

Club Name: _____

Codename

Password

Crew 1 Name: _____

1:		
2:		
3:		
4:		
5:		

Crew 2 Name: _____

1:		
2:		
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Crew 3 Name: _____

1:		
2:		
3:		
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Crew 4 Name: _____

1:		
2:		
3:		
4:		
5:		

Crew 5 Name: _____

1:		
2:		
3:		
4:		
5:		



Dear Kinetic City Leader:

It's not every day that you and your after school program get to save a Universe. But that's what you and other Kinetic City clubs around the world will be doing with **Kinetic City: Mission to Vearth**.

Is this an awesome responsibility? Well, sure. But it's also lots of fun.

In each two-week mission, you and your kids will perform five exciting activities focused on a single area of science. Then, using what they've learned, your kids will play an on-line Mission to Vearth game to earn **Kinetic City Power Points** for your Club.

These Kinetic City Power Points help protect Planet Vearth from the nasty Deep Delete virus. They will also appear on your Club Web Site, showing the world what you've accomplished.

Please don't worry if you're not a computer whiz, or a science whiz. The activities in this box should be fun and easy for you and your kids to do. Most of them can be done away from the computer.

In this Leader's Guide, you will find instructions on how to get started with Kinetic City, including how to register your Club and set up your Club Web Site. There are also overviews of the four missions in this box, including copies of the five activities that correspond to each mission. If you need more copies of these activity pages, you can photocopy them or print them out from the website.

If for some reason your Club is unable to go to the Kinetic City website, simply use the paper copies of the activities in this Leader's Guide. Again, most Kinetic City activities do not require a computer.

Thank you so much for participating in **Kinetic City: Mission to Vearth**. We hope you and your children enjoy following the adventures of the Super Crew, and helping them defeat Deep Delete.

Who would've thought that saving a Universe could be so much fun?

Sincerely,

BOB HIRSHON

Executive Producer

Kinetic City: Mission to Vearth



An URGENT Message from the Kinetic City Super Crew

W

ow, are we glad you're here! We're the Kinetic City Super Crew. We solve mysteries, fight crime and have fun on our incredible train, the **Kinetic City Express**. We also have an amazing computer named **ALEC**.

Maybe you've heard us on the **radio**, or read our **books**.

But now we're in big trouble, and we need your help. We live in a virtual universe inside a computer, on a planet called **Vearth**. A really awful guy named **Gruel** has attacked our universe with a computer virus called **Deep Delete**. It chews up science information from our world, and then strange things begin to happen. **Gruel** is being helped by our old enemy **Count Sonos**, and his unbelievably lazy nephew, **Lumbert**.

Every two weeks, **Deep Delete** attacks some part of our world. It might mess up gravity. Or make all our machines work backwards. Or it could do strange things to our environment.

Whatever happens, there's only one way to fix it: we need you Earth kids to figure out how the world is **supposed** to be. In other words, discover the **truth** about things. We'll help you with a set of activities called **Reality Reboots**. Once you do them, you'll be an expert on whatever it is **Deep Delete** is wrecking. Then you can use your smarts to go online, take a **Mission To Vearth**, and zap **Deep Delete**.



ALEC

To find out more, and to see what's happening today, just come to our home site at **www.kineticcity.com**

We hope to be seeing a lot of you. After all, without your help, we're in **big trouble**.

Thanks!

Your friends,
The Kinetic City Super Crew

Getting Started with Kinetic City: Mission to Vearth



he following steps are recommended to help your kids get the most they can out of **Kinetic City: Mission to Vearth**.

As always, we encourage and look forward to your comments and suggestions!

GETTING STARTED

The very first thing to do is introduce your kids to Kinetic City. Explain to them that they are about to play a new kind of interactive story-game on the Internet called **Kinetic City: Mission to Vearth**. In this game, there is a virtual world named Vearth that desperately needs their help to survive.

After this brief explanation, give each student a copy of the Urgent Letter from the Super Crew. The letter describes the situation the Super Crew is in, and why they need "Actual" kids to help them. You may also wish to read the letter aloud. Emphasize to the kids that the future of Vearth depends on their heroic efforts!

Next, pass out the letters and consent forms. These let the children's parents know that their kids will participate in a new science program; that the children will work on the Internet; and, most importantly, that they may post work to their own Kinetic City Club website. It is up to the Club to decide if their website will include a team picture or other photographs of the children. While the children are completely anonymous on the site, and while parents rarely object to having their kids' picture in their town newspaper (which is often also posted online), they still may be uncomfortable with this idea. We highly recommend you not include photos if parents object or do not return the form at all.

The next step is to pass out the Kinetic City backpack tags and ID cards. Once your Club has a name, and the children log on and register, the kids can write their code names on their cards and keep them in their backpack tags. Of course, these tags can be put on anything, from a book bag to a notebook, if they don't wish to have them on backpacks.

Now, pass out the Kinetic City Case Journals and let the kids know they'll be sent on a new mission every two weeks. They should know that they will play an important role in the **Kinetic City: Mission to Vearth** story.

NAMES AND PASSWORDS

Your first job is to form an official Kinetic City Club, and divide it up into five groups called "Crews." Have the kids spend some time coming up with a fun name for their Club. Pick something that does not identify exactly where you are (in other words, you can call yourselves the New York Brainiacs, but not the New York P.S. 138 Brainiacs). Once your entire Kinetic City Club has a name, have the children break up into five groups of roughly equal members to form the Crews. Have the Crews spend a few minutes coming up with a good name for their group. Let them know that this name will appear on their Crew's home page on the Web, and will be the name by which other players from all over the world will know them.

Finally, the children will have to make up names and passwords for themselves. They should not use their own names or other personally identifiable information. Animal names are fine (tiger, eagle, froggie), or inanimate objects (scooter, puppet, cookie), or famous characters (merlin, ariel, batman, anastasia) or even words they make up (freegle, blotz, morpholog). Their passwords should be hard to guess but easy for them to remember.

The reason they have codenames and passwords is that they will be playing games on the computer, and we need to keep track of their scores. That way, they can log on from any computer in the world and play to improve their score or look at new challenges. We don't know any of the children's identities—just the made-up names and passwords.

When they log in, the children have the opportunity to enter an email address. The only reason we give them this option is so that we can remind them of their password if they forget it. Otherwise, they'd have to start over with a new name and password, and they'd lose their points. Again, we don't use these emails for any marketing purposes, nor allow anyone else to use them. And they do not have to supply this information to play.

GOING ONLINE

To participate in Kinetic City online, you will need an Internet-connected computer with a browser (preferably **Internet Explorer**) and a free plug-in called **Flash**. (To download Flash, go to www.macromedia.com/downloads and click on "Macromedia Flash Player")

A fast Internet connection will make the wait times shorter. If you have a slower connection (for example, one that dials over a phone line), it would be a good idea to open each Kinetic City page once before the children arrive. After your computer opens a page once, it will probably save it to its memory, and it will open faster when the kids go back to it.

Once all of the kids are in Crews and the Club name is set, go online to www.kineticcity.com and have the kids register individually at the Join page. Each child will be asked to choose a code name and password. Again, if they supply their email address, we will email them their password if they forget it.

GETTING FAMILIAR WITH THE SITE

Once the kids are at the site, they can learn a little more about the Super Crew characters. Have them explore the Home Page and the Control Car especially. If you like, any of the pages on the site can be printed out and copied for the children.

Once your children are familiar with **Kinetic City**, you're ready to get started!



Evaluation and Assessment



Kinetic City: Mission To Vearth is, to the best of our knowledge, the only after-school program based entirely on national science learning benchmarks, and developed specifically with each of those benchmarks in mind. We are confident that children performing our activities will gain a new understanding of these benchmarks, and become more motivated, confident learners.

Research by independent evaluators supports this confidence. The full text of this evaluation is available at our www.kcmtv.com website. We will continue to perform these evaluations on randomized, statistically significant groups of *Kinetic City* users, and to post the results on our website.

We also include tools that allow you to assess individual child performance, built into the program. For example, all children record their activity data and results in their *Kinetic City Case Journals*, providing leaders with detailed information on how each child is progressing through the material.

Each Mission in the *Case Journals* begins with topic questions that ask children to think about the topic before they have explored it. This provides a baseline for each mission for each child.

Examining the work sheet for each activity allows leaders to check for participation and assess the conclusions children have drawn from their data. Leaders can look for progress by comparing the children's pre-mission ideas and theories with the conclusions they present after each activity. Leaders can even pose the pre-mission questions again at the conclusion of the mission, and have children discuss what they learned.

In addition, each team is encouraged to report on their activities on their *Kinetic City Web Page*, giving leaders more information on their progress.

Of course, every child plays the *Mission To Vearth* game, which poses ten multiple-choice questions for each mission. By earning *Kinetic City Power Points*, children demonstrate basic understanding of some of the key learning goals in the mission.



By building these assessments into the *Kinetic City* game itself, children record data, draw conclusions, take quizzes, etc., without thinking of any of them as "tests." They are all just part of the fun of participating in *Kinetic City*.

In addition, an independent evaluator will be creating and administering more detailed assessments for a subset of several hundred children, the results of which will help us plan and develop the *Kinetic City* program. In addition to the results of this study, we will also make available on our website the same assessment tools used by the evaluator for Club Leaders who wish to use them.

As an after-school program, *Kinetic City* will never replace a well-designed, rigorous, in-school, teacher-led curriculum. That is not our intent.

However, our assessments have shown that children who participate in **Kinetic City: Mission to Vearth** quickly out-perform other children on knowledge of standards-based content information, conceptual information, and in overall motivation toward science learning.

Overall, we feel that **Kinetic City: Mission To Vearth** has been shown to be effective by independent experts more than any other after school program. This is part of an ambitious and rigorous evaluation that will continue and, we hope, expand as we continue to improve and refine *Kinetic City*.

HELP!

Site isn't loading? Game piece missing? Fly in your coffee?
Whenever disaster strikes, check www.kcmtv.com to see if your problem is addressed there. Or use our email center to contact us. When all else fails, call our toll-free sales and service line, 1-888-438-5272.



Mission Pack: Omega



In this set of four missions, children will learn about human learning, the body's basic functions, the diversity of life, and the evolution of life.

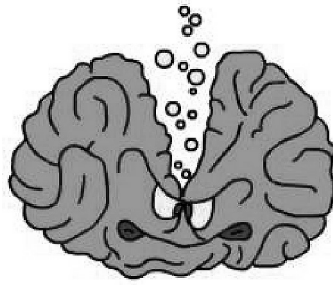
SLEURON ("Human Learning") looks at learning from a number of different angles, in order to emphasize that humans acquire and develop new skills in many ways beyond the classroom. In the *Mind Game*, students will test their reaction time, and watch how it can be improved with practice, which clearly demonstrates that some kinds of learning don't involve higher thought. The *Move Crew* also shows that learning can be a physical as well as a mental process, but takes this concept from the individual to the group level. In the *Fab Lab*, they'll explore the power and limits of short-term memory, while in the *Smart Art*, they'll find that learning to give good directions can be just as important as faithfully following them. Finally, in the *Write Away*, they'll get to imagine a fun scenario in which new skills are put to use, while being asked to recognize the difference between (and interdependency of) inborn talents, learned skills, and acquired knowledge.

In **NASTRO** ("Basic Functions"), the focus is the body and how it works. A common theme in this unit is the way our body parts depend on each other to work. In the *Mind Game*, the children are asked to sort organs into systems, while the *Smart Art* encourages them to locate the positions of these organs inside the body. In the *Write Away*, they're asked to champion the importance of a particular body part; challenging and debating with their peers should produce the conclusion that all body parts are important in their own ways. In the *Fab Lab*, they'll see firsthand how their heart rates relate to their physical activity, while in the *Move Crew*, they'll explore the relationship between the lungs and the heart that makes respiration possible.

GRINDER ("Diversity of Life") moves from the interdependence of parts of the body to the interdependence of life on the planet. Much of this unit is devoted to the process of classifying and sorting organisms according to their characteristics, which paves the way for the study of taxonomy later on. In the Mind Game, the children will try to sort unusual plants and animals into familiar categories. In the Fab Lab, they'll sort everyday objects in as many different ways as they can, which encourages them to start thinking the way scientists do when they categorize living things. The Move Crew shows how animals can be grouped according to their habitats, while the Smart Art encourages them to think about what else might live in a particular environment. Finally, the Write Away challenges kids to defend an unpopular animal from extinction, emphasizing the important concept that just because animals are unattractive or a nuisance to people doesn't make them disposable.

