A CLASSROOM EXERCISE FOR TESTING URBAN MYTH:

Does Wedding Rice Cause Birds To Explode or Were Ann Landers, Martha Stewart & Bart Simpson *Wrong?*

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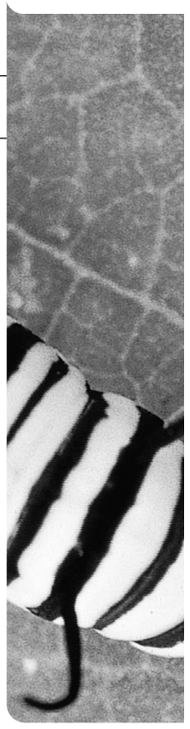

My primary responsibility is teaching large, non-majors biology classes of 300 students per section. The purpose of science and the scientific process is heavily emphasized throughout the semester. I emphasize components of the *National Science Education Standards* that include having students learn science by actively engaging in inquiry and demonstrating that the scientific process is valuable in everyday life as well as making personal decisions. I especially emphasize application of the alternative hypothesis approach of strong inference (detailed by Platt, 1964) in the decision-making process. Trying to excite students with a firsthand experience of the scientific process (involving both inductive inference and hypothetic-deductive reasoning) is a constant challenge and requires creativity. Most in-class, hands-on activities that exemplify the scientific process are particularly difficult. During class discussion I explain how strong inference can prevent establishment of erroneous pet hypotheses. UFO sightings are my favorite example. Individuals who observe glowing objects moving across the night sky immediately proclaim sighting a UFO (the pet hypothesis). Note that such individuals use "UFO" as a synonym for "spaceship," when in reality UFO is a solid scientific term in that the flying object has not been identified. By

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not applying strong inference, alternative hypotheses (such as jets, satellites, meteorites, and excessive alcohol consumption) are ignored.

Pet hypotheses are the seeds from which urban myths grow. As a biology teacher, I hear the same myths repeatedly. One of these includes biting snapping turtles. It is believed that these reptiles are capable of biting fingers and toes completely off. I have had many students exclaim that they know friends of friends who have lost fingers and toes to snapping turtles. In reality, snapping turtles have the potential to damage soft tissues, but lack the power to break bone. A fifty-pound snapping turtle can barely dent a wooden pencil. The second myth states that snakes will not crawl over rope laid on the ground. Thus rope can serve as an effective barrier to keep snakes away. I recently talked to a neighbor who knew this to be true and was using the method to keep garter snakes from getting into his small, backyard fishpond. As he was telling me how well this worked, I watched a garter snake crawl over the rope and slide into the pond. By far the most common myth is that rice thrown at weddings is harmful to birds causing them to explode or choke to death. This is an excellent example of a pet hypothesis that has grown into an urban myth. Such myth lends itself beautifully to scrutiny by the scientific process. Moreover, designing experiments to test an urban myth is, although not hands-on, an interactive exercise that can engage students in the large classroom.

In this article, I first provide the history of the wedding rice myth. I then detail an interactive class activity that involved students in my large, non-majors biology classes. These students developed a series of experiments that scientifically determined if rice could be harmful to birds. Finally, I provide suggestions on how others can replicate most of the activity.

The Wedding Rice Myth & Its History

The urban myth that rice is harmful to birds is well established. It states that throwing rice at weddings attracts birds that eat the rice. After these birds drink, the rice then absorbs water and expands. The rest of the myth has two versions. One version is that the rice expands choking the bird to death. The more gruesome version is that the rice expands in the bird's "stomach" causing it to explode, thus killing the bird. In reality birds do not have stomachs. They have crops where the food goes after being eaten. Food then passes down the digestive track to the gizzard where, in the case of seeds, it is ground before entering the intestines. Presumably the crop is what explodes.

