Before moving on to the question of how scientism came about, and why, an example will be given of overstepping the conclusions that can be made when using statistical methods. This occurred in the dairy industry a number of years ago with a renewed interest in shorter dry periods. Some dairy scientists ran some experiments: some cows got shorter dry periods and others got the normal dry period length (60 days). Most of the experiments found some reduction in milk yield in the following lactation with fewer days dry. But the statistical analysis said: there's (for example) a 40% chance that this difference is not real. So the scientist looks at that and says that concluding there *is* a difference, an effect, is too risky – there's a 40% chance I'd be wrong. That part is ok. Now what they should have said at that point is just: results are inconclusive. But instead they said: there's no difference, no effect of shorter dry periods, you can shorten your dry periods with no consequences – thus risking a Type II error (concluding there is no difference when, in fact, there is one), and that was done without any assessment of the likelihood of that error. It was a bad conclusion. Later statistical research showed that the probability of a Type II error (saying no when the true answer is yes) in these experiments was quite high. Given the small number of cows used in the experiments, the effect would have to have been huge in order to say, with good confidence, that the difference was real. It would have been like looking for something in your house, *in the dark with a blindfold on,* and then when you don't find it you tell everybody: no, it's not in here! Furthermore, later research, using a much larger number of cows, also showed that there *is* a reduction in milk yield in the following lactation with shorter dry periods. Nonetheless, the conclusion that shorter dry periods have no effect made it into the popular press magazines and it became widely accepted as true. And why not – "science" said so.

You might find this hard to believe. How could that happen? Undoubtedly it is in part due to lack of a clear understanding of the statistical methods used. But the compelling nature of another one of the isms that can and does affect "scientists" as well, namely careerism, should not be underestimated. These isms often coalesce into a single whole to mislead man. Careerism is not a trivial issue among scientists. While they might like to make money as well, being highly esteemed in their field, making a name for themselves is often the highest gold among scientists. And to do that they have to come up with new discoveries and have impact, which can lead to an over-eagerness to make conclusions – novel discoveries. Adherence to truth, truth as a goal free of self-interest, is not so easy to maintain. It is a habit that has to be chosen and practiced by demanding it from one's self. Otherwise, it will be overridden by personal desires.

Finally, one last problem in scientific research, especially in biological disciplines, is the limited scope of inference common to most studies. This is especially important in human pharmaceutical trials. Testing the effectiveness of a drug or treatment is one thing, knowing all of its side effects is another. The variation and complexity in biological systems (human beings, for example) renders it impossible to answer all of these questions. It's a "natural" limitation. Yes, "scientific" knowledge or discovery does have limits.

Before moving on, perhaps a few words should be said about disciplines like physics, which use statistical methods to a much lesser degree, if at all, than, say, biological disciplines. Physics is generally considered much more abstract than other disciplines. Gravity, for example – you can't pick it up and hold it in your hand so what is it? While physics is generally more abstract than other disciplines, at the same time the systems dealt with in physics are generally less intricate than (say) biological systems. Motion or force, for example, might be expressed with a single (and exact) mathematical equation with only a few variables like mass (size) and distance. As such, a person might expect that conclusions made in physics are practically infallible, virtually certain. Well some are going to be more certain than others, perhaps depending on just how abstract and how measurable the system under question is. Take Isaac Newton (born 1642), for example. Newton was and is a very well-known and influential mathematician and physicist. Newton wondered if there were universal physical laws that everything, everywhere followed – in space and on earth. Motion, force, celestial mechanics – these were topics of great interest to Newton. Take gravity, for example. What is it and does it behave according to one universal law? The question was not: is the "amount" of "gravitational pull" the same everywhere, but rather does this "force" follow one rule, one equation that accounts for all relevant variables

(mass for example), always and everywhere or does it follow different rules in different places? Newton finally concluded that it did follow universal laws, that laws of physics were universal, that space and time were fixed and absolute. Newton's laws predicted motion and force very well and thus became widely accepted and were used very successfully in engineering. But eventually some deviations, particularly in cosmology (e.g., study of planetary motion), were beginning to get noticed. Newton's equations or "laws" didn't always quite hold, for example, in predicting planetary motion. Then along came Einstein who proposed a theory of relativity, different than Newton's laws of a fixed, absolute universe. As a side note, for "everyday" type things here on earth, Newton's and Einstein's equations/laws give almost identical results or predictions which is why Newton's laws stood for so long and, for many practical purposes, still hold today.

Now let us step back from this for a moment and come back to the main point, which is *not* to teach physics! The important point here is that Newton's laws were, first of all, called laws. The name itself suggests, at least to a non-expert such as myself, that the issue is settled. But it wasn't settled. Prevailing beliefs changed. This isn't something bad or wrong but that ***IS*** the way scientific conclusions go. That is the point. In 50 years maybe Einstein's theory will be considered erroneous, and in fact there already some challenges to it. As I believe one of the Pope's said: **Today's scientific dogmas are often tomorrow's errors**. Whoever said it, history has proven it true. Progression in understanding of the natural world is not just a matter of building on what is already "known" but also at times changing what was "known," and it's not all that infrequent.

There is one and only one "institution" or discipline that has true dogmas – things that are irrefutably and infallibly true always and everywhere and that is the institution created directly by our Lord Himself – His One, Holy, Catholic, and Apostolic Church which teaches the Sacred Sciences. Our Lord guaranteed inerrancy only in the area pertaining to that which is far and away most important, namely that pertaining to eternal life, that which is needed to get to Heaven. What is known or not known about the physical world is fine and dandy, but it's not needed to fulfill the purpose of this life; if it was, God would have revealed it directly and protected the teachings of the physical sciences with the same guarantee. This helps to keep things in perspective, it helps to put (and keep) first things first.

None of this is saying that "science" is bad. It's not saying you can't trust any "science" or that scientists are never competent or never have pure intentions. Medical doctors, for example, may not be scientific researchers per se but they certainly work in an area of applied science and I'm sure many of them really want to serve the best interest of their patient. So let us come back now to what the main point or question actually is: Trust the science? As if to say: "scientific" answers cannot be wrong, close your eyes and follow the new gods – scientists; they will lead you into all truth. It's an absurd statement. Science is not bad, but *scientism* is simply an immature, unsophisticated, ridiculous claim and that needs to be recognized as such. It actually discredits science. Having some basic understanding of "scientific methods," which includes an understanding that it also involves human judgement, is almost necessary for that recognition. Don't fall for childish, outlandish statements or demands. Scientism is a hindrance, not a help, to good science.

Maybe at this point a person might be ready to say something like: "well, yeah, ok science isn't perfect or infallible and scientism is kind of silly and I'm not going to abide with it. I agree: Science yes, scientism no." Yet the nagging question of: how did scientism come about to begin with, how did it get popularized, remains. Could it really be wrong if it's what everybody says? Leaving the question of how it came about unanswered leaves a hole and it can leave a person with a little doubt – maybe there's something I'm missing. Addressing this question will not only be helpful in dispelling scientism, but it will also help reveal the general atmosphere, you might say, of the whole (so-called) enlightenment period of history. Dr Lawrence Principe, a chemist and historian referenced in a previous article, describes the ascent of scientism. That topic, the origin of scientism, will be taken up in next week's article.

God bless you, Fr Kuhn.