In FLOSSIL ("Evolution of Life") the emphasis is not so much on evolution per se but on the fact that animals in the wild must compete for resources, and have developed adaptations that help them survive in their environment. To that end, the Move Crew asks the students to play the role of a bird with a specialized "beak" and to compete for food with other birds. The Smart Art and Write Away offer complementary thought experiments in adaptation: the former asks kids to draw an animal that might live in an especially strange environment, while the latter asks them to write about an environment that a bizarre, fictional animal would live in. The Mind Game demonstrates how human activities such as pollution can drive natural selection. Finally, the Fab Lab looks at the importance of fossils in tracing natural history, and asks the children to become paleontologists and piece together ancient skeletons.

Overall, these four missions encourage children to develop key habits of mind that will serve them well in future science classes, and introduce important new concepts to their worldview. By the end of Mission Pack: Omega, we hope that all children participating will have at least a basic grasp of these concepts and feel interested and motivated enough to learn more.



Mission Overview: Sleuron

In this two-week Mission, children will learn about learning: in other words, the ways in which humans acquire new skills or information. At this age, they're not expected to understand the intricacies of the human nervous system, or complex psychological theories. The goal here is to get them to think about learning as a broad range of processes, which encompass much more than just traditional "book learning" or rote memorization. They'll also have the opportunity to talk about various strategies for learning, and to see that different people learn best in different ways.

The activities for this mission are **Zapl**, an online game that tests their reaction time; **Cover Up!**, a memory challenge; **Stomp High-Low**, an exercise in group learning and physical coordination; **Construction Instruction**, a game that tests their ability to give directions; and **New For You**, a writing exercise that gets them thinking about learning in an imaginative context. For more detailed information on these activities, see the following page.

If these activities make kids want to learn more about learning and the biology behind it, here are a few suggestions:

Kids' Health, a comprehensive website about health and the body, has a section all about the brain:

http://www.kidshealth.org/kid/body/brain_SW.html

Neuroscience for Kids is a more sophisticated site devoted entirely to the brain and nervous system:

<http://faculty.washington.edu/chudler/neurok.html>

Sharon Cromwell's book **Why Do I Laugh or Cry? and Other Questions About the Nervous System** (Rigby Interactive Library, 1998; ISBN 1-57572-161-9) provides an introductory guide to the nervous system for elementary and intermediate level students.

Kathleen Dwyer's **What Do You Mean I Have a Learning Disability?** (Walker & Company, 1991; ISBN 0-8027-8102-0) is a short book that might be worthwhile for kids who have learning disabilities or want to understand those who do.

ACTIVITY NOTES FOR LEADERS:

Sleuron

Mind Game: ZAP!



This is a simple game that challenges the kids' **reaction time**. In one round, the kids have to react to a visual cue; in the second, an audio cue; and in the third, they might receive either one. The key concept here is that kids can improve their reaction time by practicing, but they can never get it down to zero, because the signals traveling through their nervous system always need some time to travel. It's a good jumping-off point for talking about the brain as a central command center for the rest of the body.

Fab Lab: COVER UP!

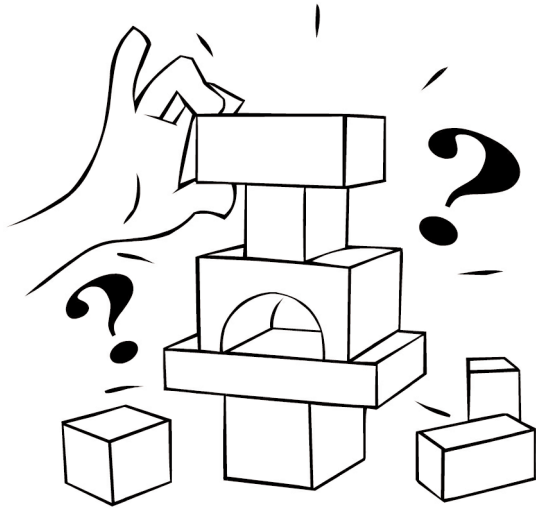
This is a memory game very similar to "Concentration." It provides the opportunity to talk about short-term versus long-term memory. You might ask the kids if it was easier or harder to remember where the different tiles were as time went on, and what strategies they used to remember where the most valuable tiles were located. Some kids might say that it was easier to focus on a few tiles, or on general areas where higher-point tiles were clumped together, than to try and remember the exact location of every tile. That's because short-term memory has a limited storage capacity.



Move Crew: STOMP HIGH-LOW

This is a physical coordination activity modeled after the routines of the performance group Stomp. You might talk about the differences and similarities between physical

learning and "mental" learning. This game demonstrates that skills can be practiced until they become automatic, so ask your kids how much they were thinking and concentrating when they first learned the routine, compared to when they had mastered it. You might also point out that it's often easier to learn complicated activities like this one step at a time, adding a new element only after they've mastered the previous one.



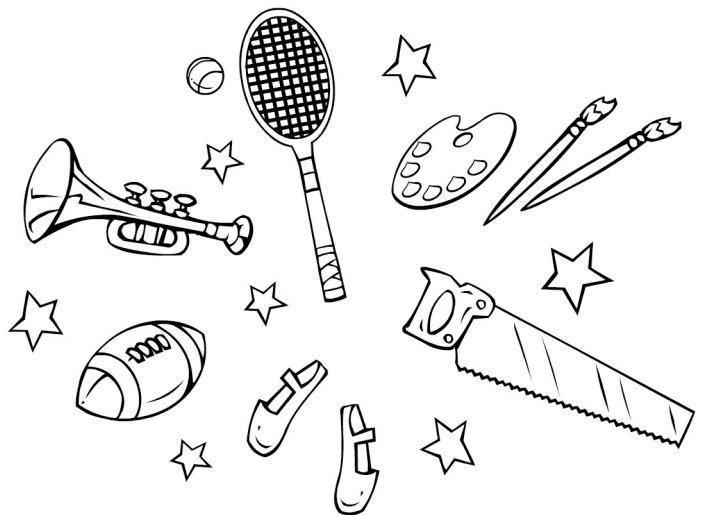
Smart Art: CONSTRUCTION INSTRUCTION

This is a game about giving directions. It's important to emphasize that the responsibility for a team's success lies with the kids who are giving the directions, not the kid who's building the structure. Ask the kids what kinds of instruction styles worked best for them.

Can they relate that to tests they've taken, or other learning situations they've been in? If different kids had different preferences, it's important to say that they're equally valid.

Write Away: NEW FOR YOU

This gives the kids a chance to use their imaginations, and also to think about the differences between inborn talents (like running fast), learned skills (like typing), and acquired knowledge (like facts from a book). It's worth noting that most complex activities that a kid might do—playing piano or baseball, for example—involve all three.



ZAP!

Briefing

When someone yells "Think Fast!" and throws a ball at you, can you usually catch it? What if you practice doing that a whole bunch of times? Do you get better at it?



All that stuff has to do with something called **reaction time**. That's the time it takes for electrical signals to travel to and from your brain, along thin fibers called **nerves**. The signals pick up information and make your body do stuff. In this Mind Game, you'll test your reaction time and see if you can speed it up.

Activity

HOW TO PLAY:

In this game, you're a hungry frog. Your job is to catch a fly with your tongue as soon as you see or hear it.

To zap out your tongue, press the red button.

One rule: Don't zap too early, or the round doesn't count!

ROUND ONE

Watch the radar screen that will open up on the bottom left. As soon as you see the fly come into view, zap it! Your reaction time will appear on the screen.

Try it two more times. See if you can react faster.

ROUND TWO

Now you'll be listening instead of looking. As soon as you hear the fly buzz, zap it! Again, try and improve your reaction time on each turn.

ROUND THREE

This is the challenge round. You'll have to pay attention to BOTH the radar screen and the sound. Maybe you'll see the fly, maybe you'll hear it - but either way, zap it!

Debriefing

Did your reaction time get better each time you played? Which round was best for you? Were you surprised?

More Info

Reaction Times: What's Going On?

Here's a quick rundown of what happened during your reaction time:

- 1) The fly appeared on the screen (or made a noise).
- 2) Your eye (or ear) detected the fly, and sent an electrical signal along your nerves and into your brain.
- 3) Your brain processed the signal, which allowed you to see (or hear) the fly.
- 4) Your brain sent a signal through your nerves to your fingers.
- 5) The signal told your fingers to press down on the computer mouse.
- 6) You clicked on the mouse and zapped the fly.

All that can happen in less than half a second! But it still takes time. You can shorten your reaction time with practice, but you can never get it down to zero.

A quick reaction time can help you avoid danger. For example, if you're crossing the street and hear a car horn honk, you want to get out of the way fast! Animals (like frogs) depend on fast reaction times for hunting prey or escaping hungry predators.

Cover Up!

Briefing

The human brain features the awesome power of **memory**. It lets us take an idea and store it so we can use it again in the future.

Here's a game that will test your **short-term memory**. The player who can store information and bring it back right away will score the most points!



Activity

WHAT YOU'LL NEED:

White, Blue, and Red chips (You can also use pennies, nickels, and dimes, or cut up squares from paper.)

Little Plastic Cups (6 for each player, all the same size and color. Make sure you can't see through them.)

A stopwatch, timer, or watch with a second hand.

HOW TO SET UP:

- For each player, take six chips—two of each color. The blue chips are worth 5 points, the red chips are 10 points, and the white chips are worth 1 point.
- Place all the chips in the center of a table, and mix them up.
- Get an equal number of small cups and set them to one side.

HOW TO PLAY:

- Start the timer. Everyone has 60 seconds to remember where all the different chips are.
- When time is up, take the cups and cover up all the chips.
- The first player picks up a cup and takes the chip under it.
- Take turns and go around the table, trying to get as many points as possible.
- When the last chip is collected, the round is over. Add up the points on all of your chips.

The player who collected the most points is the winner!

Debriefing

Were you able to improve your score the more times you played?

What tricks did you use to try to remember where the big points were hidden?

Was one player able to score higher than others? How did he/she score so well?

Stomp-High-Low

Briefing

Think about three different things you've learned recently. (Write them down if you can). Were they all things you learned from books, or teachers? Does your body learn in the same way that your mind does? In this Move Crew, you'll teach your body some brand-new tricks.



Activity Page

WHAT YOU'LL NEED:

- A stopwatch
- A team of at least five kids

HOW TO PLAY:

- Form a line with each kid about two feet from the next one.
- The kid on one end begins the Stomp-High-Low by stomping his or her foot, and giving the next kid in line a "high ten" (just like a "high five" but with both hands).

- That kid gives the next kid in line a “low ten,” (with both hands as low as possible) and that kid gives the next kid a “high ten,” and so on, all the way down the line. (These kids don’t do any stomping!)
- When the last kid in line gets the hand-clap, he or she stomps a foot and gives a high-ten right back to the same kid.
- This continues all the way back down the line until the very first kid receives the hand clap and gives a final Stomp.

Have someone time you with the stopwatch. Begin timing with the first Stomp, and end with the last Stomp. See how fast you can do it without making any mistakes!

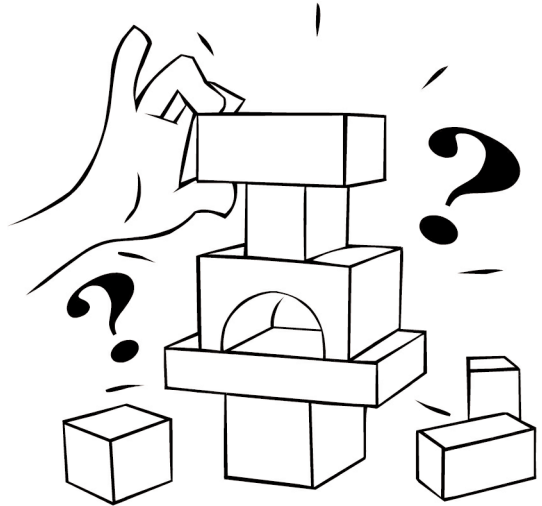
Debriefing

Learning something with your body can take just as much work as learning something with your mind. If you’ve learned to swim or ride a bike, you probably remember how hard that was when you started! But as you practice, it becomes easier and easier, until you can do it almost without thinking about it, like walking. In other words, it becomes **automatic**. Did Stomp-High-Low start to become automatic the more you did it?

Construction Instruction

Briefing

Suppose you had to teach someone how to make a peanut butter sandwich (and they had never done anything like that before). How many steps do you think it would take? In this Move Crew, you'll have to teach your teammates to build things they've never built before - and you'll have to overcome some big challenges while you do it!