Mikkelson and Mikkelson (2003) reviewed the origin of the myth. They suggested that the late Ann Landers may have started it by explaining in a 1996 syndicated newspaper column that rice might be harmful to birds and that rose petals should be thrown at weddings as a safe substitute. Martha Stewart helped perpetuate the myth by suggesting (both in her wedding book; Stewart, 1999; page 44; and on a 24 March 2001 radio broadcast of "Car Talk" with Tom and Ray Magliozzi) that wedding guests should throw bird seed to avoid harming birds. In fairness, Stewart did state in her syndicated newspaper column (Stewart, 2002) that it is a mistaken belief that rice is harmful to birds. Blame goes beyond Landers and Stewart. During an episode of the television program "The Simpsons," Bart Simpson was warned that throwing rice could harm birds. This myth has spawned an industry. Many online wedding catalogs now sell heart-shaped, designer wedding rice (at about $25/pound). Most of these suppliers promote this product as "environmentally safe heart-shaped rice that will not harm birds or animals" (note that birds are not considered animals). One supplier (Brides' Village, www.bridesvillage.com/deshearwedri.html) clarified that rice is not harmful to birds. It points out that the main problem is that rice could roll when stepped on thus making church steps slippery for guests. Many churches and reception halls do not permit rice to be thrown in order to prevent harming birds and guests from falling.

Despite numerous sources explaining why rice is not a threat to birds, this urban myth has become thoroughly entrenched in U.S. culture within relatively few years. During the spring 2002 semester, I asked 600 students in my two biology classes if it was acceptable to throw rice at weddings. By show of hands, 50% said it was not acceptable to throw rice. When I asked why, 45% of the 600 students said it was because birds choke on rice. I asked how many students had witnessed birds choking or exploding after eating rice. Only one student claimed to have seen such an event. This student said his grandmother routinely feeds rice to chickens to kill them. The student claimed to have personally watched chickens explode "into pieces" after eating rice and drinking water. His description was extremely graphic and gruesome, and the student was adamant that the story was true.

Interactive Class Project

The wedding rice myth provides a wonderful example of how the scientific process can be used to examine plausibility of the myth. Students in large classes can consider the myth from a scientific perspective without attempting a hands-on activity.

After the initial survey, class discussion passed through a series of stages as the semester progressed. Each stage involved one or a series of questions leading

to hypotheses and design of an experiment, execution of the experiment by me, discussion of the results, then additional formulation of questions, hypotheses, and experiments. The essential aspect of this exercise was that students generated all the hypotheses and helped design experiments. I served as the laboratory technician, and I provided scientific guidance. The following is the progression of stages.

Stage 1

I initiated the discussion with the following question: What is rice and how is rice different from bird seed? Many students found it illuminating to realize that rice is seed no different from bird seed structurally and functionally. Based on this, the first hypothesis was generated.

Hypothesis 1

Rice expands more than typical bird seed.

Methods of Experiment 1 (Bird Seed & Rice Expansion Experiment)

We compared how different seeds, including rice, increase in volume when mixed with water. The protocol for this experiment was that a constant volume of seed would be added to calibrated beakers and water would be added until level with the grain. At this point we considered technique. We had two options. One was to add water initially. The second was to continue adding water so it remained level with that of the seeds over a four-hour period. We felt this would produce the maximum expansion. Biologically-valid arguments could be made for either method, but we decided to strive for maximum volume. At this point in the discussion, I introduced the concept of replication and potential problems with having one beaker per seed type. We decided that replicates of 10 beakers per seed were best. Seven different varieties of grains were used that are typically purchased as wild bird feed. These included buckwheat, field corn, finch feed (which is a blend of 15 different grains), hard red wheat, niger thistle, popcorn, safflower, and white millet. Jasmine white rice was used for comparison. For each seed type, 10 beakers were filled with 40 ml for seeds, with water added to the 40 ml mark. All beakers were placed in a warming oven with a temperature of 102˚F (to represent the general body temperature of birds). Once an hour for four hours, I checked the volume and added more water to remain level with the seeds. After four hours, the volume of seed in each beaker was recorded.

Table 1.
Comparing one variety of non-instant white rice to other seeds often used as bird seed. The initial volume for all seeds was 40 ml per beaker. Final volume and range are in ml.

