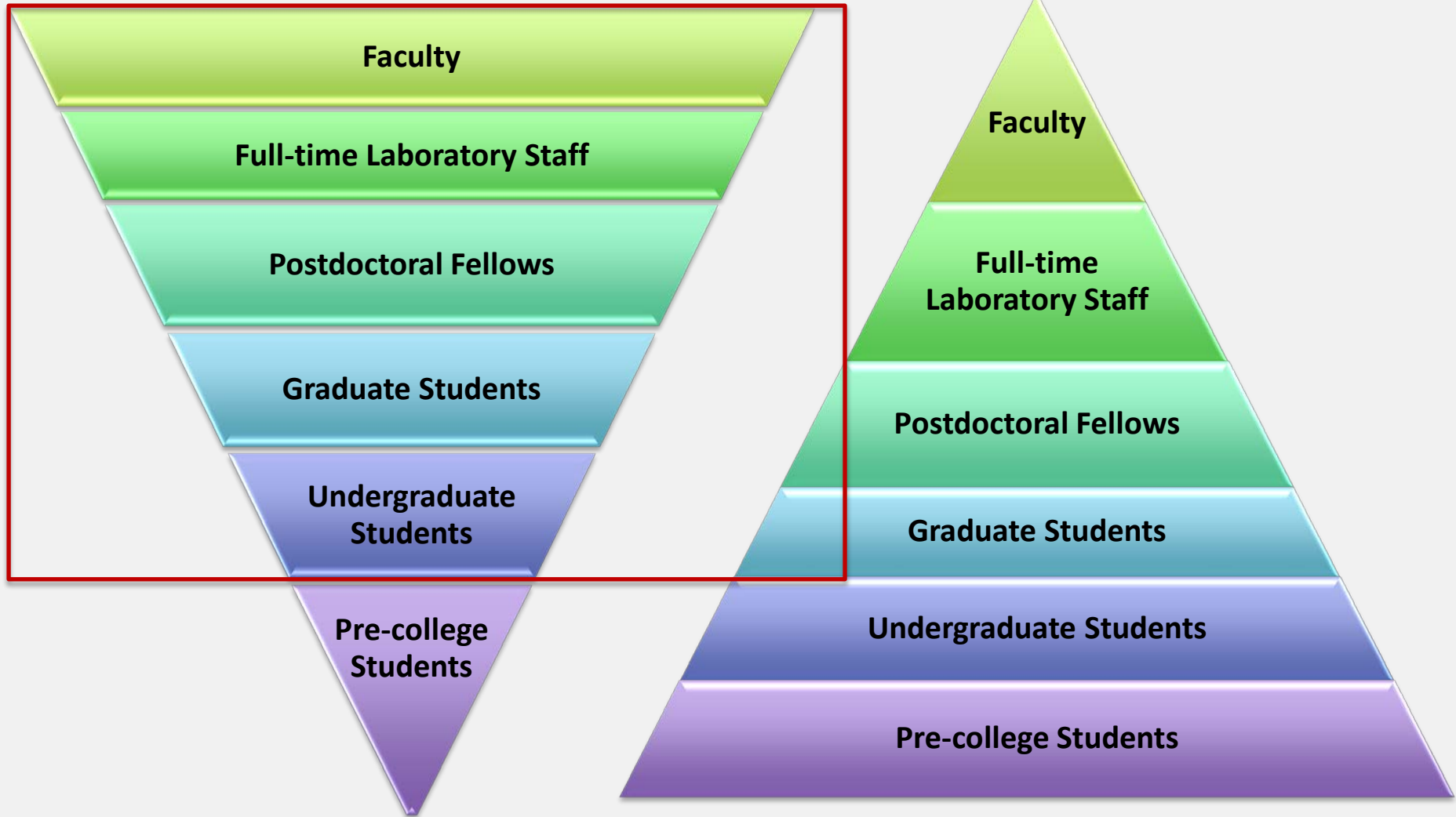
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What is a safety culture?