Activity

WHAT YOU'LL NEED:

- A set of Construction Instruction cards
- A set of 7 blocks
- A blindfold
- A stopwatch and someone to keep time

HOW TO PLAY:

- Lay all the blocks on a table. Pick someone on your team to be the "Builder." Everyone else is an Instructor. Make sure you have someone to keep time.
- The Builder faces the table and puts on the blindfold.
- The timekeeper says "Go!" Then he or she picks a card and shows it to all of the Instructors.
- The Instructors need to tell the Builder how to build EXACTLY what's on the card, using the blocks provided. They can speak one at a time or all at once.
NOTE: You should build the blocks vertically (like a building) not flat (like a puzzle).
- Instructors cannot touch the blocks, or any part the Builder's body.
- The Builder cannot talk or ask questions.
- Once the Builder has successfully built what's on the card, stop the clock and record the time it took to do it.

ADD IT UP!

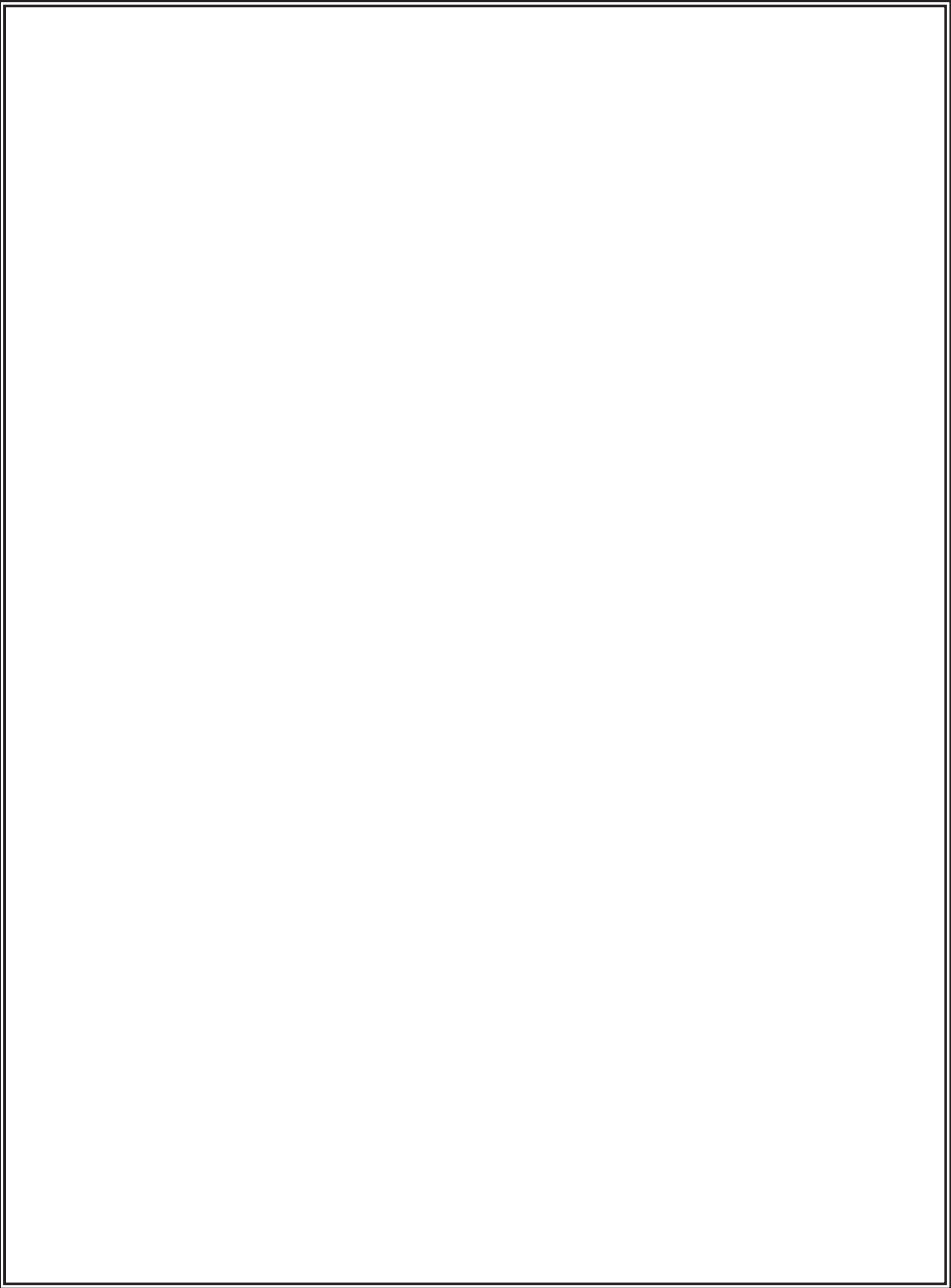
- After each round, pick a new person on your team to be the Builder.
- Play five more rounds the same way until everyone has had a chance.
- The goal is to build six structures in less than ten minutes total. If your get behind early, you'll all need to improve your instruction skills to catch up!

IMPORTANT NOTE: Every card has a thin gray line underneath the picture, to show you which end is the bottom. The gray line is NOT a part of the thing you have to build!

Debriefing

Was it as easy to give instructions as you thought? Did you have to "learn" how to give instructions better? What kinds of skills and techniques did you pick up? What happened when you were the one building the tower? What kinds of instructions worked best?

Think about the peanut butter sandwich again. Now how many steps do you think your instructions might have? How would the instructions be different if you were giving them to someone from a far-away country that didn't make sandwiches at all?



New For You!

Briefing

How many different skills do you use in a typical day? Or even in a half hour? (See if you can list a few). What if your life were totally different? In this activity, you'll think of a situation that would test you in lots of different ways!



Activity

WHAT YOU'LL NEED: A six-sided die

WHAT TO DO: Look at these three columns.

A. TALENTS

1. A keen sense of smell
2. Being able to run fast
3. Excellent vision
4. Being ambidextrous
(able to use right or left hand equally well)
5. A knack for languages
6. A good ear for music

B. SKILLS

1. Riding a unicycle
2. Playing the tuba
3. Lassoing a bull
4. Knitting
5. Starting a fire with sticks
6. Gymnastics

C. KNOWLEDGE

1. Program a computer
2. Performing surgery
3. Understanding whale communication
4. Identifying ancient artifacts
5. Fixing machines
6. Piloting a helicopter

Column A is called "Talents" because they're abilities that you're born with, or that just come naturally. Column B is called "skills" because they're things you learn, and then practice to get good at. Column C is called "knowledge" because they're things that combine information you've learned with several different skills. You usually have to think a lot about these activities while you're going them.

Roll the die. Whatever number comes up, circle that item in Column A (for example, if you roll a 2, circle "Being able to run fast.") Do the same thing for Columns B and C.

Now write a story in your Journal about a situation in which you'd need all three of those abilities at the same time! Be as imaginative as you want!

Finished? On to the debriefing!

Debriefing

What was it like writing about that? Could you picture yourself doing those things? Were these things that you'd like to be able to do at some point, or would you never want to learn those things? If you could have picked three things, instead of rolling the die, which ones would you have picked?

Now think again about a typical day in your real life. How many skills do you use in a day, or even an hour? Is it more or less than you thought of before?



Mission Overview:

Nastro

In this two-week Mission, children will learn about the basic functions of the body. Particular attention is paid to the way organs are organized into systems, and how different organs and different systems depend on each other. We also look at essential physiological processes like respiration and blood circulation.

The activities for this mission are **All Systems are Go!**, an online game about organ systems; **The Pulse is Right**, which looks at the effects of activity on heart rate; **Respiration Stations**, which models the interaction between the respiratory and circulatory systems; **Inside Out**, an art project that gets kids thinking about the size and location of the body's organs; and **Bragging Writes**, a writing exercise that focuses on the importance of a randomly selected organ.

To learn more about the body and its organs, kids can explore the following resources:

Kids' Health is a comprehensive website about health and the body, with detailed sections devoted to each of the major organ systems:

www.kidshealth.org

BrainPOP is another excellent kids' site with an extensive collection of health and body-related movies:

<http://www.brainpop.com/health/seeall.weml>

The "Yuckiest Site on the Internet" is a lively resource for answering kids' curiosities about gross body functions, including vomit, snot, passing gas, and more: www.yucky.com

Janice VanCleave's **The Human Body for Every Kid** (John Wiley & Sons, 1995; ISBN 0-471-02413-9 hardcover; 0-471-02408-2 paperback) is a good, comprehensive resource for kids of this age.

Valerie Wyatt's **Earthlings Inside and Out: A Space Alien Studies the Human Body** (Kids Can Press Ltd., 1999, ISBN 1-55074-511-5 hardcover; 1-55074-513-1 paperback) is an imaginative look at the human body through the eyes of an extraterrestrial.

ACTIVITY NOTES FOR LEADERS:

Nastro



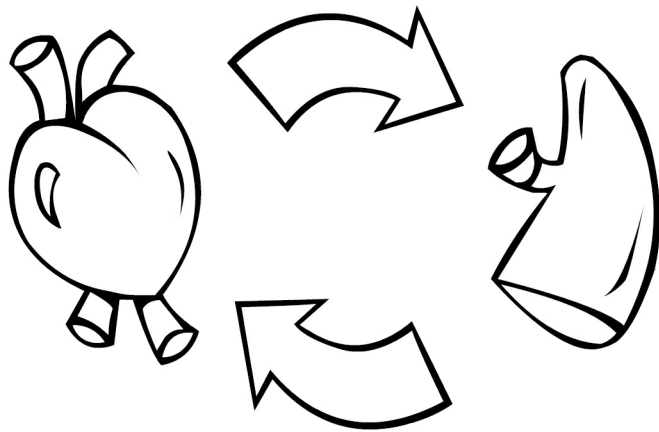
Mind Game:

ALL SYSTEMS ARE GO!

The object of this game is to get kids to assemble the body's organs into systems. If your kids need background information, Kids' Health has detailed discussions of the major organ systems. Go to <http://www.kidshealth.org/kid/body/>

Fab Lab: THE PULSE IS RIGHT

The goal here is to see how our heart rate increases during vigorous activities. The kids should know that a higher heart rate gets the blood moving faster, which means more oxygen gets to the body, which means it can do more work. You might also ask why they think their pulse rate goes up when they get scared (it's because the body is preparing to fight or run away). Before they launch into the activity, make sure the kids can all find their pulse and count it reasonably well.



Move Crew: RESPIRATION STATIONS

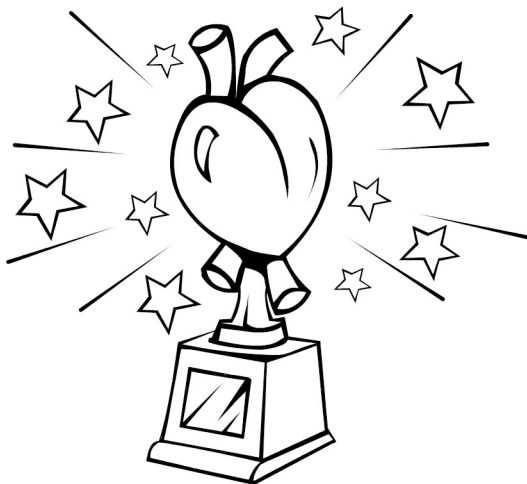
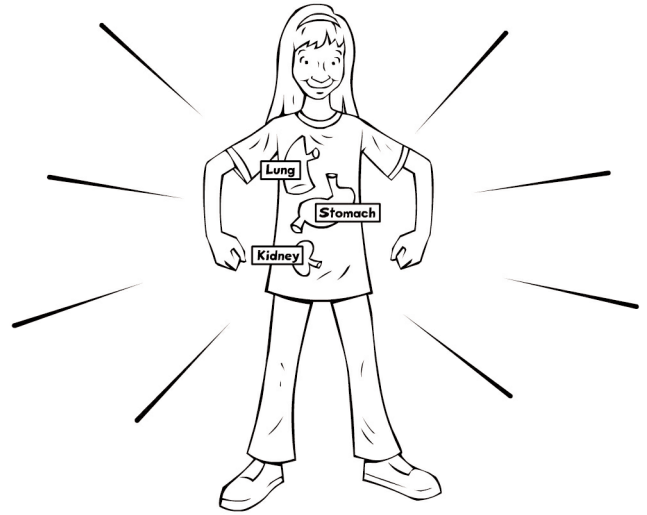
The idea of oxygen passing from the air we breathe into our bloodstream may be a tricky one for kids. This activity doesn't get into exactly how that happens, but you can explain that once the air gets into our lungs, it passes through tiny openings in the mem-

brane, called **capillaries**, and into the bloodstream. (This happens in tiny bulb-like air sacs called **alveoli**.) Once there, the oxygen hitches a ride on red blood cells until it gets to the parts of the body that need it. It's also important for kids to know that our body needs a constant supply of oxygen for all the work it does.