Grain Type	Final Volume (Range)	Percent Change
Bird seed		
Buckwheat	63 (60-70)	58
Field corn	53 (55-70)	53
Finch feed*	46 (40-50)	14
Hard red wheat	66 (60-70)	65
Niger thistle	54 (50-60)	35
Popcorn	70 (55-70)	53
Safflower	48 (40-55)	20
White millet	49 (40-55)	21
Mean		**40**
Rice		
Jasmine white	53 (50-60)	33

* Finch feed is a compilation of 15 different seeds that provides a balanced diet to species of captive birds.

Results

Table 1 shows that white rice increased in volume by 33%, while bird seed expanded by 40% on average, with wheat showing the greatest increase of 65%.

Conclusion

Jasmine white rice expands less than seeds commonly used in bird feeders, thus unlikely to harm birds.

Stage 2

Students immediately questioned whether jasmine white rice was indicative of rice in general and if this is the rice thrown at weddings. They quickly decided that

Experiment 1 should be repeated comparing every variety of rice and rice product obtainable.

Hypothesis 2

All types of rice expand similarly.

Methods of Experiment 2 (Comprehensive Rice Expansion Experiment)

We decided that for sake of comparison the protocol of Experiment 1 should be repeated for all similar experiments. Three varieties of white rice (arborio, basmati, and jasmine) and four varieties of brown rice (long-grained, medium-grained, short-grained, and sweet) were tested. In addition, five rice products were used (cream of rice, designer wedding rice, instant white rice, instant brown rice, and puffed rice cereal).

Results

Table 2 shows results of this experiment. Brown and white rice are similar in their capacity to expand (29% and 35%, respectively). The designer wedding rice instantly turned into white "mucus" but did not change volume. Puffed rice cereal instantly dissolved and lost volume. Both instant brown and instant white rice expanded 2.7 to 2.4 times the original volume.

Table 2.
Comparison of different varieties of white and brown rice as well as processed rice products. The initial volume for all seeds was 40 ml per beaker. Final volume and range are in ml.

Grain Type	Final Volume (Range)	Percent Change
White rice		
Arborio white	58 (50-70)	45
Basmati white	49 (45-55)	23
Jasmine white	53 (50-60)	33
Mean		**34**
Brown rice		
Long-grained brown	53 (45-60)	31
Medium-grained brown	51 (45-55)	28
Short-grained brown	50 (None)	25
Sweet brown	53 (50-60)	31
Mean		**29**
Rice products		
Cream of rice	57 (50-60)	57
Heart-shaped rice	40 (None)	0
Instant white rice	98 (90-105)	146
Instant brown rice	109 (100-120)	170
Puffed rice (cereal)	26 (20-35)	-36
Mean		**42**

Conclusion

None of the rice varieties likely thrown at weddings (white and brown varieties) expand more than bird seed. Instant rice expands enough to present a potential risk to birds.

Stage 3

Based on the results from Experiment 2, students felt that the amount of expansion by instant rice could be the basis of the urban myth; so we could not dismiss the myth with the data collected at this point. Several students were curious to know if any seed expanded to the extent of instant rice. Thus a comprehensive seed comparison was needed.

Hypothesis 3

Instant rice has the greatest potential to expand of any seed or seed product possibly eaten by birds.

Methods of Experiment 3 (Comprehensive Seed Expansion Experiment)

Twenty varieties of seeds and grain products were subjected to the protocol of Experiment 1.

Results

Table 3 shows that legumes in general are capable of expanding more than non-legumes (116% verses 33%, respectively). Red lentils

were capable of tripling in volume; these seeds expanded extremely rapidly. Of the 20 seeds and grain products, only red lentils expanded more than instant rice.

Conclusion

Other than red lentils, instant rice has the greatest capacity to expand. Thus if anything has the potential to harm birds by expansion, instant rice is a likely candidate.

