Learning Set 2

Back to the Big Challenge

Make recommendations about developing a new rice plant that will produce more rice and more nutritious rice.

Addressing the *Big Challenge: Make recommendations about developing a new rice plant that will produce more rice and more nutritious rice*, will help you answer the *Big Question* for this Unit: *How can genetic technology help improve people's lives?* You have learned enough now about how traits are passed from generation to generation to begin addressing the challenge. The letter from the Rice Institute tells you which part of the challenge you should begin working on.

RBWI
The Rice for a Better World Institute

To: All Collaborating Scientists

From: The Rice for a Better World Institute (RBWI)

Subject: Research Update

The field experiments on how traits are passed from generation to generation were successful. We are now ready for you to look more closely at the traits we desire in a new rice plant. Earlier, we sent you an inventory of the traits we have in our data bank. Using the same experimental procedure you sent us for rice-seed color, we have carried out further experiments. We now know more about how the traits in our inventory are inherited. We discovered that each of these traits comes from a single dominant or recessive allele in a gene. Please look at the table to learn more about these traits.

Rice variety	Trait	Inheritance
A	grows well in dry conditions	recessive
B	grows well even in flood conditions	dominant
C	has high starch content	dominant
D	has high fiber content	recessive
E	has high levels of vitamins and minerals	recessive
F	is resistant to maggots (pests)	recessive
G	is resistant to worms (pests)	dominant
H	is resistant to caterpillars (pests)	dominant
I	is resistant to beetles (pests)	dominant
J	is resistant to grasshoppers (pests)	recessive
K	is resistant to rice blast (disease)	recessive
L	is resistant to leaf blight (disease)	recessive
M	is resistant to fungus (disease)	recessive
N	is resistant to stem rot (disease)	recessive
O	produces more rice grains per plant than other rices	recessive
P	requires less fertilizer per acre of rice than other rices	dominant

Please use this new information as you make recommendations about developing a rice plant that produces more nutritious rice and produces rice under different weather conditions. We wish you success as you continue your investigations.

Using the information in the table above and what you have learned in this *Learning Set*, each group will create a plan for addressing one criterion of the challenge. Groups will either make recommendations about developing a rice plant that produces more rice, or they will develop recommendations about developing a rice plant that produces more nutritious rice.

Recommend

You will make recommendations to the Rice for a Better World Institute about developing a variety of rice that grows better and is more nutritious. As you work on your recommendations, keep in mind the big ideas you learned in this Learning Set.

- Mendel's experiments with pea plants and inheritance
- how flowering plants reproduce
- self-pollination and cross-pollination
- how recessive and dominant traits are passed on to the next generation
- using Punnett squares to predict what traits the next generation will have
- designing field experiments to find out more about traits and how they are inherited

Write as many recommendations as you need to write to make sure the scientists and farmers will know everything they need to do to develop new rice plants that meet their criteria. Some of your recommendations will be about which rice varieties to cross with each other, and some will tell them what they should learn more about and what experiments they need to do.

Write each of the recommendations in a way that will tell the institute scientists and farmers why they should trust it. Think about starting your recommendations with "If," "When," or "Because." For example, you might begin a recommendation by writing, "If the farmers wanted to plant seeds that would produce rice that contains more starch…" Even better would be a recommendation of the form, "Because rice uses self-pollination…" Then complete the statement.

To prepare for presenting to the class, and so you can be sure your recommendations match the evidence you have collected and the science knowledge you have learned, use a *Create Your Explanation* page for each

recommendation your group makes. Your recommendation will be your claim. Add evidence and science knowledge that supports it. Then develop a statement linking your recommendation to the evidence and science knowledge.

Create Your Explanation

Name:_____ **Date:**_____

Use this page to explain the lesson of your recent investigations.

Write a brief summary of the results from your investigation. You will use this summary to help you write your Explanation.

Claim—a statement of what you understand or a conclusion that you have reached from an investigation or a set of investigations.

Evidence—data collected during investigations and trends in that data.

Science knowledge—knowledge about how things work. You may have learned this through reading, talking to an expert, discussion, or other experiences.

Write your Explanation using the ***Claim***, ***Evidence*** and ***Science knowledge***.

