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## The Yolk’s on You: Egg Balancing and the Equinox

Consider the humble chicken egg. Outside, its hard white calcium shell is mostly round and smooth. It might have small bumps on it, or even tiny ridges and waves, but its overall geometry is so well defined that we use the term “egg-shaped” when we see something similarly crafted. The very word “ovoid” comes from the Latin for “egg.”

Inside, we have the white part of the egg—the technical term is *albumen*—and the yellow yolk. This goo is what is destined to become a chicken, if we let it. Usually we don’t. Humans have all sorts of dastardly schemes planned for chicken eggs, from the simple act of cooking them to such bizarre practices as frying them on sidewalks to show how hot it is and using them to “decorate” houses on Halloween night.

But there is an even weirder ritual performed with the ovum of the *gallus domesticus*. Every year, all across the United States and around the world, this ritual is performed at the beginning of the spring season. On or about March 21, schoolchildren, newspeople, and ordinary citizens take a chicken egg and try to stand it on end.

A nonscientific survey—conducted by me, by asking audience members when I give public talks and people I meet at parties or standing in line at grocery stores—shows that about one-half the population has either heard of this practice or tried it themselves.

That's roughly 130 million people in America alone, so it's certainly worth investigating.

If you've watched this ritual, or have tried it yourself, you know that it takes incredible patience, care, and stamina. It also takes luck, a flat surface, and a sprinkling of bad astronomy.

At first glance you might not expect astronomy to play any great role here. However, like the cultural rites of ancient peoples, it's the *timing* that's important. This ritual is performed on the date of the spring equinox, which is the time when the Sun crosses from the southern to the northern hemisphere of the sky. The spring equinox is called the *vernal equinox* by astronomers; the root of the word "vernal" means "green," which has obvious links to spring-time. To my mind, the idea of balancing an egg is as strange a way to celebrate the spring equinox as is dancing at the foot of Stonehenge dressed as Druids.

So what are the details of egg standing, exactly? It goes something like this: According to the legend, it's only possible to stand an egg on end and have it balance perfectly on the exact date of the spring equinox. Some people even claim that it must be done on the exact *time* of the equinox. If you try it any other time, even minutes before or after, you'll fail.

That's all there is to it. Seems simple, right? Every year at the magical date, newscasters—usually TV weatherpeople, since the date has climatological ramifications—talk on the air about balancing eggs. A lot of schoolrooms, in an effort to perform a scientific experiment, also try to get the little ova upright. Sometimes the newscasters will go to the classroom to show the tykes trying, and after a while, voilà! Someone gets an egg to stand! The cameraman is rushed over and the beaming future scientist gets his or her face on TV that night, film at eleven.

Unfortunately, if the teacher doesn't go any further, the child's future as a scientist may be in some doubt. This hasn't really proven the legend one way or another. Let's take a closer look at it.

We need to start by asking what should be an obvious question: why would the vernal equinox be the only time you can do this? I have asked that of people who believe the legend to be true,

and they make vague claims about gravity aligning just right on that special day. The Earth, the egg, and the Sun all line up just right to let the egg balance. But this can't be right: there is always some point on the surface of the Earth exactly between the center of the Earth and the Sun. It has nothing to do with any special time. And shouldn't the Moon have some effect too? The Moon's gravitational force on the Earth is pretty large, so its gravity is pretty influential. Yet the Moon plays no part at all in the legend. Obviously, the vernal equinox is not the root of the issue.

Luckily, we don't have to rely totally on theory. The legend of vernal egg-balancing makes a practical prediction that can be tested. Specifically, the prediction is: *If an egg will stand only on the vernal equinox, then it will not stand at any other time.* Once you think of it that way, the experimental verification is obvious: try to stand an egg on end some other time. The vernal equinox is usually on March 21 or thereabouts every year. To test the theory, we need to try to upend an egg on some other day, a week, month, or even farther from the time of the equinox. The problem is, most people don't follow through with the experiment to its logical conclusion. They only try it on the equinox, and never on any other day.

However, I've tested it myself. The picture shows not just one but *seven* eggs standing on end in my kitchen. Of course, you're skeptical—as you should be! Skepticism is an important scientific tool. But why take my word for it? Chances are it's not March 21 as you read this. Go find some eggs and give it a try. I'll wait.