Stage 4

Students were surprised to see from the results of Experiments 2 and 3 that instant rice has such a capacity to expand compared to other seeds. They were also surprised by the extent to which red lentils expanded. Fortunately, no evidence exists that red lentils are thrown at weddings. Nonetheless, the class felt we should continue to consider red lentils as the extreme example. During discussion students considered if red lentils or instant white rice could expand enough to rupture a bird crop. Students suggested filling an artificial, plastic crop with seed and water to see if expansion could cause rupture. The class felt that a plastic similar in rip resistance to a bird crop was needed. I purchased a pocket penetrometer to estimate tensile strength (= rip resistance). Sandwich bags have strengths of 1.5 kg/cm^2. Students questioned if this was too thick to compare to crops. Pigeon crop membranes have a strength of less than 0.1 kg/cm^2 (Krupa, personal observations). A student's father who worked for a plastics company specializing in plastic bags sent the thinnest plastic the company produced. This plastic had strength of 0.5 kg/cm^2 (still 5 times stronger than a pigeon crop).

Table 3.
Comparison of different varieties of seed, grain products, and vegetable products. The initial volume for all seeds was 40 ml per beaker. Final volume and range are in ml.

Grain Type	Final Volume (Range)	Percent Change
Legumes		
Adziki bean	74 (60-80)	85
Anasazi bean	85 (80-95)	113
Baby lima bean	69 (60-80)	71
Garbanzo bean	84 (80-90)	110
Great northern bean	87 (80-100)	118
Kidney bean	75 (70-80)	86
Mung bean	91 (90-100)	128
Navy bean	87 (80-95)	118
Red bean	80 (75-85)	99
Soybean	96 (85-100)	140
Green lentil	84 (80-90)	110
Red lentil*	120 (none)	200
Black-eyed pea	95 (90-110)	138
Mean		**116**
Non-legumes		
Flax	62 (50-70)	54
Hemp	49 (45-60)	21
Quinoa	60 (55-65)	49
Sesame	44 (40-50)	9
Mean		**33**
Miscellaneous		
Instant mashed potatoes	99 (90-110)	148
Rolled oats	50 (45-50)	24
Quick oats	51 (45-55)	26
Mean		**66**

* Red lentils had the greatest increase in volume of any seeds tested

Hypothesis 4

If expanding instant rice and red lentils are capable of rupturing a plastic crop, then instant rice could present a risk to birds.

Methods of Experiment 4 (Plastic Bird Crop Experiment)

Instant white rice, arborio white rice, cream of rice, and red lentils were tested. For each of

these, 100 ml of the seed plus 100 ml of water were placed in a plastic bag. There were 10 replicates for each seed type. The open end of each bag was closed and twisted until the bag was tight. The bags were placed in the warmer oven and checked each hour for the first 8 hours, then left in the oven for 24 hours.

Results

None of the 40 bags ruptured. The bags with arborio white rice and cream of rice were as loose as when the experiment began. After the first hour, all red lentil bags were tight and stretching as the lentils expanded. By the second hour, the instant white rice bags were tight and stretching. All bags with lentils and instant white rice remained in this condition for 8 hours. The bags slowly relaxed from 8 to 24 hours later.

Conclusion

Expanding rice and red lentils could not rupture the plastic bags. This did not confirm that weaker bird crops could resist rupturing.

Table 4.
Results of four varieties of seeds allowed to expand in wet, brown paper bags submerged in water. All paper bags and their contents were left for 24 hours. Ranges of rupture times are in parentheses.

Seed Type	Lapsed Time until Paper Bag Ruptured
Red lentils	10.2 min (7 – 13)
Instant white rice	19.5 min (13 – 26)
Long-grained brown rice	Did not rupture
Arborio white rice	Did not rupture

Stage 5

Based on the results from Experiment 4, one student asked the cliché question, "Could any of these seeds expand their way out of a wet paper bag?" I measured the rip resistance of a wet, brown paper bag and found it to be 0.2 kg/cm^2. Thus wet paper bags had a rip resistance close to pigeon crops.

Hypothesis 5

When placed in wet paper bags, seeds will not expand enough to rupture the bag.

Methods of Experiment 5 (Wet Paper Bag Experiment)

Instant white rice, arborio white rice, long-grained brown rice, and red lentils were used in this experiment. 200 ml of each were placed in heavy duty, brown paper bags (10 cm x 25 cm). The open end of each bag was then rolled over repeatedly until the seeds were firmly secured. A rubber band was wrapped around the bag to prevent it from unfolding. All bags were placed in pans of warm water, weighted down under water, and left for 24 hours.

