

The 491st Convocation

Address: "Make It Easy, It Is Going to Be Hot"

By José Quintáns

August 24, 2007

Good afternoon. My wife's admonition was, "Make it light. Avoid overheating their brains through exposure to your infinite wisdom." She suggested instead that I tell you cool stories about my life and career at the University. "Make it light," she said, "It will be hot and muggy."

First I will tell you a story about my family origins, the first time it has been told in public. Once upon a time in a faraway corner of Iberia, my great, great, great uncle Piño do Carballo was walking along the river Sar on a clear moonless night looking for black holes in the Milky Way. It was five minutes past midnight in 700 AC when suddenly a brilliant flash of light from the heavens crashed down ahead of him. Unshaken, he went to the site where the meteorite had landed and to his amazement discovered that it had brought the remains of St. James the Greater or Sant Yago, the apostle who had been martyred in Palestine centuries before. At the site, now renamed Santiago de Compostela (compostela meaning the field of the star), a shrine was built that immediately became a major destination for pilgrims. It eventually became known as El Camino de Santiago and is hiked every year by thousands of people in search of an ecologically safe approach to soul cleansing.

But beware, the official legend tells a different story. There are several "official" versions. The most popular was recounted by Marilyn Stokstad in her book *Santiago de Compostela in the Age of Great Pilgrimages*. Her story goes:

After James was martyred in Jerusalem, his disciples spirited away his body... placed his earthly remains in a boat and set sail from Jaffa. In only seven days the ship, propelled miraculously by wind and waves, arrived at the coast of Galicia. As the ship neared the land, a

horseman, riding beside the sea, was carried by his bolting horse into the waves, but instead of drowning, horse and rider came to the surface covered with scallop shells. Henceforth, the scallop shell became the symbol of St James and the badge of the pilgrim to his shrine.

It is indeed true that the scallop shell is the pilgrim's badge. But its real origins again date back to my ancestor Piño do Carballo who, in addition to being an astronomer, was an entrepreneurial chef who created the famous Galician dish "vieiras a la gallega" (or Galician scallops), which he served to early visitors to the inn he built next to the shrine.

Unfortunately, I do not have time to give you a full account of my ancestry. So I will fast-forward the story to the end of the fifteenth century when the scholarly Bishop Alonso de Fonseca III, who had just established the University of Santiago de Compostela, appointed my great, great uncle Pepe Ramón dean of faculty attire and assigned him the task of designing the academic robes for the faculty. Dean Pepe was partial to thick, velvety, bishop-like black gowns with sleeves embroidered in white lacing and matching white gloves. He also liked colorful hoods, and most of all he appreciated the fashion value of lampshades for academic garb. Thus now you know the answer to the most frequently asked question at Chicago convocations: my outfit represents the doctors' robes from my alma mater, the University of Santiago de Compostela.

Santiago de Compostela is the capital of Galicia—the beautiful northwest corner of Iberia—a rainy, green, and mountainous land inhabited by a charming and resilient people who speak Gallego. Gallego is the most melodic and sweetest of all Roman languages. It sounds like this:

Un dia voltaréi, nativa terra,
A descansar en ti dos meus Camiños,

Mais non te alcontaréi, En min te Levo,
Pero eu estóu moi lonxe, lonxe, lonxe

These verse, by the twentieth-century Galician poet Celso Emilio Ferreiro, speak of the longing for Galicia:

One day I shall return from my travels,
To rest within you, native land,
But I will not find you. I carry you inside,
But I am very far away, far away, far away.

So now that you have an ear for Gallego, on behalf of Bishop Fonseca I would like to be the first convocation speaker at Chicago to congratulate you in Gallego: “Noraboa estudantes da Universidade de Chicago que vos graduades hoxe! Noraboa!”
(Congratulations!)

It is indeed an honor to have the opportunity to greet you from this pulpit and to speak to you about some fundamental issues confronting us now. And at this very moment what concerns me the most is how humid it is in this chapel, particularly under my academic gown. So I want to describe to you the biology of what is happening. Yes, I am going to lecture you on sweating—a topic previously neglected at summer convocation addresses.

It is a simple physical phenomenon—the loss of fifty-eight calories per gram of water evaporated—that cools us. Basically, evolution took advantage of the heat loss associated with the liquid to gas transition in water by coming up with a tubular system that delivers almost saltless water to our skin for evaporation. Sweating is the adaptive response of non-furry animals to heat. For those of you who find sweating unbecoming, think about the alternative: panting, like dogs. You should be grateful that evolution got rid of your ancestors’ fur and provided them with sweat

glands instead, so University of Chicago graduates would not have to pant it out in Rockefeller Chapel.

Our sweat is the secretory product of over two million specialized glands distributed in selected locations just underneath our dermis. Having sweat glands in our forehead, palms, and feet makes cooling sense. But to have so many of them in our armpits requires some additional thinking, which I invite you to do on your own.

Please consider this to be your first postgraduation homework assignment, befitting your training at the University. This evening during dinner, discuss with your family and friends: “Why do we have so many sweat glands in our armpits?”