Finished? So, could you do it? Maybe not. It's not easy, after all. You need patience, a steady hand, and a fairly strong desire to balance an egg. After I got those eggs balanced, I had trouble balancing any more. My wife happened to come downstairs at that moment and asked me what the heck I was doing, and she quickly decided that it looked like fun. Actually, I think it was her competitive nature that drove her; she wanted to stand up more eggs than I did. She did. Actually, she had a hard time at first. I told her that



Standing eggs on end has nothing to do with the time of year, and everything to do with a steady hand, a bumpy egg, and lots of patience. These eggs were photographed in autumn, months after the vernal equinox. (But don't take my word for it; try it yourself.)

I had heard it's easier to stand an egg if you shake it a little first to help the yolk settle. She did, but pressed too hard on the shell. While she was shaking it her thumb broke through the shell, and she got glop all over the wall of our kitchen! I imagine we have the only house in the country where something like this could happen.

Eventually, she was successful. She was the one who got the rest of the eggs to stand; we got eight total from that one carton. Clearly, her hands are steadier than mine. Once, when scheduled to give a public talk about Bad Astronomy at the Berkshire Museum of Natural Science in Pittsfield, Massachusetts, I arrived late due to an ice storm. I had to change my clothes quickly and literally run to the auditorium. When I arrived, I was out of breath and my hands were shaking a little from the stress and excitement. I usually start off the lecture by balancing an egg, but because I was shaking a little I had a very hard time of it! I struggled with the eggs all during the time the lecture series curator was introducing me, and by some sort of miracle I got it balanced just as he fin-

ished announcing my name. To this day, it's the loudest and most pleasing ovation I have ever received.

The lesson here is that if you are patient and careful, you can usually get one or two eggs from a carton to stand. Of course, you can also cheat. If you sprinkle salt on the table first, it will support the egg. Then you gently blow on the remaining salt so that it gets swept away. The salt holding up the egg is almost invisible, and will never be seen from a distance. I, however, would never do something like this. Honest! Actually, over the years I have become pretty good at balancing eggs with no tricks. Practice makes perfect.

Still, this doesn't answer the question of *how* an egg can balance at all. It's such an odd shape, and oddly balanced. You'd really just expect it to fall over every time. So just why does an egg stand? I'll admit to some ignorance of the structure of eggs, so to find out more about it I decided to find an expert.

I found a good one right away. Dr. David Swayne is a poultry veterinarian for the United States Department of Agriculture in Athens, Georgia. When pressed, he admits to knowing quite a bit about chicken eggs. I bombarded him with questions, trying to get to the bottom, so to speak, of the anatomy of an egg. I was hoping that somewhere in the structure of an egg itself was the key to balancing them (although I forgot to ask him which came first, it or the chicken).

The characteristic shape of an egg, he explained to me, is due to pressure from the chicken's reproductive system as the egg is pushed through the reproductive organs. The yolk is made in the ovary, and the albumen is added as the yolk is forced through a funnel-shaped organ called an infundibulum. The white-yellow combination is only semi-gooey at this point, and it is covered with a membrane. The infundibulum forces the egg through using peristalsis, a rhythmic squeezing and relaxing of the infundibulum. The back part of the egg getting pushed gets tapered from being squeezed, and the end facing forward gets flattened a bit. That's why an egg is asymmetric! Eventually, the egg reaches the shell gland, where it sits for roughly 20 hours and has calcium carbonate deposited all around it. That's what forms the shell. The calcium comes out in little lumps called concretions, which is why eggs sometimes have

little bumps on the bottom. Once the shell is formed, the egg goes on its way out the chicken. (At this point I'll stop the narrative and you can use your imagination for the last part of the egg's journey. After hearing Dr. Swayne discuss it I couldn't eat an omelet for weeks.)

At this point I had two theories about egg balancing. One was that if you let the egg warm up, the albumen will thin a bit and the yolk will settle. Since the yolk moves down, the center of gravity of the egg lowers, making it easier to stand. Dr. Swayne put that to rest pretty quickly. "The viscosity of the albumen doesn't depend on temperature," he told me. "It's designed to keep the yolk pretty much in the middle of the egg." That makes sense; the yolk is really the embryo of the chicken and shouldn't get jostled too much. The albumen keeps it from bumping up against the inside wall of the shell, where it might get damaged. A thinned albumen can't do its job, so it has to stay thick. Warming the eggs won't help much in standing them on end.