Results

Table 4 shows the results of Experiment 5. The bags with the red lentils began to expand immediately and the first bag ruptured after 7 minutes. Instant white rice expanded less quickly with a mean rupture time twice that of red lentils. After 24 hours, none of the bags with arborio white rice or long-grained brown rice ruptured.

Conclusion

Instant rice was capable of rupturing a wet paper bag, thus bird crops could rupture as well.

Stage 6

The class discussion turned to the most obvious question: Even if a bird crop could rupture as instant rice expands, will birds eat enough instant rice for this to happen? It was simple to test this question because I raise several species of domestic grain-eating birds such as pigeons, ringneck doves, and diamond doves. I have approximately 60 birds in a large aviary. I do feed brown rice as a treat, but I have not tested their preference for the different types of rice or instant rice.

Hypothesis 6

Given a choice, birds will not eat instant white rice.

Methods of Experiment 6 (Preference Feeding Experiment)

A total of 900 ml each of three varieties of brown rice (short-grained, medium grained, long-grained), three varieties of white rice (basmati, jasmine, instant), and safflower were placed in glass bowls in the aviary. Safflower is a white seed (structurally similar to sunflower

seeds) that is routinely fed to my birds as a treat. It served as a standard of seed types preferred by my birds. After three days, all glass bowls were removed, the volumes measured, and the uneaten seeds returned to the aviary. The experiment ended when all seeds were eaten.

Results

Table 5 shows the results of this experiment. As expected, safflower was most preferred by my birds and was completely eaten in three days. After three days, instant white rice was least preferred with only 6% of it eaten by the birds. The other five varieties of rice were of intermediate preference with 20% to 50% having been eaten. It took 12 days for 60 birds to eat 900 ml of instant white rice.

Conclusion

Pigeons, ringneck doves, and diamond doves will avoid eating instant white rice given other food options.

Table 5.
Volume of seeds (of initial 900 ml) left uneaten in aviary after three time intervals.

SEED TYPE	3 days	9 days	12 days
Brown Rice			
Short	550	0	0
Medium	550	0	0
Long	500	0	0
White Rice			
Basmati	700	0	0
Jasmine	450	0	0
Instant	850	400	0
Safflower	0	0	0

Stage 7

It was clear that instant white rice is the only variety of rice that expands enough to pose a possible risk to birds. Thus students found it rather enlightening that my pigeons and doves simply did not like eating it. A student posed the ultimate question that would get to the root of the urban myth. This student wanted to know how readily birds would eat instant rice when hungry, thirsty, and given nothing else to eat. Under these conditions, could birds be harmed by eating large quantities of instant white rice? This was the initial experiment proposed by the class at the beginning of the semester. At that time, I explained that this experiment could not be done without more evidence birds would not be harmed. It was not until after the results of the first five experiments and especially the sixth, that I was comfortable that this final experiment would not harm my birds.

Hypothesis

Instant white rice could be harmful when it is the only food available to hungry, thirsty birds.

Methods of Experiment 7 (Instant White Rice Feeding Experiment)

At 5:00pm on Day 1, water and food were removed from my large aviary containing 10 pigeons (a large breed called modenas that are 2.5 times the weight of wild rock doves), 30 ringneck doves (the size of wild mourning doves), and 20 diamond doves (the size of canaries). At 8:00am the following morning, 2200 ml of instant white rice were placed out as the only available food. Birds were permitted to eat for 15 minutes before water was placed in the aviary. Rice remained in the aviary for 12 hours; it was then removed and the volume measured. Birds were observed throughout the day for any evidence of distress or other negative reactions to instant rice.

Results

During the 12 hour period, 60 birds ate 1500 ml of instant white rice. They ate the instant rice vigorously then drank during the first 20 minutes. No birds choked to death, exploded, or otherwise died. No birds regurgitated rice or water. No birds showed any sign of distress. The flock continued to feed on the rice for the rest of the day without problem.

