

GOING TO MARS

Ohio Wesleyan University Commencement Address

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Thank you, Dr. Gifford. Thirteen years ago, my family and I were sitting where you are today. My wife, Margaret, and I were the proud parent of our son, Allen, a member of Ohio Wesleyan's graduating class of 1995. I was impressed with the high quality of his liberal arts education here, and I have seen how it has served him well. Thus, I am most pleased to thank publicly all of those who make Ohio Wesleyan such a special place of learning.

During your lifetime, a spaceship carrying humans will probably go to Mars. Let's think about it. How far is it to Mars? I consulted Google who knows everything. When Earth and Mars are closest, it is 36,000,000 miles, and when they are farthest apart, it is 250,000,000 miles. Oh, we need to calculate orbits. And how fast can we go? The space shuttle travels at maximum speeds of 17,000 miles per hour, but we will need to take so much. We need to plan for a trip of several years. How much fuel will we need, how much food, how much oxygen? We'll need a larger spaceship than anything that currently exists. With so much weight, how much thrust will we need to achieve the correct orbit?

Steven Squyres, the Director of the Mars program for NASA, said "the accuracy needed to target a landing site on Mars is like throwing a basketball from New York to Los Angeles, and having it go through the hoop without touching the rim". If you miscalculate, if you guess, if you ignore scientific reality, you will miss Mars and drift forever in space.

What is the scientific method and what is its purpose? It is a way of trying to understand how nature works. Through objective reasoning, observation, and experimentation, one tries to see nature as it actually is. Of particular importance,

the observer must be neutral, unattached to the outcome. Wishing it to be a particular way invariably blinds one's ability to see the way it actually is.

An important early step in understanding outer space was made in the late 16th century by Galileo. You probably know the story. His observations were made possible by a new invention, the telescope. Each clear night, he peered at the heavens through his telescope. He made detailed drawings. He plotted the location of the planets. He came to a shocking conclusion. All planets, including Earth, were revolving around the sun.

At the time, it was thought that the Earth was the center of the universe, and everything revolved around the Earth. The Sun comes up in the east and it sets in the west, and we sit here in the center. We are the center of the Universe. Well, it seems that way. I can't tell you how many times in my research career, the reality, the truth, turned out to be the opposite, the opposite of the way it seemed.

After Galileo told people about his observations, controversy erupted. New thinking, particularly when it contradicts established dogma, invariably leads to controversy. He was denounced, threatened, harassed, and imprisoned. Today, we say, "why all the fuss?" Everybody knows that the Earth revolves around the Sun. So what!

However, science continues to challenge our understanding of the World, and it certainly challenges our understanding of the human body, a doctor's area of endeavor. Let me say at the onset, the practice of medicine is and always will

be both an art and a science. Love, compassion and forgiveness have healing properties. But today's subject is science and medicine.

Up until the 19th century, medicine was largely herbs, potions, bleedings or purges, which someone claimed helped a particular malady. Most of these therapies did more harm than good. By the late 19th century, science began to take hold as a critical part of medical thinking. Our nation's medical schools were joined with our universities to encourage interactions with the basic sciences, such as physics and chemistry. The marriage of science and medicine has led to many medications that truly help. I will talk only about one area, improvement in the treatment of infectious diseases.

In the 19th century, the microscope was invented. Just as the telescope allowed Galileo to see the heavens in a new way, the microscope allowed physicians to see the microscopic world for the first time. We learned the causes of many infections. We learned that billions of bacteria live on our skin; billions live in our intestines. The microscopic life in our human body is as complicated and diverse as macroscopic life on Earth. It is no wonder that people become disoriented, and fearful, of the revelations of science.

I have had the privilege of studying a bacterial disease called Lyme disease, from the initial discovery through vaccine development. I would emphasize that all research is a group endeavor. In telling highlights of the Lyme disease story, I speak for the hundreds of researchers who have contributed to the effort.

After my medical residency, I applied for a position at the Centers for Disease Control. This turned out to be the lift-off of my medical research career. I learned the science of evaluating outbreaks of disease. After my two-year stint at CDC, I began a fellowship in rheumatology or arthritic diseases at Yale in New Haven, Connecticut. You probably think of arthritis as a disease of older people. You may be less aware that inflammatory arthritis is a common manifestation of autoimmune diseases, such as rheumatoid arthritis or lupus, and these illnesses often affect younger adults, and even children.

Several months after starting my fellowship in 1975, I learned from a friend at CDC about a cluster of children in Lyme, Connecticut who were thought to have juvenile rheumatoid arthritis. My friend learned of these children from two concerned mothers in Lyme, a small town only 25 miles from Yale. There is another connection. Dr. Robert Gifford, the trustee at Ohio Wesleyan who introduced me, was at that time, a junior faculty member in Yale's Rheumatology Division. One of those concerned mothers contacted Dr. Gifford about taking care of her family.