“the core values and behaviors resulting from a collective commitment by leaders and individuals to emphasize safety over competing goals to ensure protection of people and the environment.”

- The Nuclear Regulatory Commission Safety Culture Policy Statement

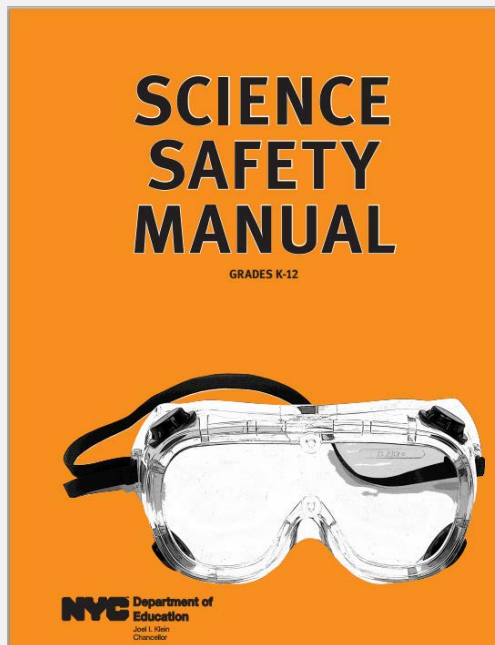
Approaches to Creating a Safety Culture



How do you introduce concepts of biosafety/laboratory safety to high school, middle school, and elementary school students?

- **Educate the Teachers**

- Include safety principles as part of training and education
- Provide useful resources
 - Safety in the Science Classroom Resource List from NSTA
 - Science Safety Manuals



The image is a screenshot of the NSTA (National Science Teachers Association) website. The top navigation bar includes 'About NSTA', 'Member Services', 'Professional Development', 'Conferences & Institutes', 'Publications & Products', 'Exhibits & Advertising', 'Get Involved', and 'Science Store'. The main content area is titled 'Safety in the Science Classroom' and includes a search bar, a 'Member Login' section, and a list of resources. The resources listed include 'Safety in the Science Classroom, Laboratory, or Field Sites (PDF)', 'Tips for the Safer Handling of Microorganisms in the School Science Laboratory (PDF)', 'Safety Acknowledgment Form for Working with Microorganisms (PDF)', 'YouTube and Other Public Posting of Science Demonstration Videos (PDF)', 'Eye Protection for Your Laboratory', and 'Safe Handling of Alcohol in the Laboratory'. There is also a 'Safety Resources List' section with links for 'Resources for Middle / Secondary Schools' and 'Resources for Elementary Schools'. The page is sponsored by NSTA and includes a 'Join Today' button.