Smart Art: INSIDE OUT

In this activity, kids will draw and cut out pictures of organs and tape them onto another kid's body. To prevent inappropriate or aggressive touching, you may need to set rules about who does the taping. We suggest that the model should tape the organs to his or her own body, with the other kids giving instructions.

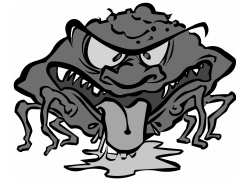
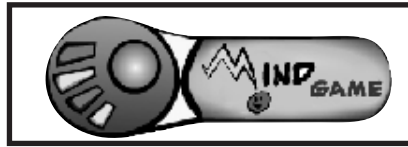
For useful Web resources that show the location and relative size of the body's organs, follow the link to the Extra page from the online activity.



Write Away: BRAGGING WRITES

Kids will choose an organ from a list and write about why it's the most important organ in the body. We suggest rolling a die to select from the list in order to encourage kids to focus on organs they might not pick otherwise. Encourage the kids to do their own research on the Web or in the library if there's time.

The bottom line here is that all of the organs are essential, and they can't function without one another.



Nastro

All Systems Are Go!

How many different organs does your heart work with? How about your lung? In this game, you'll test your knowledge of the body's systems and how they work together.



Activity

HOW TO PLAY:

In this game, Arnold Ruttabega's organs are all mixed up. It's your job to re-organize them so they can work together.

Once the game starts, the name of an organ system will appear at the bottom of the screen. Your job is to get all of the organs that belong in that system into the body (you don't need to know exactly where in the body they go). But be careful! If you drag in an organ that doesn't belong, all the organs pop out, and you have to start over!

Try to complete four body systems as fast as you can!

Debriefing

Did you find out anything you didn't know before? What do you think would happen if any one of the organs in a system was missing or damaged? Can you think of other systems of organs in the body?

More Info

Your Organs: It's All Part of the System

Your body's organs can't do their jobs on their own. Everything that one organ does directly affects at least some other organs. And every organ depends on other organs to help do its job.

When a bunch of organs work together on one big project, that's called a **system**. For example, the organs that help you eat and digest food, including the **tongue, stomach, intestines, liver, and gall bladder**, make up the **digestive system**.

Probably the most jam-packed system in the body is the **muscular system**. There are over 600 different muscles in your body, from the leg muscles that let you walk, to the muscles in your jaw that let you talk and eat. (By the way, everybody has the same number of muscles, whether you're a 300 pound weightlifter or the skinniest kid on the basketball team. The only difference is in how big the muscles are.)

Many organs play a part in more than one system. For example, organs that help move blood around - the **heart, veins, and arteries** - make up the **circulatory system**. And the **lungs** are part of the **respiratory system**, which is all about breathing. But they are also connected together, because your blood needs to pick up oxygen from the lungs. In this game, we put those two systems together, and call it the **respiratory/circulatory system**. Another part of the respiratory system is the **trachea** (that's pronounced "TRAY-key-uh"). It's the air tube that goes from your mouth to your lungs.

In fact, that's a good example of how entire systems connect with each other. You need the respiratory system to collect oxygen from the air, so the circulatory system can carry it around in your blood to all your cells—including your muscle cells. The muscular system depends on the **skeletal system** - bones, like the **skull**, **ribcage**, **pelvis** and **femur** (it's pronounced "FEE-mer" and it's your thigh bone) for structure and support. And almost all the systems depend on your **nervous system**, which includes the **brain**, **spinal cord**, and **nerves** to help run it and tell the organs what to do. The **eyes** can also be considered part of the nervous system, since they carry images to the brain.

All of these systems work together to make up the coolest system of all: you!

The Pulse Is Right

Briefing

How many times do you think your heart beats in a minute? How much do you think that can change? In this Fab Lab, you'll find out!



Activity Page

WHAT YOU'LL NEED:

- A stopwatch (or clock with a second hand)

WHAT TO DO:

- First, find your pulse. There are a couple of good places to look. One is the side of your neck, just underneath your jaw. Another is your wrist, in the groove just below the side of your palm where your thumb is. Gently place two or three fingers on either of these places and see if you can feel your pulse beating.
- Once you've found your pulse, measure it. Count the number of beats you can feel in six seconds. Add a zero to the end of the number. This is roughly your resting pulse rate, measured in beats per minute. Write this number down in your Journal.

- Now do twenty jumping jacks, as big and as fast as you can. When you're done, check your pulse again. Write down your new pulse rate.
- Rest for about two minutes (sit down or lie down). Then take your pulse again. Write down the new rate.
- For the last step, you're going to run around the room five times fast. (If the room isn't big enough or clear enough to do this, do fifteen push-ups or sit-ups). BEFORE YOU DO IT, write down what you THINK your pulse rate is going to be afterwards.
- Now do it, and then check your pulse. What was it? How close was your guess?

Debriefing

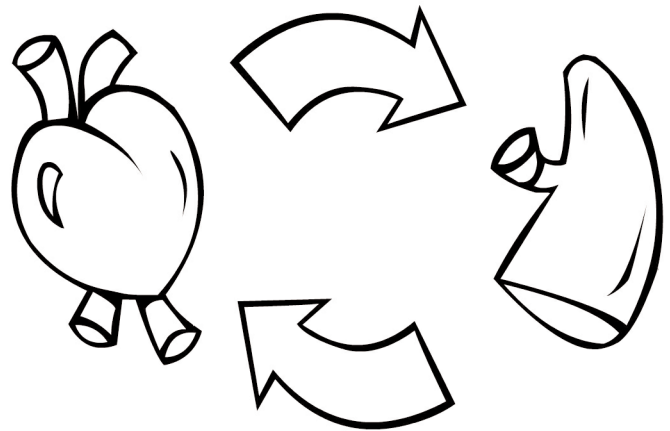
What was your lowest pulse rate? Your highest? Did it change more or less than you expected?

What determines whether your pulse rate goes up or goes down? Why do you think that is?

Respiration Stations!

Briefing

How do you think oxygen gets from the air into the parts of your body that need it? How many steps do you think it takes? In this Move Crew, you'll trace the path oxygen takes from breathing to running, jumping, lifting, or anything else you need to do!



Activity

WHAT YOU'LL NEED:

- 12 Red pom poms to represent oxygen
- 12 Blue pom poms to represent carbon dioxide
- 1 heart button
- 1 lung button
- 1 leg muscle button
- 1 blood cell button

GETTING READY:

- 1) Choose one kid to be the Lung and put on the Lung button. Your job is to supply the blood with oxygen. Take a bag of red pom poms to represent the oxygen molecules.
- 2) Choose one kid to be the Heart and put on the Heart button. Your job is to pump the blood around the body.

- 3) Choose one kid to wear the Leg Muscle button. Your job is to do what legs do—jump, stretch, run, and so on. When you do that, you convert oxygen into carbon dioxide. Take a bag of blue pom poms to represent the carbon dioxide molecules.
- 4) Choose one kid to wear the Blood Cell button. Your job is to transport oxygen to the body, and carbon dioxide back to the Lung to be exhaled.

HOW TO PLAY:

- 1) First the Blood Cell goes to the Lung to get oxygen. The Lung takes a deep breath in, takes a red (oxygen) pom pom. from the bag, and hands it to the Blood Cell.
- 2) Next, the Blood Cell needs to get pumped through the Heart. To do this, she runs over to the kid playing the Heart and tags him. The Heart says "Thump-Thump" and tags the Blood Cell back.
- 3) Next, the Blood Cell goes to the Leg Muscle. The Leg Muscle takes the red oxygen pom pom from the Blood Cell, jumps up in the air, and hands the Blood Cell a blue (carbon dioxide) pom pom.
- 4) The Blood Cell runs back to the Heart, tags the Heart, and gets "pumped" back to the Lung.
- 5) When the Blood Cell reaches the lung, she hands over the blue pom pom. The Lung lets a deep breath out and puts the blue pom pom in the bag.
- 6) The Lung takes a deep breath in and hands the Blood Cell another red pom pom. Then the cycle starts over again.

Once you've got the hang of it, see how fast you can make the Leg do ten jumps. If you're playing against other teams, see which team can do it the fastest.

If you want to try something else, keep adding Blood Cells to the system until you've got a whole bunch of them zooming around at once. How many blood cells can you keep going at one time?

Debriefing

What did you find out about the way oxygen travels through your body? Why are the lungs important? How about the heart? What would happen to your energy level if you weren't getting enough oxygen?

Extra Page

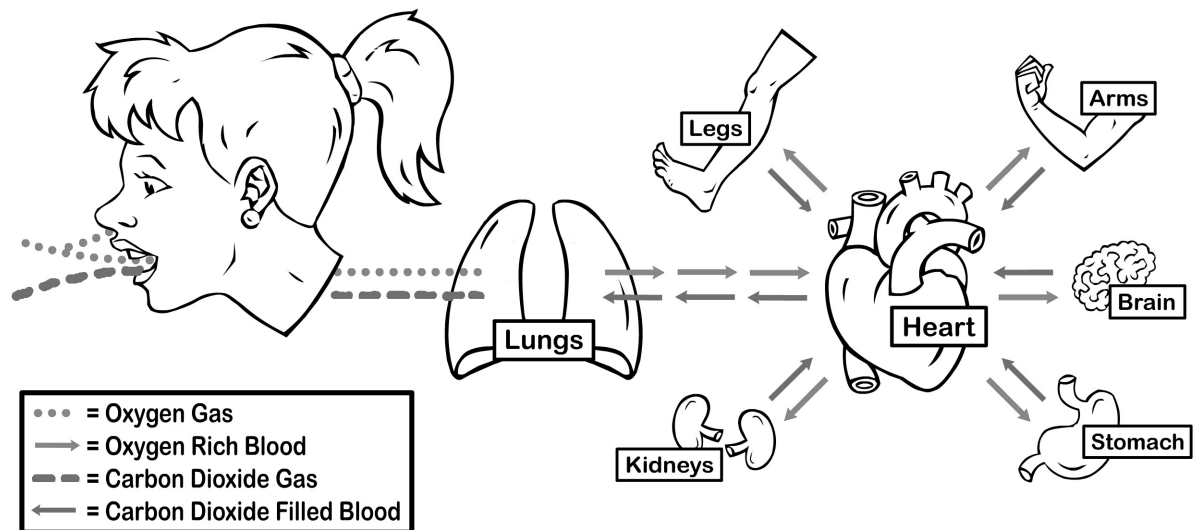
Every part of your body needs oxygen to do the work it needs—whether it's jumping with your legs or thinking with your brain. You get the oxygen when you breathe in air through your lungs. Then the oxygen gets absorbed into your blood, and pumped through your heart to the rest of your body. As the cells in your body work, they use up oxygen and release carbon dioxide as waste. The carbon dioxide is picked up by your blood cells, carried back through the heart to the lungs, where it's converted back into a gas and expelled in your breath when you exhale.

Respiration Stations

1. Oxygen from the air goes in when you inhale...

2. ...and reaches the lungs, where it is dissolved in your blood...

3. ...and then goes to the heart which pumps it all over your body.



4. The body uses the oxygen for work, and returns the blood to the heart with carbon dioxide...

5. ...which is replaced by oxygen in the lung...

6. ...and you exhale the carbon dioxide gas.

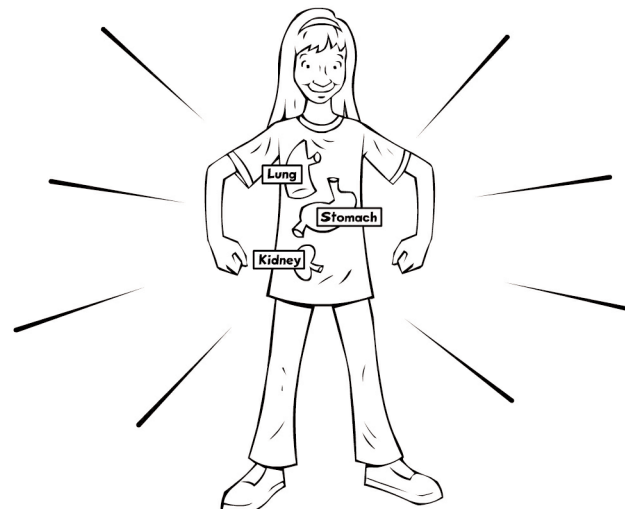
Inside Out

Point to a spot on your body. How many different organs do you think are under that spot? How do they all fit in there? In this Smart Art, you'll have to figure that out as you make a full-sized map of all your insides!