Communicate Your Solution

Solution Briefing

After you have developed your recommendations, you will communicate your recommendations to one another in a *Solution Briefing*. To prepare for the briefing, make a poster that includes the criterion you were trying to achieve, the traits your new rice will have, and all of your recommendations. Then, use the following questions to plan your presentation:

- What criterion do your recommendations address?
- What traits does your rice need to have to meet the criterion you are addressing?

- How are those traits inherited?
- How will you make sure your new rice contains the traits you want it to have?
- For each recommendation,
  - What information about the rice did you use to help you make your recommendations?
  - What science knowledge supports your recommendation?
- What ideas did you think about along the way, and why did you not recommend them?
- What questions do you still have?

As you listen to your classmates' presentations, make sure you understand their answers to these questions. If you do not understand something, or if they did not present something clearly enough, ask questions. When you think something can be improved, be sure to contribute your ideas. Be careful to ask your questions and make your suggestions respectfully. As you listen, record your notes on a *Solution Briefing Notes* page.

Solution-Briefing Notes

Name _____ **Date** _____ **Design Iteration** _____

Design or group	How well you think it will work	What I learned and useful ideas		
		Design ideas	Construction ideas	Science ideas
Plans for our next iteration				

Reflect

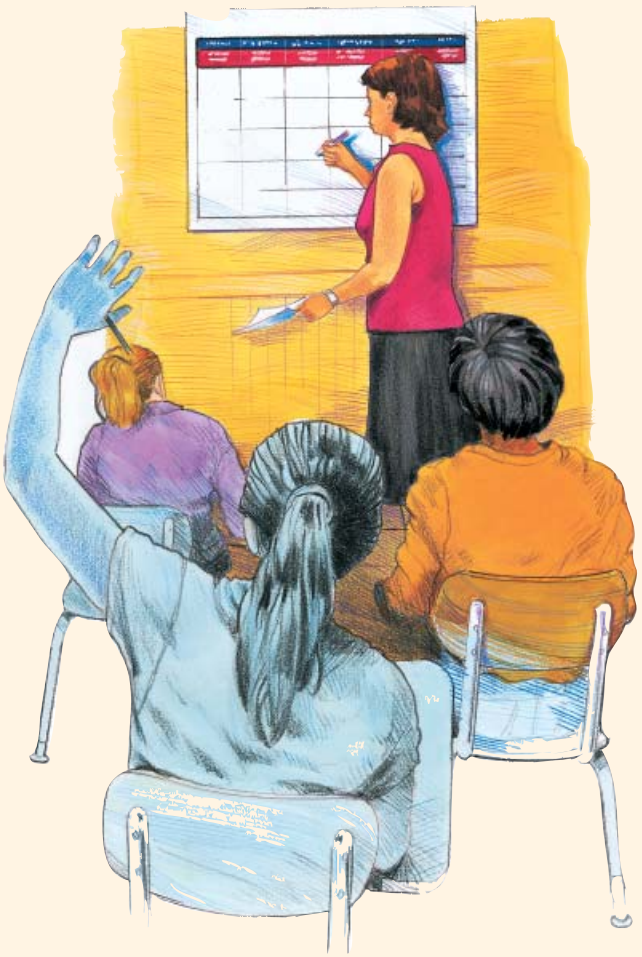
You've made recommendations about how to develop rice that is either more nutritious or that grows better. But the Rice for a Better World Institute needs you to develop a rice variety that addresses both criteria. Work with

your group to try to come up with a way of breeding rice that is both more nutritious and that grows better. As you work towards this goal, think about the answers to these questions.

1. How did your recommendations differ from those of other groups who worked with the same criterion? How were they similar? Why?
2. How are the recommendations about developing more rice and developing more nutritious rice similar to each other? Why? How are they different? Why?
3. What happens in the next generation of the rice you developed? What traits will that generation have?

Be prepared to work with your class to come to an agreement on how to combine the two traits you desire into one new rice plant.

Update Criteria and Constraints



Now that you have learned more about achieving the challenge, you may have identified additional criteria and constraints, or you may feel that the criteria and constraints need to be stated more specifically. Using your new knowledge and evidence from this *Learning Set*, review your list of criteria and constraints. Update the list, making it more accurate. A more accurate list will help you better achieve the challenge.

Update the *Project Board*

The last column on the *Project Board* is the place to record what you have learned that might help you address the *Big Challenge*, to make recommendations on developing a rice plant that will produce more rice and more nutritious rice. Add your recommendations to the *Project Board* so you can return to it later.