My other working theory relied pretty heavily on those little calcium bumps. They are almost always on the bottom, fatter end of the egg. According to my theory, these imperfections act like little stool legs, which help support the egg. Through my own experimenting I found that a smooth egg is very difficult if not impossible to stand up, but a bumpy one is actually pretty easy, once you get the hang of it. So it's not the vastness of space and the infinite subtle timings of the Earth as it orbits the Sun that gets the egg to balance, I concluded, it's the stubby little bumps on the end. So much for the grandeur of science.

Yet the legend persists. Science and reason are a good arsenal to have in the battle against pseudoscience, but in most cases they take a backseat to history and tradition. The egg-balancing legend has been around for a while, and is fairly well ensconced in the American psyche. I get lots of e-mail from people about standing eggs on end, especially around the middle of March, shortly before the equinox. A lot of it is from people who think I am dead wrong. Of *course* it's all about the equinox, they tell me. Everyone says so. Then they tried it on the day of the equinox for themselves, and it worked! The egg stood!

Of *course* it did, I tell them. It'll stand on any other day as well, which they can prove to themselves if they just try it. They haven't followed through with their experiment, and they convince themselves they are right when the evidence isn't all in. They rely on word of mouth for what they believe, and that isn't a very strong chain of support. Just because someone says it's so doesn't make it so. Who knows from where he or she first heard it?

In this case, we can find out. Most urban legends in America like this one have origins that are lost in the murky history of repeated tellings. However, happily, this one has a traceable and very specific origin: *Life* magazine. As reported by renowned skeptic Martin Gardner in the May/June 1996 issue of the wonderfully rational magazine *Skeptical Inquirer*, the legend was born when, in the March 19, 1945 issue of *Life*, Annalee Jacoby wrote about a Chinese ritual. In China, the first day of spring is called Li Chun, and they reckon it to be roughly six weeks before the vernal equinox. In most countries, the equinoxes and solstices do not mark the beginning of seasons; instead, they're actually the midpoints. Since a season is three months or twelve weeks long, these countries believe that the actual first day of spring is six weeks before the equinox.

The Chinese legend has an uncertain origin, according to Mr. Gardner, although it is propagated through old books about Chinese rituals. In 1945 a large number of people turned up in the city of Chunking to balance eggs, and it was this event that Ms. Jacoby reported to *Life*. Evidently, the United Press picked up the story and promptly sent it out to a large number of venues.

A legend was born.

Interestingly, Ms. Jacoby reported that balancing an egg was done on the first day of spring, yet it was never said—or else it was conveniently forgotten—that the first day of spring in China was a month and half before the first day of spring as recognized by Americans. This inconvenient fact should have put a wet blanket on the proceedings, but somehow that never slowed anything down.

In 1983 the legend got perhaps its most famous publicity. Donna Henes, a self-proclaimed “artist and ritual-maker,” gathered

about a hundred people in New York City to publicly stand eggs up at the exact moment of the vernal equinox on March 20, 1983. This event was covered by the *New Yorker* magazine, and a story about it appeared in its April 4, 1983 issue describing how Ms. Henes handed out eggs to the onlookers, making them promise not to stand any up before the appointed time. Around 11:39 P.M. she upended an egg and announced, “Spring is here.”

“Everyone in the crowd, us included, got busy balancing eggs,” the *New Yorker* effused. “Honest to God, it works.” The unnamed reporter was not so convinced, however, as to swallow this line whole. Two days after the equinox, the reporter brought a dozen eggs to the same place where the ritual had occurred. For twenty minutes the reporter tried to balance the eggs but didn’t get a single one to stand on its end.

The reporter admits the failure may have been psychological. “The trouble may have been that we didn’t want the egg to balance—that we wished to see Donna Henes to be proved right.” This, despite the reporter having asked several physicists about the legend, and having all of them say they couldn’t think of why it should work. I find it ironic and faintly troubling that one of those physicists said that water swirls down the washbasin drain one way in the northern hemisphere and the other way in the southern hemisphere—this is another astronomy-based urban legend, and it is not true. (See chapter 2, “Flushed with Embarrassment,” for more on that.)