Soon after the call from my friend at CDC, Dr. Gifford casually remarked, "I am scheduled to see a whole family with arthritis, all 4 children and both parents. What do you think of that? And by the way, they are from Lyme, Connecticut". Arthritis in children is relatively rare. Have you known of a child with arthritis? One child, maybe, but an entire family, that was unheard of.

An investigation was begun. We attempted to find all children in Lyme with arthritis. We identified 39 such children in this small town. Their joints were

painful and swollen, as in juvenile rheumatoid arthritis, but the clustering of cases was the striking finding. On some roads, one house after another had an affected child. Nothing like this had been described previously. Just as Galileo had plotted the location of the planets, we plotted the location of affected children on a map. We noted when cases occurred. We explored exposures that the children may have shared in common.

Shockingly, the pattern of disease in the community was suggestive of an insect-borne illness, and further investigation specifically implicated ticks. This idea was just as surprising to us, as the idea probably was to Galileo that the Earth revolved around the Sun. Time magazine reported, “a number of children in Lyme had arthritis, but doctors at Yale proposed the radical idea that Lyme arthritis was actually a tick-transmitted infection”. I can’t tell you how many times in my research career, the reality, the truth, turned out to be the opposite, the opposite of the way it seemed.

This insight about tick transmission provided the correct orbit, which allowed the rest of the puzzle to fall into place. Although it took years of work, a previously unrecognized spirochetal bacterium was then isolated from implicated ticks and from patients with Lyme disease. With this knowledge, specific diagnostics tests could be developed, and curative antibiotic regimens could be worked out. Before this knowledge, we saw patients suffer with Lyme disease for years. Now, they could usually be cured with antibiotics in several weeks.

Despite the many successes of modern medicine, the human body remains incredibly complicated, and our understanding is still limited. With many

illnesses, for example, autism, cancer, Alzheimer's disease, we struggle to understand and help. These and other tragic illnesses continue to exact a terrible toll on patients and their families. However, in the developed world, peoples' expectations have totally changed. One hundred years ago, people accepted that illness, disability, and early death were frequent. They had no choice. Now, as a consequence of the many successes of science and medicine, people expect a long and healthy life.

I never expected how patients' heightened expectations would affect Lyme disease. Over the past several decades, a Lyme disease counterculture has emerged that has ascribed a range of puzzling and poorly understood illnesses to this tick-borne infection. For example, debilitating fatigue or pain syndromes affect millions of people. You say, "college students frequently feel fatigued". But imagine the worst pain that you ever had, day after day, or that every day of your life is like your worst day. Medical tests may not reveal a cause. Patients suffer; their families suffer. As physicians, we struggle to understand and help. Such patients are sometimes now diagnosed as having "chronic Lyme disease".

The media presents testimonials about these patients. They communicate with one another via the Internet. A patient says, "I was cured by antibiotics which I took for two years". We are not told, and indeed no one knows, how many patients were not helped, or were even harmed by such therapy. Based on these testimonials, the lay public has come to think that pain and fatigue syndromes are the reality of Lyme disease.

But science says no. Diagnostic tests based on scientific studies fail to show evidence of Lyme disease in most of these patients. Additionally, 5 studies of pain and fatigue syndromes following Lyme disease reported that placebo treatment with a sugar pill gave similar results as long-term antibiotics. If you ignore scientific reality, if you twist it, if you wish for a particular answer, you will miss Mars and drift in space. Physicians, like myself, have said “scientific evidence does not support giving antibiotics for years for Lyme disease”. They have been denounced, threatened, and harassed.

No single medical advance has had a greater impact on human health than vaccines. Although a small percentage of individuals have serious side effects from vaccination, vaccines in general are much, much less harmful than the infections they prevent. However, as with the Lyme disease story, vaccines have become a vehicle to explain a host of poorly understood illnesses. People have claimed passionately that a vaccine causes autism. Class-action lawsuits resulting from these claims threaten the vaccine industry.

And this is what happened to the Lyme disease vaccine. Over the past decade, two drug companies did extensive studies concerning the efficacy and safety of a newly developed Lyme disease vaccine for human use. In 1998, the FDA licensed the vaccine. But the Lyme disease counterculture said “vaccination for Lyme disease made my symptoms worse”. Despite a lack of scientific evidence that the vaccine caused harm, the manufacturer withdrew it in 2002 primarily due to the threat of class-action lawsuits. When science and medicine are divorced, our efforts lead nowhere; we drift in space.

Graduates of the class of 2008, we honor you today for successful completion of your liberal arts education at Ohio Wesleyan University. Through religion, the arts -- literature, history, music -- and the sciences, you have been exposed to humanities' highest aspirations and accomplishments. Most important, you have been taught to think critically, to question, to reason, to come to your own conclusion. You don't have to rely solely on intuition. You don't have to blindly follow the crowd. You can figure things out. You can discern the truth. Blast off is in about one hour, and your journey may even take you to Mars. Have a great trip.