Activity

WHAT YOU'LL NEED:

- Construction paper
- Crayons or Markers
- Masking Tape



HOW TO PLAY:

- Everyone makes a bunch of different organs out of construction paper. The size and shape of the organs should be as realistic as possible!
- Use different colors for different organs. Write the name of the organ on each one when you're done.
- One kid volunteers to be the Model. He or she stands up. This kid will wear all the organs that everyone just made.
- Now it's time to make your map of the body! The Model will do this by hanging all the organs on his or her body with tape. Help your Model figure out where they go. They can go on the front or the back, or get stacked on top of one another.
- The goal is to put the organs in all the right places!
- Need to know more about the body's organs? See "More Info."

Here are some organs you might want to use:

Esophagus (food tube)

Trachea (Windpipe)

Liver

Kidneys (Make 2 of them)

Stomach

Heart

Lungs (Make 2 of these, too!)

Pancreas

Small Intestine

Large Intestine

Any others you can think of!

Debriefing

How many body parts did you make? Was it hard to fit them all in? Did it feel like a lot of them had to go into the same place?

Think of the spot on your body you pointed to earlier. How many organs do you think are there now?

Were there places that didn't have any organs? What do you think is in these parts of the body?

More Info

If you need more info on the organs of the human body, what they look like, and where they're found, check out these sites:

Kids Health's My Body site has lots of information on the body's different systems, and pictures too:

<http://www.kidshealth.org/kid/body/mybody.html>

The Marion County Public Library of Indianapolis, Indiana has pictures of many of the body's organ systems here:

http://infozone.imcpl.org/kids_pathfinders.htm#science

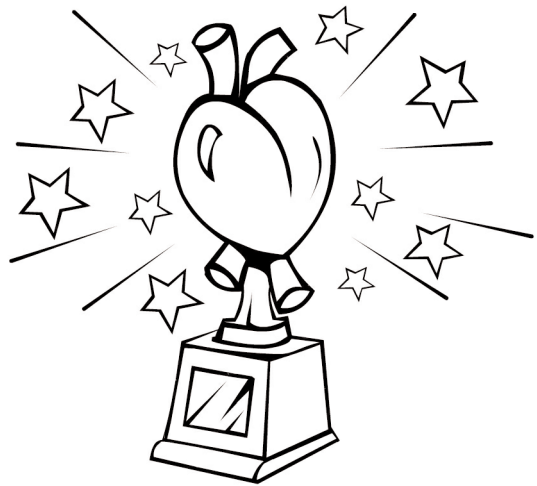
The body's systems are also mapped out on the Inner Body site:
<http://www.innerbody.com/htm/body.html>

ThinkQuest has another tour of the human body here:
<http://library.thinkquest.org/J001614F/>

Bragging Writes

Briefing

Quick: Which organ do you think is the most important organ in the body? Why? In this Write Away, you'll have to convince your friends that one organ is the best in the whole body—but it might not be the one you just thought of!



Activity

WHAT YOU'LL NEED: A six-sided die

WHAT TO DO:

- Roll the die. Find the organ that matches the number you rolled below:
 - 1) Liver
 - 2) Kidneys
 - 3) Stomach
 - 4) Heart
 - 5) Lungs
 - 6) Brain

- Imagine that organ has been nominated for the "Most Valuable Organ" award by the Body Part Association of America. Your job is to write a speech that will convince the awards committee that this organ is the best organ in the whole body.
- When you're writing, you can talk about all the important things your organ does, and what would happen if the organ stopped working. You can also talk about how other organs depend on your organ to do their jobs!
- Write your speech in your Journal, if you've got one. Otherwise, use any old sheet of paper.
- When you're finished, have everyone read their speeches out loud to one another.

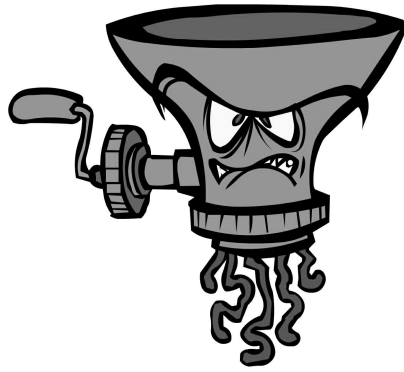
Debriefing

Now which organ do you think is the most important? The one you thought of before you wrote your speech? The one you wrote your speech about? The one that someone else wrote an especially good speech for? Do you think it's really possible to choose one organ over all the others? Why or why not?

More Info

If you need to learn more about your organ and what it does, check out Kids Health's My Body site:

<http://www.kidshealth.org/kid/body/mybody.html>

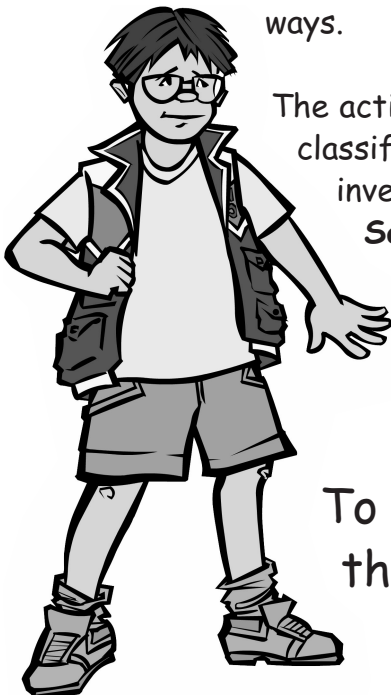


Mission Overview:

Grinder



his two-week Mission focuses on the diversity of living things. One of the goals is simply to get kids to recognize the great variety of living things that exist in different habitats, and to understand that each of them is unique and important. Another main theme is classification. Although students of this age aren't expected to learn formal scientific classification schemes, they are old enough to make up their own classification systems, and to understand that living (and non-living) things can be sorted and grouped in any number of ways.



The activities for this mission include: **A Touch of Class**, an online classification challenge; **It Takes All Sorts**, in which the kids invent a complex sorting system for everyday objects; **Indoor Safari**, a biodiversity card game; **Wildlife Window**, an art activity that gets kids thinking further about animals and their habitats; and **Here Comes the Judge**, in which kids are asked to defend unpopular animals from extermination.

To learn more about biodiversity, consult these resources:

The EPA's Explorers Club has a site for kids about endangered species:
<http://www.epa.gov/espp/poster/>

The National Zoo offers this extensive Library of Animal Facts:
<http://www.fonz.org/animals/animalfacts.htm>

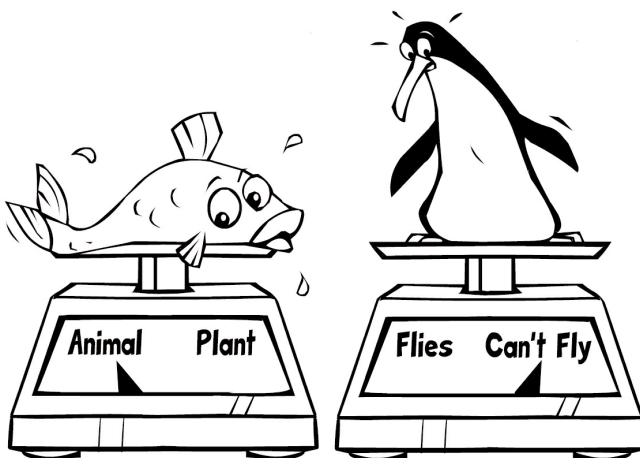
The AES Bug Club for Young Entomologists is a great introduction to the study of insects:
<http://www.ex.ac.uk/bugclub/>

The Classroom of the Future is an excellent reference for biomes or habitats:
<http://www.cotf.edu/ete/modules/mseese/earthsysflr/biomes.html>

Susan Goodman's **Bats, Bugs, and Biodiversity: Adventures in the Amazonian Rain Forest** (Atheneum Publishers, 1995; ISBN 0-689-31943-6) is a unique description of the Peruvian rain forest as told through the eyes of seventh and eighth graders from Michigan.

ACTIVITY NOTES FOR LEADERS:

Grinder



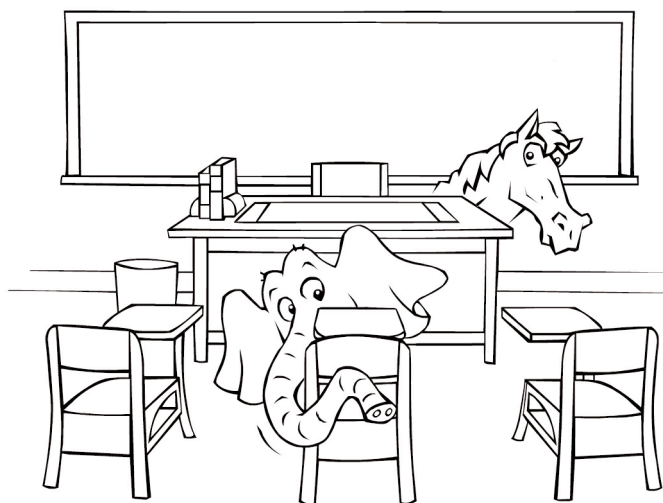
Mind Game: A TOUCH OF CLASS

In this game, the kids need to identify all the animals that belong in different categories. The challenge here is that the number of correct answers varies from round to round. Kids may be surprised by some of the categorizations

(for example, that whales are mammals and not fish); the More Info page contains information about some of the curveballs.

Fab Lab: IT TAKES ALL SORTS

In this activity, kids are asked to sort a pile of fasteners (buttons, paper clips, rubber bands, etc.) into broad categories and sub-categories. In one round, they're asked to sort by what the fasteners do, and in another, by the way they look, but these are just guidelines: the exact categories are up to the kids. Since the kids will work as a team, they'll have to agree on the categories, which helps drive home the main point: that the same items can be classified in many different ways.

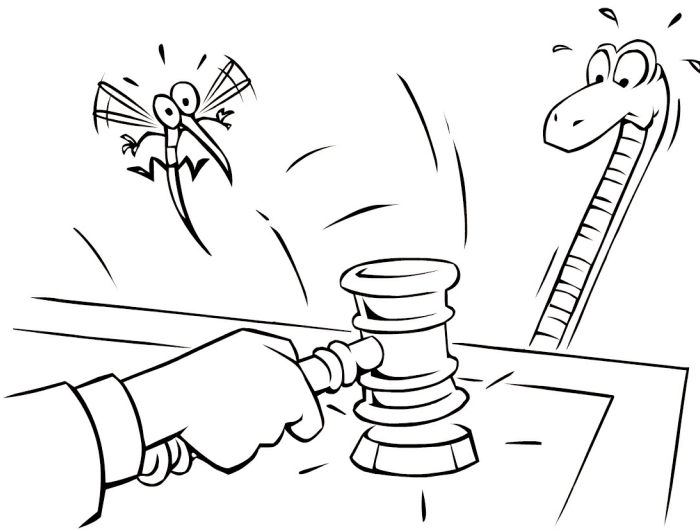
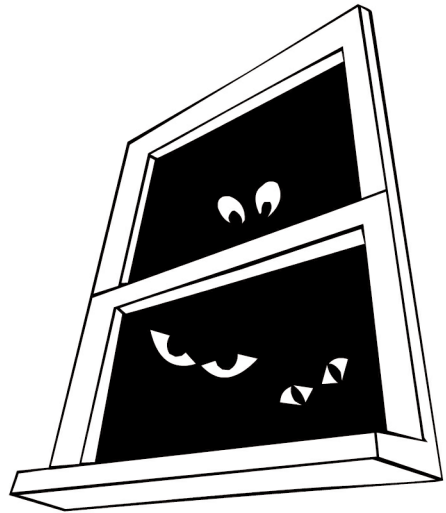


Move Crew: INDOOR SAFARI

This is a card game that's vaguely similar to Gin, but it involves animals and habitats instead of numbers and suits. The object is to get a hand with five different animals from the same habitat (the information is all on the cards). We've added a mobile component to make it more physically active (the cards are hidden around the room to start off), but you can adapt this if you need a more sedentary game.