The glands are basically a coiled epithelial tube that secretes an isotonic salt solution that makes its way to the surface slowly along the gland’s reabsorptive duct so salt (NaCl) can be retrieved before reaching the surface. Typically a person can sweat 1 to 1.5 liters per hour, and this rate can increase up to fourfold depending on conditions. If you are not acclimatized to hot weather and sweat too fast, the NaCl is not reabsorbed and your sweat will taste of salt. Alternatively, salty sweat is produced by individuals with a faulty ion pump. The pump that retrieves NaCl is mutated in individuals suffering from cystic fibrosis (CF). As a result, CF patients have salty sweat that is the basis for the diagnosis of the disease.

Sweating is a well coordinated and complex physiological process under the control of the hypothalamus—the integrative center in your midbrain that orchestrates the responses of the organism to the environment by organizing circadian and seasonal rhythms, as well as coordinating thermoregulation, sleep and wakefulness, fluid homeostasis and thirst, food intake, and reproduction. When you think about it, it makes sense to have the management of fluid intake coordinated with the fluid loss from sweat so you can feel thirsty and remedy the situation with the appropriate behavior. And as you think about all this, you may feel a bit drowsy and perhaps be tempted to doze off. You might wonder how it would be possible to fall asleep

during such a fascinating peroration. Well the culprit is the thermosensitive hypothalamic neuron in charge of thermoregulation, which does double duty and influences arousal mechanisms of the sleep-wake cycle. This makes good sense because when you sleep you decrease your motor activity and your heat-producing metabolism so your brain can cool off. So it is biologically correct that you nap while I speak, as long as it is hot and muggy.

Why am I telling you this? Because I want to make three points. The first is that I want this occasion to be truly memorable and also relevant to the serious problem of global warming. Fifty years from now when you revisit campus for your reunion, you will remember the guy with the funny hat speaking with a Gallego accent about sweating it out and that he correctly predicted that it would get even hotter and muggier and urged you to do something about it. So I very much hope that you actually do something about it. The second point is about biological illiteracy. As an educator and an enthusiastic instructor and supporter of core biology, I am very concerned with the growing biological illiteracy of American society. This is what Gerald Weissmann, the author of *Galileo's Gout*, a very important book recently published, would call the coming "age of endarkenment." Just to give you an idea of the problem, this last Winter Quarter I conducted one of my trademark surveys in two sections of core biology. All the respondents had been at Chicago for only one quarter, and the survey was conducted at the very beginning of the quarter. Remarkably, only 39 percent of the Chicago undergrads knew that the kidneys make urine. Another 21 percent thought they made bile; and 31 percent of the respondents endowed their kidneys with the ability to secrete "all of the above," which included urine, bile, and lymph. Fortunately, 98 percent of the Chicago undergrads believed that humans evolved from earlier animals, which is much better than the 30 percent national average of believers in evolution. Interestingly, 55 percent of our respondents identified themselves as agnostics or atheists—a finding in line with the national statistics linking strong religious beliefs and ignorance about evolution. This conclusion was supported by one respondent who self-identified as fundamentalist. This particular student, an economics major, did

not believe that humans evolved from apes and thought the kidneys made bile. So please consider the findings in the survey if you did not like what I had to say about sweat production; it could have been worse. I could have talked about kidney function or bile production by the liver. Or better still, lymph. I love lymph! A convocation speech about lymph and swollen feet would be quite mesmerizing, I think.

And now we come to the end of the story, which I would like to conclude with immunological and evolutionary overtones. I want to remind you all how infectious life really is and has been since its origins a few billion years ago. Keep in mind that all of us eukaryotes are the descendants of a successful infectious event that brought the bacterial ancestors of mitochondria into our earliest cellular precursors. Also, be aware that infectious agents practice anti-immunology rather successfully, i.e., they possess a vast repertoire of biological tricks to foil immune function. All educated people wonder in amazement at how much immunology microbes actually seem to know. I say this here to encourage you to think about microbial anti-immunity as the most compelling refutation of Intelligent Design propositions about the origins of immunity. The argument is that the Intelligent Designer (ID) that planned immunology is continuously outsmarted by another Even More Intelligent Designer (EMID) that is responsible for anti-immunology.

So as I prepare to bid you farewell and Godspeed, I remind you “not to ask what your immune system can do for you, but what you can do for your immune system!”

May your journeys include a trip to Santiago, which according to James Michener, author of *Iberia*, “is the finest journey in Spain.” Preferably make this journey on a leap year, which is a Holy Year, the only time when the soul cleansing Holy Gate at the cathedral is open to erase the sins of the pilgrims who cross it. I visited the Holy Gate just before joining the faculty here so I would arrive in Chicago in a state of primeval purity that would qualify me to wear whites gloves at convocation. This visit took place when I was young, and to this day I remember how I had to go

through the gate several times till I got the green light. It was much different when I revisited a few years ago, having been on the faculty for over two decades; as I approached the Holy Gate, a flash of pure white light appeared, and celestial music was heard with angels singing, "Santo, Santo, Santo loco!"

And finally, my Darwinian farewell to all of you: May your highly adaptive and ethical behavior serve you well when you and your offspring face the challenges of natural selection, many of which will be infectious in nature. May you stay clear of retroviruses and antibiotic resistant bacteria. May you always keep your vaccination records current. And if you do, your lymph will promptly return to its source, blood plasma; your liver will produce good bile; and your kidneys will conserve water so your sweat glands can secrete all the refreshing sweat you will need to survive in a hotter planet.

"Saúde a todos, companheiros."

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