- **Educate the Students**
 - Computer video games
 - STAR-LITE

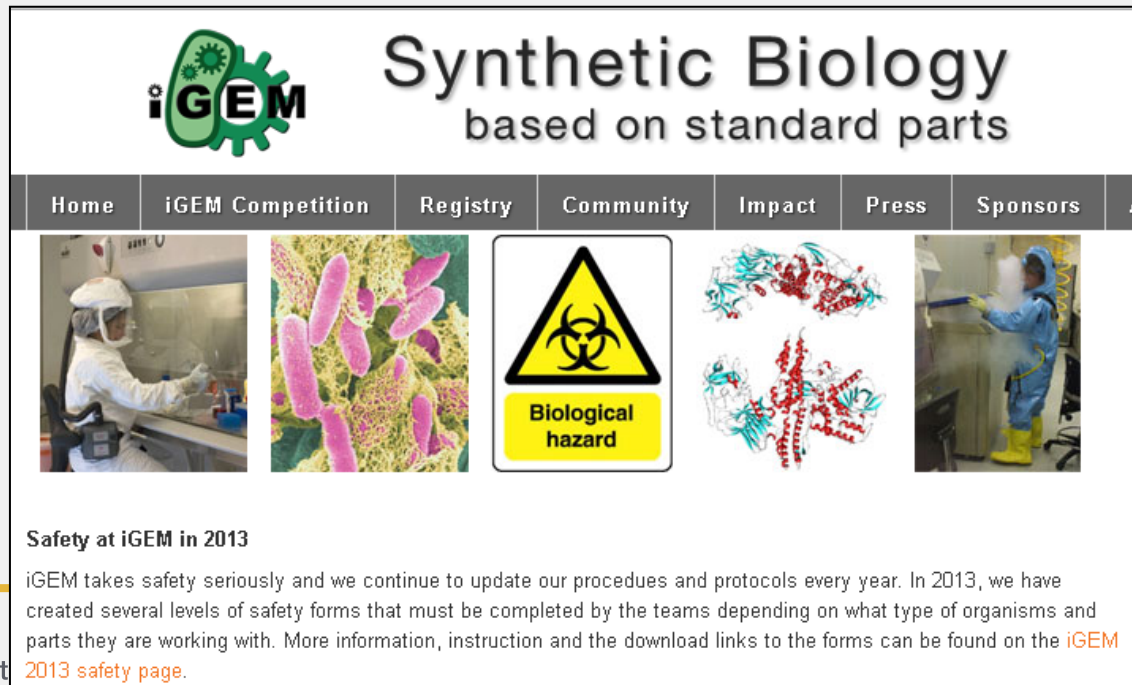
- **Safe Techniques Advance Research – Laboratory Interactive Training Environment**
- **Online game that targets high school students and undergraduate university students**
- **“integrates visualization of consequences...development of critical-thinking proficiencies, and application of problem-solving skills.”**



www.starlite.nih.gov

- **Educate the Students**
 - Computer video games
 - STAR-LITE
 - Requirement of participation in science fairs/competitions
 - iGEM Competition

- International Genetically Engineered Machines
- Undergraduate, High School, and Entrepreneur Divisions
- Goal is to “build biological systems and operate them in living cells”
- Teams are required to answer questions about the safety of their project and are provided safety resources
- igem.org/safety



The screenshot shows the iGEM website's Synthetic Biology page. At the top left is the iGEM logo, a green gear with a cell-like shape inside. To its right is the text "Synthetic Biology based on standard parts". Below this is a navigation bar with links: Home, iGEM Competition, Registry, Community, Impact, Press, Sponsors, and A. The main content area features five images: a person in a white lab coat and mask working in a lab; a microscopic view of pink rod-shaped bacteria; a yellow biohazard warning sign with the text "Biological hazard"; a 3D molecular model of a protein structure; and a person in a blue lab coat and mask working in a lab. Below the images is the heading "Safety at iGEM in 2013" followed by a paragraph: "iGEM takes safety seriously and we continue to update our procedures and protocols every year. In 2013, we have created several levels of safety forms that must be completed by the teams depending on what type of organisms and parts they are working with. More information, instruction and the download links to the forms can be found on the [iGEM 2013 safety page](#)."

- **Educate the Students**
 - Computer video games
 - STAR-LITE
 - Requirement of participation in science fairs/competitions
 - iGEM Competition
 - Instructional/activity guides












- **Create an instructional guide for elementary students to introduce principles of biological and laboratory safety**
- **Develop an accompanying teacher's manual with conceptual explanations and supplemental activities**
- **Determine how these materials could be incorporated into the classroom**

- **Bucky the Biosafety Officer Presents Keeping Scientists Safe**
- **Premise: How do scientists working with germs not get sick?**
- **Concepts Covered**
 - How to Dress in a Laboratory
 - Hazard Recognition
 - Chain of Infection
 - Hand washing



First, let's get dressed!

- Dr. Bark told Rover that scientists work in a special kind of room called a laboratory.
- To go into a laboratory, we have to wear special clothes.
- These special clothes protect scientists just like a helmet protects you when you ride a bike.