Smart Art: WILDLIFE WINDOW

This builds on the Indoor Safari activity by asking the kids to “fill in the blanks” in one of the habitats they learned about. This activity can be combined with independent research—kids can look on the Web or in libraries to find out more about a particular habitat. They should be encouraged to think beyond large animals to fish, insects, plants, and even microscopic creatures.



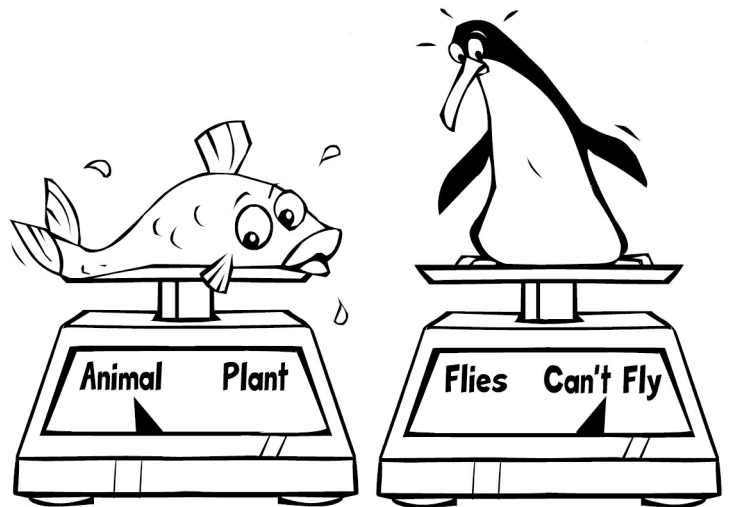
Write Away: HERE COMES THE JUDGE

Suppose you could get rid of all the mosquitoes in the world? This activity poses that question for a number of icky critters, and then asks the kids to argue against it. Again, there is the opportunity to encourage independent research to support their argument.

A Touch of Class

Briefing

What's an animal, a vertebrate, a mammal, a primate, and a hominid? The answer to all of these is you! Human beings belong to all these scientific categories and more. In this Mind Game, you'll sort out all kinds of critters into different categories, and you'll race against time to do it!



Activity Page

HOW TO PLAY:

On your screen, you'll see a whole bunch of different plants and animals on green square tiles.

At the start of each round, you'll see the name of a category flash across the top of the screen. Your job is to click on everything that belongs in that category. There might be a whole lot of correct answers, or there might just be one or two. (Whenever you click on a tile, it will pop out and change from green to white.)

When you're finished, click on the "Go!" button on the bottom of the screen. You'll get your score and move on to the next round!

SCORING:

- + 10 points for every plant or animal you get right.
- 5 points for every plant or animal you miss.
- 5 points for anything you picked that doesn't belong in that category.

Debriefing

What were the biggest categories you had to fill? What were the smallest? Did you find out anything about some of these animals or plants that you didn't know before?

More Info

Here are some things you might not have known before playing the game:

An **animal** is anything that has more than one cell and can't make its own food. Most **plants** can make their own food from the sunlight. However, a few plants, like the Venus Flytrap, are carnivorous (they eat insects). But they still make their own food too.

Mammals are a group of animals that usually have hair or fur, and nurse their babies with their own milk. Humans are mammals. Whales are mammals (not fish!) even though they live in the ocean. The duck-billed platypus is a strange mammal that **lays eggs** but still nurses its babies.

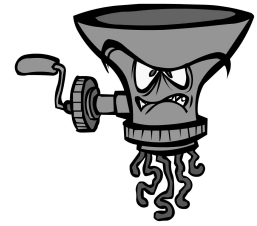
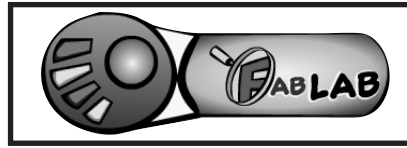
Most **birds** can **fly**, but some can't, like ostriches and penguins. Ostriches can run fast, however, and penguins are excellent swimmers.

Many kinds of animals use **poison or venom** to attack prey or defend themselves from attackers, including some kinds of spiders, frogs, snakes, jellyfish, and eels. The platypus has a toxic bite that can poison its victim.

Spiders aren't insects. They belong to a different group of creatures called **arachnids**, which also includes mites, ticks, and scorpions. One difference is in the number of legs: insects have six; arachnids have eight.

Some animals have **backbones**; others, like insects, have hard outer shells that help them hold their shape. And others, like jellyfish, are just soft all over.

Many animals **eat insects**, including humans in many parts of the world.



Grinder

It Takes All Sorts

Briefing

Think about the clothes in your closet. How many different ways could you sort them out? You could go by the type of clothing it is (sweater, jacket, pants, and so on). Or by color. Or by what season it's good for. Or by how new or old it is. That's a lot like what scientists do when they classify plants and animals. In this Fab Lab, you'll sharpen your sorting skills by inventing your own classification system!



Activity

WHAT YOU'LL NEED:

- A whole bunch of fasteners, including buttons, screws, paper clips, rubber bands, and other stuff like that.
- Observation Chart

ROUND A: SORT BY APPEARANCE

1. Spread all of the fasteners out on the table and look at them closely.
2. Observe how some of the fasteners are alike. Observe how some of them are different. Consider the different sizes and colors of the fasteners. Think about what each is made of.
3. Now working in your group, sort the fasteners into three groups based on what they look like. Give each group a name and write it in on the chart provided. Be sure to include a description of the group and how many items are in that group!
4. Now sort each of these large groups into sub-categories or smaller groups. Count how many are in each group and give the group a name too!

ROUND B: SORT BY FUNCTION

1. Mix the fasteners back up on the table.
2. Think about what each fastener is used for. Are they used for clothes? On paper? Are they used at home? At school?
3. This time you are going to make three large groups based on the function of the fastener. Write the name of each category on the chart just like before.
4. Now come up with sub-categories for each category like you did in Round A.

Debriefing

What was different about the two rounds? How did that change the way you looked at the fasteners? Can you think of another way to separate the fasteners into big categories, besides their appearance or how they're used?

Now think about the category we call "animals." How many different ways could you begin to separate that into smaller categories?



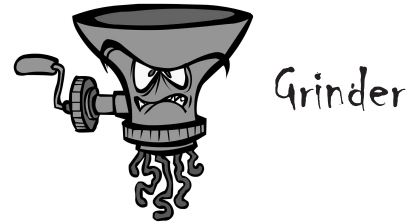
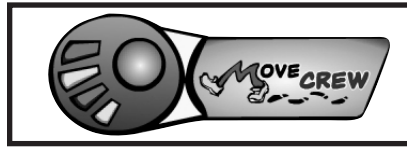
ROUND A: SORT BY APPEARANCE

<div>CATEGORY NAME (# OF ITEMS) _____ _____ _____ _____</div>			<div>CATEGORY NAME (# OF ITEMS) _____ _____ _____ _____</div>			<div>CATEGORY NAME (# OF ITEMS) _____ _____ _____ _____</div>		
↓			↓			↓		
<div>Sub-category () _____ _____</div>	<div>Sub-category () _____ _____</div>	<div>Sub-category () _____ _____</div>	<div>Sub-category () _____ _____</div>	<div>Sub-category () _____ _____</div>	<div>Sub-category () _____ _____</div>	<div>Sub-category () _____ _____</div>	<div>Sub-category () _____ _____</div>	
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ROUND B: SORT BY FUNCTION

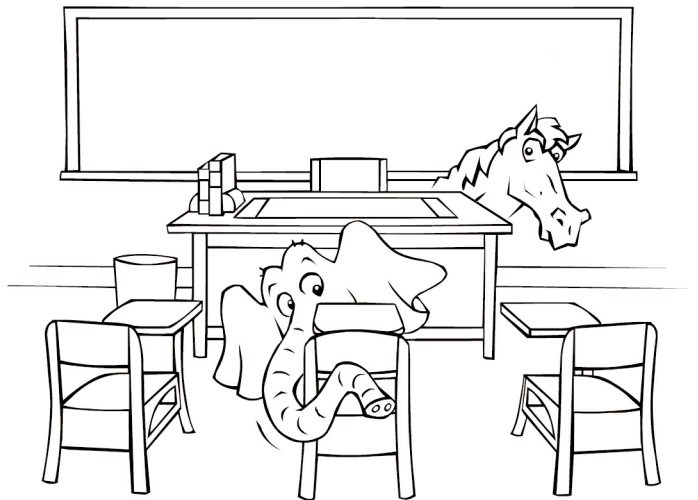
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Indoor Safari

Briefing

Quick: Name three living things that live in the ocean. Were they all fish? It's true, there are tons of fish, but there are also plants (like seaweed and kelp), shellfish (like clams and oysters), marine mammals (like whales and dolphins), worms, bacteria, lots of microscopic plants and animals—the list goes on and on. In this Move Crew, you'll try and fill up a habitat with as many creatures as you can!



Activity

WHAT YOU'LL NEED: A set of Indoor Safari cards

HOW TO PLAY:

The object of the game is to collect five cards representing five different animals who can all live in the same habitat.

ROUND 1

- Have your Leader (or someone who isn't playing) hide the cards around the room you're in.
- When the Leader gives the signal, go find five animal cards.
- When you've got five cards, take a look at what you have. (Don't tell anyone else!) Each card has a picture of an animal on it. The background tells you which habitat(s) that animal can live in. You want five DIFFERENT animals that all belong in the SAME habitat.
- Decide which cards you want to keep. You can trade in as many as you want.
- Discard all the cards you don't want, face down, in a pile in the center of the room.

ROUNDS 2 & BEYOND

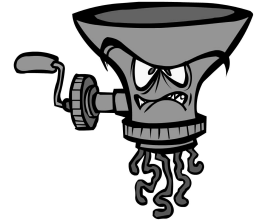
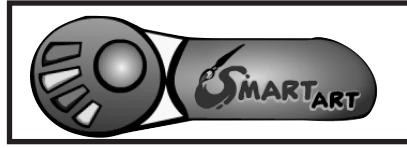
- When the Leader gives the signal, go and get more cards. You can look for cards that might still be hidden, or pick from the discard pile WITHOUT LOOKING AT IT FIRST. (Once you pick something from the discard pile, you can't put it back until the next round.)
- Get as many cards as you need to get back to five cards.
- Look at your cards again and discard the ones you don't want.
- If you get to the end of the round, and you've got five different animals from the same habitat, you win! Let everyone know.
- Keep playing as many rounds as you need until somebody wins.

TEAM PLAYING:

If you've got lots of kids, you can play on teams, with each kid being responsible for one or two cards. Talk with your teammates after every round to decide which cards to discard and which ones to keep!

Debriefing

How long did it take you to find five different animals? Were you surprised by some of the animals that lived in your habitat? How many different animals do you think live in that habitat in real life?

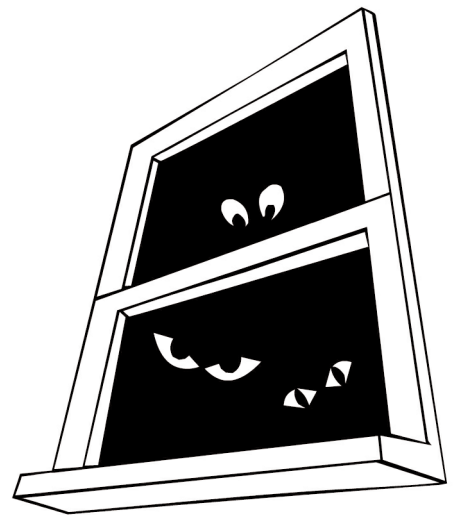


Grinder

Wildlife Window

Briefing

If you look outside the window, how many different kinds of life can you see? What if you watched out the window for an hour? A day? In this Smart Art, you'll imagine looking out of a window on a completely different world!



Activity

YOU'LL NEED:

- CASE Journal
- Crayons or markers or colored pencils

WHAT TO DO:

Choose a habitat from the list on the next page. You will find one plant and one animal underneath it.

Your job will be to draw them in a view through a window, and then add as many other different plants and animals that might belong in that habitat as you can

fit in the same picture. Try to make your picture realistic—that is, if you draw a giraffe and then a frog, draw the frog a lot smaller.

