[last modified by author 22 September 2004]

Nancy: Here's how I would plan a lesson on fruit.

FRUIT

Today let's talk about FRUIT.

[Come in with an array of different fruits and show them to the class, briefly describing each. Don't show the mango or the banana or the seedless grape yet.]

Why do plants make fruit? I would like each of you to write a brief answer to that question. (Or maybe you'd want them to volunteer answers, and if they don't, start asking kids by name, one by one.)

Expect questions – like "I don't know what you mean" or "What do you mean by 'Why?'" I would be ready to say something like: "Well, fruit tends to have a lot of sugar in it. Sugar is expensive to make. If a plant makes something expensive, it can't do something else it might have done with the same energy it used to make that expensive item – like make a lot of seeds that would help it multiply. So why would a plant that made something like an expensive fruit survive or spread or continue to be present, compared to one that didn't do that?

If they write their answers, have some or all students read the answers they have. But they don't need to write them, and I would guess that you could go a lot aster and keep them interested better if you do it all orally. Note that each proposed answer to the question is a hypothesis – a guess – which means they generated a possible answer. And that's the first step in science – in finding out something for sure, or establishing a fact, or learning something -- developing a hypothesis. Ask if they know the second step, which is finding a way to test the hypothesis. So how would they test the hypothesis that (whatever they said).

Some possible answers are:

"God made the plant make fruit." You could continue by saying, "Okay, then why would God do that?" (That's a touchy direction to take but you might be able to work it out). If you're lucky no one will bring that up! But be ready!

"Plants make fruit to protect the seed." You know, you can suggest such answers and see if they can find what's wrong with them – meaning can they falsify your hypotheses – which is what scientists do. Whenever a hypothesis comes up, you could then say, "Okay, if that's true, what would we expect fruit to be like? Would we expect it to be soft and sweet? Would we expect it to be good for a lot of different kinds of animals to eat – because fruit are like that." You'll be able to guide them so they'll figure out that this answer won't work – guide them to falsify the hypothesis.

"It makes fruit because fruit tastes good." Response from you might be, "What good does that do the plant?" You want them to connect the fruit and the seed because the fruit always covers the seed (I don't know if that always is correct). As soon as anyone brings up the connection between the seed and the fruit you can focus on that, asking what why plants make seeds – and you can explain the importance of seeds to the plant – without them plants would die out – so seeds are obviously useful to plants. [But what about those fruit that don't have seeds and do make fruit!!!?]

As soon as somebody even gets close to the notion that the fruit somehow helps the seed you can push on that – how does it help the seed? If necessary you can even carry it a bit yourself by asking them if they ever imagined that fruit might be helping the seed. After all, we can see what is good about the seed, and if the fruit is closely connected to the seed – e.g., covers the seed, is all around the seed – maybe it helps the fruit. How might it do that? (Another hypothesis comes up . . . How do we test it?).

You might want to talk about whether seeds are easy to eat. Lots of seeds are eaten by animals – they're often really good – like nuts. Why should plants make seeds that animals will eat if the seeds are supposed to make the next generation? Maybe they can't help it that the seeds are good to eat because the composition of the seeds that makes them likely to make a good plant for the next generation are the same things animals gain from finding and eating themselves. If that's true, then what does that say about why a plant makes fruit?

You ought to have figured out the differences between the nutritional materials in seeds and those in fruit.

And what can a plant do about the fact that animals eat its seeds? They ought to get the idea that seeds often have hard coats that animals can't break, or can't break easily.

Some animals, like squirrels, that eat seeds (nuts, acorns), also bury them – hide them. What might that mean for the plant? Oak trees don't make really tough covers on their acorns, which means squirrels and other animals actually can eat them – how does that work? What if a squirrel buries an acorn – or a lot of acorns? The answer is that if it doesn't find them all, some turn into oak trees.

Sometimes animals eat the seeds when they eat the fruit, and the seeds are later expelled and can still grow – or even grow better because of the fertilizer in the form of manure that the plant makes. Sometimes animals just throw the seeds away.

So we know why plants make seeds – that's easy. And why they sometimes make them really hard to eat – that's easy – and it's all for the good of the plant because seeds are the way plants survive by reproducing, like just about all the animals and plants we know anything about.

Sooner or later someone ought to come up with a notion like fruit is put there to keep the animal from eating the seed. But some animals eat some fruits and the seeds as well – so that's not an answer that applies to all fruit and all seeds. Is there such an answer? What if a seed is eaten and

not chewed up – just passes through the alimentary tract (you know, I imagine, that some seeds won't even germinate unless they pass through the alimentary tract of an animal).

You may need to help the kids come up with the idea of fruit causing animals to help disperse the seeds of the plant. And you'll have to have an answer to the question: What is the importance to the plant that its seeds be dispersed? That's the only way any organism gets into other bits of good habitat where it can survive. Most places where a plant or an animal lives eventually become a bad place to live, and if they didn't get some of their offspring into one of the now good places, they'd be out of luck. Also, many plants that make fruit live a long time – years and year – like trees – meaning they don't gain by having all their offspring grow up right next to them and compete with them. Sometimes trees even kill their offspring if the offspring grow up too close to them (by poisoning them with substances produced by the roots – you probably know the name for that process). Dispersal solves that problem.

So you are heading for the ultimate probable answer that plants that made fruit, and better and better fruit (better in the sense of being attractive to animals that do certain things with fruit) won out, because fruit caused animals to disperse the plant's seeds, and that helped the plant keep on living generation after generation.

You might then get into how all that happened (differential reproduction). If I did, I would bring up the artificial selection humans do with animals and plants to show how selection in the absence of humans works.

Someone might say: Why don't all plants make fruit? Possible answers they or you might come up with (hypotheses) are: Some of them never got started in that direction. Some of them couldn't make it work (be ready with an example).

Someone might say: Some fruit doesn't have a seed in it. What about bananas? What about seedless watermelons? Seedless grapes? Well, I called Carl Campbell and got the answers. And this is a really neat thing for this lesson plan (or whatever it is). Maybe you know the answers, because you have a degree in horticulture. But in case you don't, here's the answer. Bananas come from some islands in the Pacific, and it is known that all "domesticated" bananas come from two species of "undomesticated" bananas, both of which produce short little bananas that are full of little black seeds. If you slice a "domesticated" banana and look in the middle, you can see the dark stripes and spots that are the remnants of the seeds. Such banana varieties are propagated vegetatively. So are seedless grapes. Seedless watermelons come from crossing two seedless varieties, so the seeds that will produce seedless watermelons have to be created by the cross-breeding every generation.

Nobody knows, Carl says, how banana varieties came about that are seedless. But they did! And when they did people had enough sense to propagate them vegetatively (of course you'll have to explain that word – that method of keeping a plant alive from generation to generation). Pretty neat, huh!

Man, a lot of neat questions are involved in this lovely topic. Just think of trying to figure out -- or hypothesizing – what animal(s) any particular fruit is evolved to attract, and whether the

animal can be expected to eat the seed and pass it through its alimentary tract or just carry it. You could even have kids locate a plant that makes fruit with seeds in it (I mean when they go home at night or over a weekend) and ask them to write an essay (hypothesis) on how that system probably works – if you can explain the project really well to them so they know what to do.

And there's always that mango – from southeast Asia where orangutans live, and so hard to get off the seed, and so big and heavy to carry. . .

If you can't have fun with stuff like this I'll eat my hat.

Love, Your Pappy

Edited by D. Lahti 9/15/2021.
-This essay was drafted as a letter to his daughter Nancy, at an unknown date.