	You put on:	To protect your:	
	Pants	Legs	
	Closed Toed Shoes	Feet	
	Mask	Mouth and Nose	
	Safety glasses	Eyes	
	Gloves	Hands	
	Laboratory Coat	Body	

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Let's make sure our hands are very clean!



Turn on water.



Put soap on hands.



Rub your hands together.
Remember to wash your thumbs and the backs of your hands!



Rinse.



Dry with a clean towel.

Sing this song twice to make sure your hands are clean!
Wet and soap your hands
Make them nice and clean
Scrub your fingers
Scrub your thumbs
And everything in between.
(Row, Row, Row, Your Boat)



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- **Detective Dee and the Mystery of the Ruined Experiment**
- **Premise: How did bacterial plates get contaminated?**
- **Concepts Covered**
 - Incident Investigation
 - Standard Operating Procedures
 - Primary Containment Devices
 - HEPA filtration



Draft Page Layout



"First, Lane can you tell me what you did the day before you found the fuzzy green spot on your plate?" asked Detective Dee.



"Yes!" said Lane. "Here is what I did:

- First, I opened the incubator and took out my plate.
- Second, I walked my plate over to my desk.
- Then, I opened my plate and did my experiment
- Last, I put my plate in the incubator*."



"Ok," said Detective Dee. "Then the next day you took your plate out of the incubator and noticed a fuzzy green spot?"

"Yes," said Lane.



Alright Detective Friends! After talking with Lane, I spoke with some of my scientist friends. I wanted to know the directions Lane should have followed. They said Lane should have:

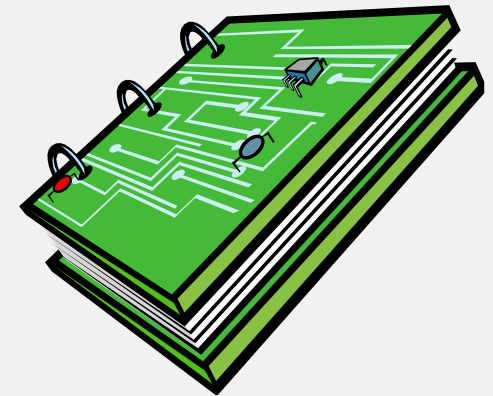
- * First, opened the incubator and took out her plate.
- * Second, walk the plate over to the biosafety cabinet.
- * Third, open the plate in the biosafety cabinet and do the experiment.
- * Last, put the plate back in the incubator.



Ok, Detective Friends, it looks like Lane didn't follow the directions. Can you figure out which step she didn't follow?

* An incubator is a container that is kept at a temperature that allows the bacteria to grow.

- **Developed for both activity books**
- **Contains:**
 - Learning objectives
 - Discussion points and questions
 - Additional activities
 - Information on the concepts covered
 - Additional resources and references



How can these be incorporated into the classroom?

- **Currently, there are no accepted national standards for science education.**
 - Next Generation Science Standards (www.nextgenscience.org)
- **The ideas of inquiry, observation, and experimentation are introduced in science curricula as early as kindergarten.**
- **State safety manuals require that teachers educate their students on how to conduct science in a safe manner.**

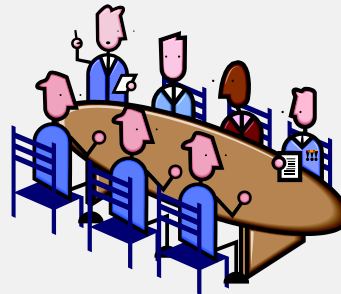


Know your audience.

Training strategies should not be a one-size fits all.



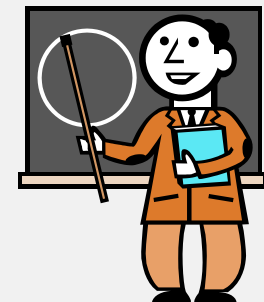
VS.



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Present concepts in a positive light.

Talking about risk and hazard without talking about risk and hazard



Distill complex principles into easily understandable concepts

Are you communicating effectively?

Is the science and practice still correct and accurate?



Acknowledgements

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