Ms. Henes went on to more balancing rituals, too. The year after the 1983 demonstration, more than 5,000 people showed up at the World Trade Center to participate in an egg balancing. Even the *New York Times* was duped; four years later, on March 19, 1988, they published an editorial with the headline: “It’s Spring, Go Balance an Egg.” Two days later, the *Times* ran a picture of people standing eggs up once again at the World Trade Center.

So this legend seems to spread easily. If the illustrious *New York Times* can help it along, the transmission may very well be unstoppable. Still, stoppable or not, I cannot let something like this get past me so easily. In an effort to stem the tide, just before the vernal equinox of 1998, I called a local TV station and chatted



with the weatherman about egg standing. He had never heard of it, but was excited because they like to have little quizzes before the forecast, and this was a good topic for the news on the equinox. So he asked the rest of the news team, composed of two anchors and a sportscaster, if an egg could stand only on the equinox. Who do you think got it right? To my surprise, the sportscaster figured the equinox had nothing to do with it, while the two news anchors both guessed it did. It's funny, too; the anchors never did get their eggs to stand up, while the sportscaster did. A triumph for science!

It may simply be that our common sense—something short and round like an egg can't stand on end—and poor recall—who can remember exactly *why* we have seasons?—combine to reinforce the legend. Worse, it gets positive feedback from the newscasts every year. Not every TV news station is as open-minded as the one I called. Imagine the real schoolroom scene described at the beginning of this chapter. We have 30 or so kids and one harried teacher, going from student to student giving encouragement. Suddenly, a child gets an egg to stand. At the same time, 29 other kids *don't* get theirs to stand. Who gets on TV? Right. It's no fun to show the ones who didn't get it. However, science isn't just about showing when you're right; it's also about showing when you're wrong.

A lot of my mail is also from people who *did* follow through. I received an e-mail from Lisa Vincent, who teaches at Mancelona Middle School in Mancelona, Michigan. She decided to test the egg myth for herself, and had her students try it on October 16, 1999, which, incidentally, is almost one year after the photos of my own test were taken (see page 14). Not only were Ms. Vincent and her students able to balance several eggs five months before the vernal equinox but they were also able to balance the eggs on their small ends. For proof she sent me a photograph of her proud students and their eggs standing in what looks to me like an upside-down position. That is a feat I had never been able to accomplish up until then, and I must admit a tinge of professional jealousy. I had always assumed it couldn't be done. However, after knowing it *could* be done, I tried even harder, and eventually managed to upend an egg on its narrow tip. It just goes to show you, even scientists need to have their world rocked on occasion.

Incidentally, Ms. Vincent told me that the eggs stood balanced that way until she decided to take them down on November 21, over a month after they were placed there. Here we have a great example of people not being willing to accept what they hear, and wanting to try it for themselves. That is the essence of science.

The essence of science is that it makes its own improvements: A theory is only as good as its next prediction. Remember my own theory about the stubby bumps supporting the eggs? Well, Ms. Vincent's middle-school class showed me I was wrong. They balanced the eggs on their tops, and I have never seen a top of an egg that wasn't smooth. Certainly, the bumps make it easier since I am always able to balance bumpier eggs more easily than smoother ones. But the bumps must not be *critical* to balancing, or else the eggs wouldn't balance on their short ends. Clearly, these kids balanced the eggs through perseverance and strong desire. One of the beauties of science is that it improves itself, and another is that you never know where that improvement will come from. Mine came from Mancelona, Michigan.

Science is about asking, why? and, why not *this* way? Sometimes you need to think *around* the problem. For example, if the spring equinox is special, isn't the autumnal one special, too? They are both basically the same, yet you never hear about people trying to stand eggs on end in September. Even better, the seasons are *opposite* in the northern and southern hemispheres; when it's spring in one it's fall in the other and vice versa. But people usually don't think of these things. It's too easy to simply accept what you're told. This is extraordinarily dangerous. If you just assume without thinking critically that someone is right, you may be voting for the wrong politician, or accepting a doctrine that has a bad premise, or buying a used car that might kill you. Science is a way of distinguishing good data from bad.

Practicing science is wonderful. It makes you *think* about things, and thinking is one of the best things you can do.