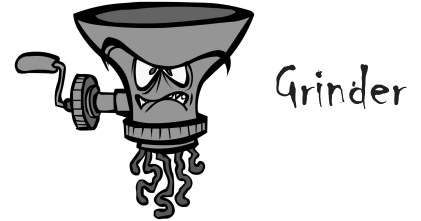
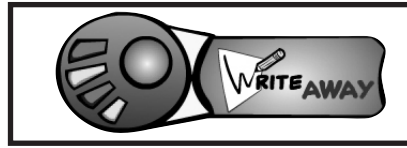
To find out about the animals in your habitat, look in encyclopedias, books, or on the Internet.

Don't forget about the small stuff, like grass, worms, and bugs! They're very important, because a lot of the larger animals eat them.

<u>Arctic</u>	<u>Savanna</u>	<u>Desert</u>	<u>Rainforest</u>
Lichen Penguin	Acacia tree Wildebeest	Sage brush Camel	Strangler fig Sloth

Debriefing

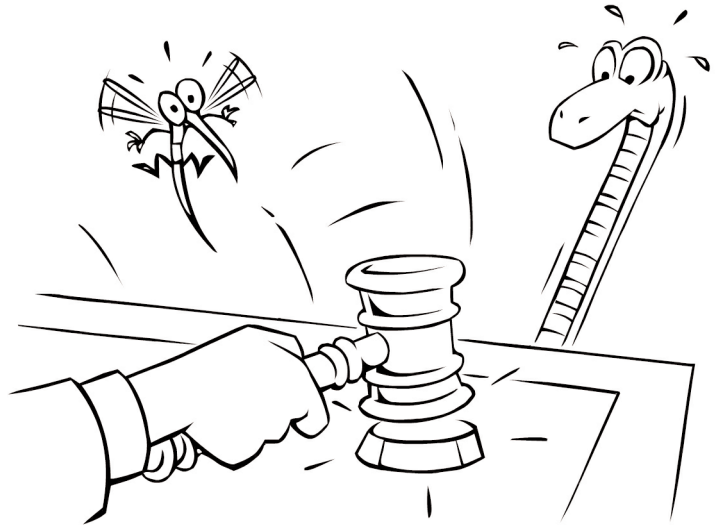
How many animals and plants were you able to fit? Was it more than you would have expected? Suppose you were looking through a magnifying glass instead of a window. What would you see then?



Here Comes the Judge

Briefing

What do you think the world would be like without mosquitoes? Pretty nice? Well, it turns out that even though mosquitoes are annoying to people, and can even spread diseases, they're also an important source of food for birds, fish, turtles, bats, and other animals, and they even pollinate some flowers. So it's important to keep them around. In this Write Away, you'll have to defend the lives of some other unpopular animals!



Activity

In this activity, a very unpopular kind of animal is on trial for its life! After centuries of annoying and grossing out humans, these animals have finally been brought to court, and the Judge has been asked to get rid of them once and for all. You've been chosen as the animals' defense lawyer, so it's your job to save their hides.

Pick a kind of animal from the following list:

Snakes
Spiders
Bees
Worms
Bats
Bacteria

Then write your defense in your Case Journal!

Debriefing

Talk about your defense with other students. Were they convinced? Did anyone else come up with a defense you didn't think of?

More Info

Find out more about worms on the Yuckiest Site on the Internet:

<http://yucky.kids.discovery.com/flash/worm/>

Learn about spiders on Animal Planet's site:

<http://www.animal.discovery.com/convergence/spidermania/spidermania.html>

Lots of stuff about bacteria, and other microscopic creatures, here:

<http://www.microbe.org/microbes/mysteries.asp>

<http://www.nationalgeographic.com/world/0010/bacteria/index.html>

Defense Worksheet

Write your defense here:

Your Honor: I know that my clients, the _____, aren't everyone's favorite creatures.

It's true, sometimes they're downright annoying. They do all sorts of unpleasant things. These include:

_____.

But don't judge them on just their bad points. Other animals depend on these creatures for food, like _____. If these creatures died, they would die too.

Not only that, these creatures actually do some good things, like

_____.

_____.

And personally, I think the coolest thing about them is that they

_____.

So you see, Your Honor, it's very important that we keep these poor creatures around. I hope you will treat them with mercy and respect. Thank you.



Mission Overview:

Fossil



his two-week Mission focuses on the evolution of life, and flows naturally from the biodiversity Mission. The focus is not on evolution itself, but on the processes that drive it. Several activities focus on **adaptations**: the physical features that help an organism survive in its environment. It's important to understand this because the creatures with the best adaptations tend to survive and pass their genes to the next generation. We also touch on fossils, and what they can tell us about extinct organisms.

The activities for this mission include: **Nowhere to Hide**, a computer simulation of simple Darwinism; **Bones to Pick**, a fossil-reconstruction game; **Feeding Frenzy**, a game about competition for food; **Blueprint for a Beast**, an exercise in imagining adaptations for strange environments; and **Where the Weird Things Are**, which lets kids come up with appropriate environments for fanciful creatures.

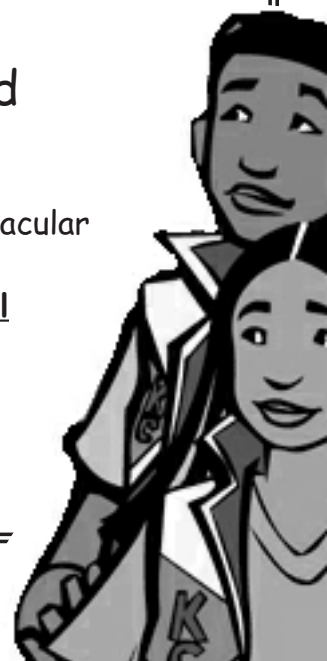
To learn more about evolution, adaptation, and paleontology, consult these resources:

Zoom Dinosaurs contains information about, and pictures of, a spectacular number of dinosaurs:

<http://www.EnchantedLearning.com/subjects/dinosaurs/index.html>

The American Museum of Natural History's Ology site has a Paleontology section, with great dinosaur stuff:

<http://ology.amnh.org/paleontology/index.html>



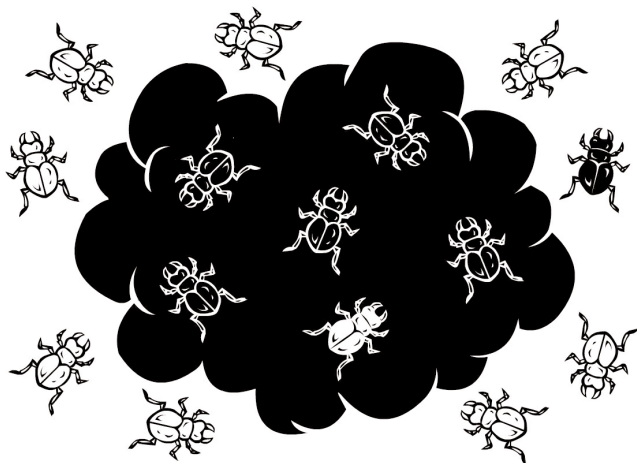
A Children's Guide to Birdwatching, from the Texas Parks and Wildlife Service, gets into some of the issues of adaptation explored in activities like Feeding Frenzy:

<http://www.tpwd.state.tx.us/adv/birding/beginbird/kidbird.htm>

Linda Gamlin's **Eyewitness: Evolution** (DK, 2000, ISBN 078945579X) introduces young readers to the history of evolution theory, its mechanisms, and the evolution of life on earth.

ACTIVITY NOTES FOR LEADERS:

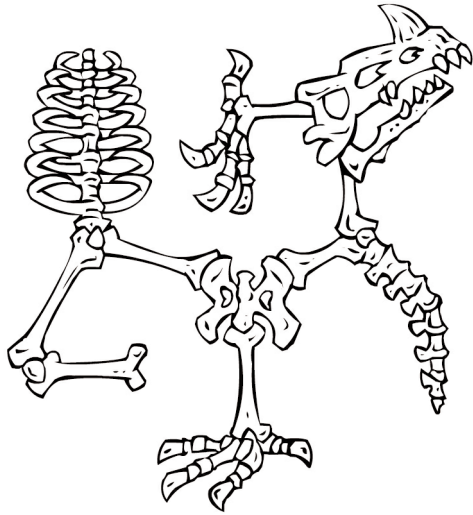
Flossil



Mind Game: NOWHERE TO HIDE

This game is based on a legendary case in England, where a population of peppered moths went from mostly white to mostly black over the course of several years. The explanation was that in the past, the white moths survived better because they blended in with white plants called lichens that lived on the trees, and weren't as easily spotted by hungry birds. After the

Industrial Revolution, all the soot from nearby factories darkened the tree trunks, leaving the lighter-colored moths exposed and giving a competitive advantage to the darker moths. This particular case is now considered questionable, but the principle is useful, so we've tweaked it to make this game. When the kids adjust the pollution level, they'll see that the moth population changes. Kids should be encouraged to wait a bit to see the results of their adjustments.

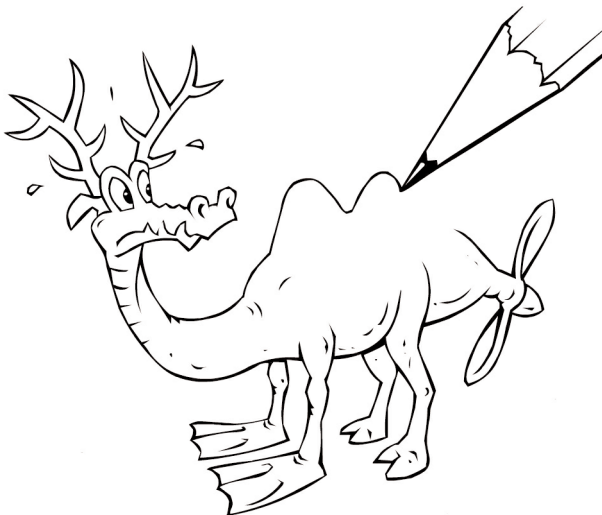
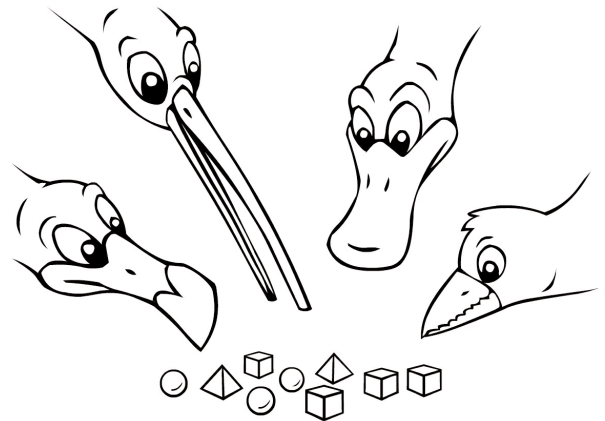


Fab Lab: BONES TO PICK

In this game, kids will try and reconstruct dinosaur skeletons drawn on cards. For simplicity, all of the skeletons are made up of six cards that are symmetrically cut. Ask the kids which types of bones gave the best hints about the whole animal. For pictures and explanations of the complete skeletons, see the enclosed answer key.

Move Crew: FEEDING FRENZY

The point of this game is to model competition for resources. Many birds have beaks that are designed for eating very specific kinds of food. The kids will probably find that some of their "beaks" are better suited for some kinds of "food" than others. If you play the game a few times, they'll probably start scanning for their "favorite" foods instead of just trying to eat everything. That's pretty much what birds do. When everyone has to use the same beak, they'll learn how much harder it is when the same kind of animal overcrowds an environment.

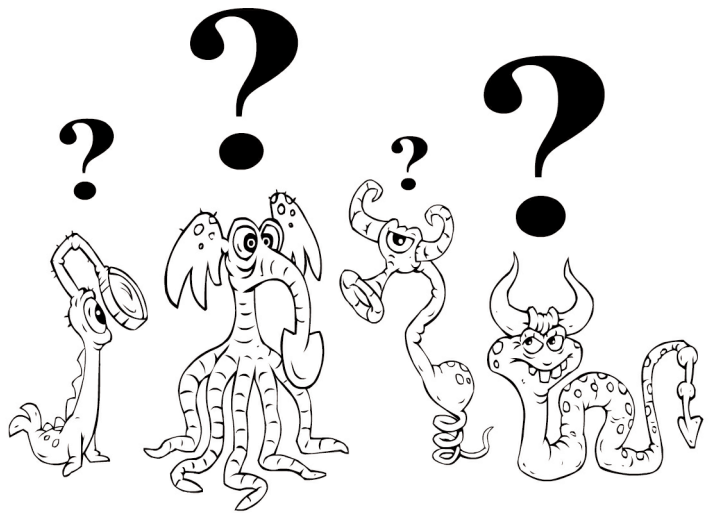


Smart Art: BLUEPRINT FOR A BEAST

This gets more into the imagination. Kids are given a bunch of weird environments and are asked to draw pictures of an animal that might live there. The animals don't have to be realistic, but they should have adaptations that enable them to find food, water, and resist the harsh conditions.