Conclusion

Instant white rice does not harm pigeons, ringneck doves, and diamond doves and probably does not harm other species of birds. The evidence strongly suggests the myth is false.

Discussion & Conclusions

To summarize the results of the seven experiments, rice (brown or white) does not pose any risk to birds. These seeds expand only minimally and less than standard bird seeds. White rice is the cheapest rice sold in most stores and likely what is thrown at weddings. Rice products such as instant brown rice and instant white rice have the greatest capacity to expand, and thus present the only potential risk to birds. These two rice products are more expensive, thus less likely to be thrown at weddings. Even so, these highly expandable rice products do not harm pigeons and doves.

This project demonstrated that without hands-on activities, students in large classes could actively participate in science. Using the scientific process in a discussion-based format to address the feasibility of the wedding rice myth provided an effective teaching tool. Class discussion of this urban myth permitted students to ask questions, generate hypotheses, and design effective experiments. Thus they experienced hypothetico-deductive reasoning and strong inference firsthand. This activity excited my students and peaked their curiosity.

Students designed a series of seven experiments that cautiously considered all aspects of the wedding rice myth. It would have been easy to simply feed my birds white rice thrown at weddings and then conclude the myth was false. This would have been simple, poor science with the potential of providing a wrong conclusion. This approach would have failed to take into account that instant rice expands enough to be of concern. Furthermore if the myth were true, the simple one step experiment would have led to disastrous results. This, too, would have been poor science. However, student participation in designing the series of experiments produced a nice example of how good science is careful, thorough, cautious, and humane to study animals. Experiment 1 suggested the myth was false only on the most simplistic level. Experiments 2 and 3 showed some support for the myth. They clearly showed that most varieties of rice were not a threat to birds, although expansion of instant rice and lentils suggested that the myth could have some basis. Experiment 4 was inconclusive. It suggested that instant rice was not capable of rupturing a slightly elastic plastic bird crop five times stronger than a pigeon crop. Experiment 5 supported the myth by showing that a wet paper bag two times stronger than a pigeon crop was easily ruptured. Experiment 6 suggested the myth was false. It revealed that given an option, birds prefer not to eat instant white rice. Finally, Experiment 7 clearly showed the myth was false. It clinched the study by demonstrating that an exclusive diet of instant white rice did not harm three species of birds.

My 600 students experienced the scientific process firsthand. They got to see results that were ambiguous as well as clear-cut. They came to realize that clean results do not always answer a question; rather, multiple experiments are necessary. Students discovered that science is not always a simple one-step process but an ongoing process that leads down a path towards an uncertain destination. Often experiments can lead to dead ends or down unanticipated, alternative avenues. Eventually, we arrive at a convincing conclusion. In this case as each experiment dismissed or failed to dismiss hypotheses, new hypotheses and experiments were generated. All seven experiments were needed to convince the most skeptical of students that the wedding rice myth was, in fact, unsubstantiated rumor. Scientifically examining a widely-accepted urban myth was the most effective demonstration of how science works that I have found for the large classroom.

The first five experiments previously described can be easily and cheaply replicated in classes ranging from middle school to college freshman level. A warmer oven is not needed as experiments can be done at room temperature, so the rice myth can be explored in virtually any class. Unfortunately, most teachers do not have grain-eating birds. Thus Experiment 7 is the most difficult to replicate. This is the major drawback to the activity. Because instant rice is not harmful to birds, an alternative activity for Experiments 6 and 7 can be done. A preference study can be performed on school property where two feeders are set up side-by-side: one with instant white rice and the other with a wild bird seed mix. This will demonstrate: 1) that wild birds do not have a preference for instant white rice, and 2) birds will not die if they do develop a taste for instant white rice. With the arrival of the West Nile virus, concerns may arise that having bird feeders near schools presents health risks. Several potential diseases are associated with birds. None of these are a significant risk, especially if students are not handling birds or breathing dust from droppings (such as in an enclosed area). It is a misguided, anti-environmental attitude to overreact by eliminating birds and bird feeders in an attempt to reduce health risk.

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