Write Away: WHERE THE WEIRD THINGS ARE

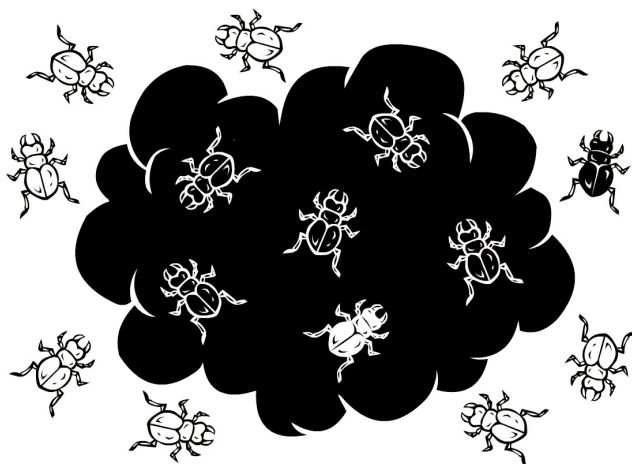
This is basically the opposite of Blueprint for a Beast - we give you the animal, the kids write about the environment. Again, it's more important that the environment suits the animal than to keep the environment "realistic."



Nowhere to Hide

Briefing

Until recently, most of the environments on Earth stayed pretty much the same for hundreds or even thousands of years. But now, humans can change an environment practically overnight. Just think what a bulldozer can do to a two-thousand-year-old forest! In this Mind Game, you'll see how big changes to the environment can affect the animals that live there.



Activity

HOW TO PLAY:

In this game, there are two kinds of bugs: green ones and orange ones. These bugs live in leafy green trees.

Every now and then, birds swoop in and eat the bugs. They usually eat the bugs they can see from a distance.

Near the forest is the Orange-O-Dyne chemical factory. The factory spews out lots of orange smoke. When the chemicals fall on the trees, they turn orange.

In this game, you can control how much pollution lands on the trees. Just click on the slider and drag it toward "More Pollution" (orange) or "Less Pollution" (green). Then sit back and watch what happens to the bugs!

Debriefing

What happened to the bugs when there was less pollution? Which ones got eaten? Why do you think that is?

What happened when the pollution levels went up?

If you've got your Journals, go ahead and answer the questions in them now!

More Info

Bugging Out in Old England

This *Mind Game* is based on a story about a moth called the peppered moth that lives in the forests of Manchester, England. There were two kinds of peppered moths: white (with salt-and-pepper coloring) and black.

For a long time, the trees in the forest were white, because they were covered with plants called lichens. And nearly all of the peppered moths were white.

In the mid-1800s, a lot of factories were built nearby and started releasing soot into the air. The soot killed the lichens and covered the tree bark.

After that happened, the white peppered moths started to disappear, while the population of the black peppered moths got bigger and bigger. After a while, nearly all the moths were black.

Later on, when the pollution was put under control, the lichens grew back, and before long, most of the moths were white again.

This story has been explained as an example of natural selection in action. In

natural selection, the organisms that are best suited to survive in an environment have the most babies and grow in numbers, while organisms that aren't as well suited to the environment shrink and disappear.

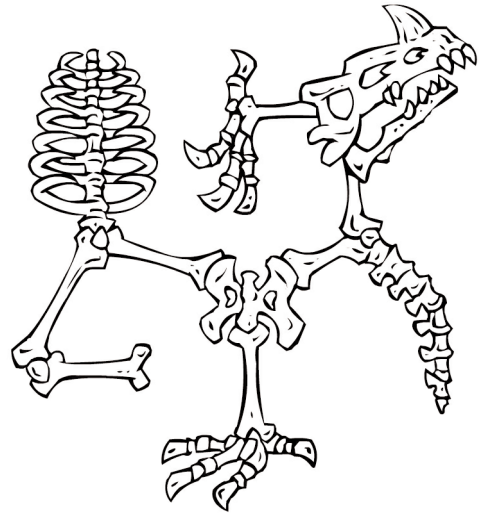
In the forests of Manchester, it was thought that birds were eating the black moths more often than the white ones because they were easier to spot. The white moths blended in with the lichens on the trees. When the lichens died, the advantage went to the black moths, which were closer to the color of the sooty bark. Now the white moths stood out and got eaten.

Recently, some scientists have questioned if this really happened that way. There are some problems with the story - for example, it turns out the moths don't really sit on the tree bark for very long. Still, we know the moth population did change when the pollution went up and down, so there's a good chance that the pollution did affect the moths in unexpected ways.

Bones to Pick

Briefing

Have you ever found a piece of a game in your room and had no idea what game it belonged to? Paleontologists have this kind of problem when they dig for fossils. They find all different kinds of fossils at different times and in different places, and have to figure out how they go together. In this Fab Lab, you'll become a paleontologist and identify different animals from their bones.



Activity

In this activity, the bones of six different prehistoric creatures have been all mixed up. Your job is to put the broken pieces back together.

WHAT YOU NEED:

- A set of "Bones to Pick" Bone Cards
- A box or bag to hold them in

WHAT TO DO:

- Everyone sits in a circle.
- Put all the cards in a box or a bag. Without looking in the box, each kid pulls out one card and passes the box to the kid on his or her left. This keeps going until every kid has six cards.
- Each kid looks at his or her bones and tries to put them together into a complete skeleton.
- If you can't create a complete skeleton from your bones, you can pass up to 4 cards to the kid on your right. Everyone passes the cards at the same time.
- Then everyone has 2 minutes to look over their new pieces and decide which, if any, pieces they will pass in the next round.
- Whenever someone finishes a whole animal, he or she steps out of the circle and is free to help the other kids. This continues until everyone has a whole skeleton.
- At the end, everyone shows their complete skeletons to the other players. They can talk about what kind of a creature they think it was: how it moved, what it ate, etc.

TEAM PLAY:

You can play this in teams instead of individuals if you've got lots of kids in your group.

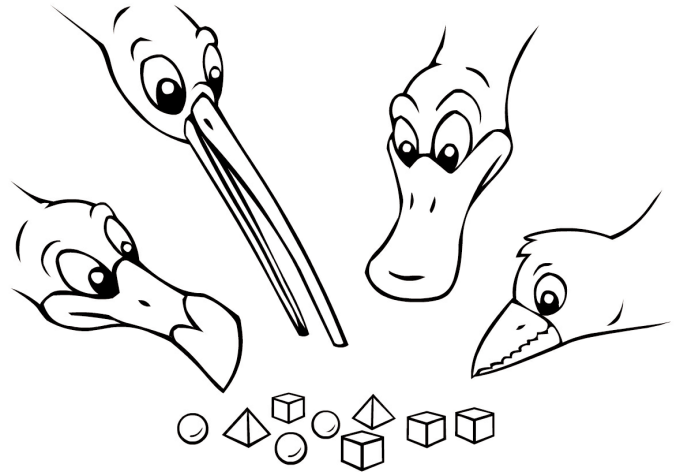
Debriefing

Were there some bones that were easier to put in the right place than others? Which ones? Which bones do you think are most helpful to paleontologists when they go digging?

Feeding Frenzy

Briefing

Imagine you're a hungry bird, living on an island with lots of other hungry birds. There are different things to eat on the island, like bugs, fruit, seeds and fish. Do you think it would be best to try to catch and eat lots of different things, or just one kind of thing? Why? In this Move Crew, you'll find out if it pays more to be piggy or picky!



Activity

In this Move Crew, you and everyone else on your Crew will become hungry birds. You'll need to snag as much food as you can before the other birds eat it!

WHAT YOU'LL NEED:

- A bunch of different "foods" (Small objects)
- Several different kinds of "beaks" (Things to pick them up with)
- Enough plastic forks for all the players

HOW TO PLAY:

Part 1

- Mix up all the "foods" and spread them out on a large table or the floor.
- Every kid gets a different kind of "beak" to pick up food with.
- When the Club Leader says "GO!" start the feeding frenzy! Everyone tries to pick up as many food items as they can, **USING ONLY THEIR BEAKS**. Remember, you can't touch the food with your hands!
- After two minutes, the Club leader calls "Time!" and the feeding frenzy stops. Everyone counts the number of food items and writes it down. Every item counts for one point, regardless of what it is.
- Think about your strategy. How can you get more food faster? Play the same round again and see if you do better.

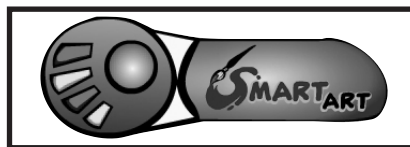
Part 2

- Everyone empties their food items back onto the floor, and the Club Leader mixes them up again.
- The Crew plays the game one more time, but this time **EVERY KID GETS A PLASTIC FORK**.
- At the end of the time, record how many food items you've collected.

Debriefing

In Round 1, was it easier to try and eat everything, or just to focus on one kind of food? Was this what you expected? Were you able to get more food when you thought about your strategy?

What changed in Part 2? Was it harder or easier for everyone to get food when they had the same kind of beak?



Blueprint for a Beast



Briefing

If you lived in Florida and moved to Alaska, what do you think you'd need to do about your clothes? You'd probably need a lot more sweaters, coats, and heavy boots than you ever owned in Florida. Evolution is kind of like that, but it happens over millions of years. Plants and animals develop adaptations: things that help them survive in their environment. In this Smart Art, you'll get a chance to build the perfect creature to live in a really weird environment!

Activity

Here are a few places where you don't see too many animals hanging around:

- Inside a volcano
- 35,000 feet above the ground (where airplanes fly)
- On an iceberg in the middle of the ocean
- Under the hood of a car
- In your nose

Your job is to build an animal that could live in one of these places. And you don't have millions of years for evolution to do its work. This critter needs some adaptations right away, or it's dead meat.

Pick one of these places and draw a picture of the animal that would live there. Your animal has to be able to do three things in its environment:

- 1) Move.
- 2) Drink and eat.
- 3) Defend itself from danger.

Before you start drawing, make sure to check out what it's like in the place that you chose. What's the temperature like? Is there water around? If so, where? Are there any dangerous natural forces (like poisonous gases, or high winds?) How will your animal deal with these? What would your animal eat? How does it eat? Are there any sudden changes that might happen that your animal should be prepared for?

Your animal doesn't have to look like anything that really exists. The adaptations can be as wild as you want. But remember -- an adaptation has to be something the animal is born with, not something it learns.

When you're done, make sure to give your imaginary animal a cool name!

Debriefing

Find another kid who drew an animal from the same environment. How are your animals alike? How are they different? Did you each tackle the same problem (for example, how the animal gets water) in different ways? Did the other kid think about problems that you didn't think of?

Where the Weird Things Are

Briefing

Suppose you had never seen a giraffe before. And suppose one showed up on your doorstep one day. Where would you ship it back to (besides the zoo)? What would you feed it? Would the long neck give you any clues about where it lived, or what it ate? In this Write Away, you'll have to figure out where some of the strangest animals you could ever imagine might belong!



Activity

A giraffe's long neck is a kind of adaptation. That's something that helps an animal live in its environment. In this case, it helps it reach the leaves of tall trees in the African Savannah. Do you think you might have guessed that just from looking at it? What else could a long neck be useful for?

WHAT YOU'LL NEED:

- Pictures of weird creatures

1. Choose one weird creature picture. Create a wild name for it, like Honey-footed Frub or Four-eyed Yarbalo. Since this is an imaginary creature, the name should be something unlike any creature we know!
2. Think about where your animal might live, and how its weird features help it live there. How does your animal eat? Move? Protect itself from danger? What are all those features good for? For example, if your animal had a sharp, hooked beak, you might say that it uses that beak to catch fish in the nearby rivers or to dig in the dirt for worms. Or to hang from tall trees so it doesn't get eaten by wildcats.
3. Write about your animal's habitat in your Journal. Use your imagination! Since the animals aren't real, anything goes!

Debriefing

What would happen to your animal if it didn't have one of its adaptations? What would happen if something in your animal's habitat changed—for example, if other animals or plants disappeared, or if the temperature changed, or if the area got drier or wetter? How would your animal be affected?

Can you think of a real animal with a strange adaptation? What do you think that adaptation is for?