Pierre de Maupertius

French mathematician, geodesist and statesman of science **Pierre Louis Moreau de Maupertuis** (September 28, 1698 – July 27, 1759) was born in Saint Malo. A well-educated nobleman, he was captain of the dragoons, and at the age of twenty-five he was elected to the Académie des Sciences in Paris. He accompanied Alexis-Claude Clairaut to Basel, Switzerland, where they studied the new analysis with Johann Bernoulli. After returning to France, Maupertuis associated with mathematician and scientist, Charles de La Condamine, and became a tutor of Émilie de Breteuil, Marquise du Châtelet. Maupertuis was one of the first in France to champion Newtonian philosophy over that of Descartes and he introduced Newton's theory of gravitation to the country.

In 1736, in order to settle a dispute as to the shape of the earth, the French Académie des Sciences sent two expeditions to measure the meridian at the equator and near the pole. Newton and Huygens had deduced that the earth was flatter at the poles, a contradiction of Descartes' contention that the earth is elongated at the poles. One expedition, led by La Condamine, was sent to Mitad del Mundo, in what was then part of Peru, but now is in Ecuador. The other expedition, led by de Maupertuis, was sent to the River Tornio valley in Lapland. His team consisted of 36 individuals, including Clairaut, the Abbe Reginald Outhier, Anders Celsius and a local participant, Anders Hellant. The group spent the winter in Tornio, where despite the extreme cold – the temperature sometimes fell to 37 degrees below zero –the company reportedly led a lively social life with the impressed locals. The measurements made in the two locales unquestionably confirmed the Newton-Huygens prediction. The results of the measurements were contained in Maupertuis' book *La Figure de la Terre* (The Figure of the Earth, 1738). As a result de Maupertuis earned the title of *grand aplatisseur* ("great flattener"). It was later shown that there were serious errors in the measurements, which did not affect the conclusions.

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When Maupertuis returned to France, he and his results met with a cold reception. In the dispute between followers of Descartes and Newton over the shape of the Earth, Newton had few French supporters. Maupertuis returned to France with a young Lapp girl, and Voltaire's crack about "Maupertuis flattening the Earth" suggested that her pregnancy was apparent. Their child was born in Paris, and presumably died there. Voltaire wrote the following verse for the engraving showing de Maupertuis dressed in the clothes he had worn on his expedition to Lapland, with one hand resting on the terrestrial globe as though he were flattening it at the poles.

> "This poorly known world which he knew how to measure,
> Becomes a monument from which he derives his glory,
> His destiny is to describe the world,
> To please and enlighten it."

Due to the fame Maupertuis earned with the expedition, Frederick the Great of Prussia invited him to Berlin. The latter accompanied the Prussian army into the field during the Seven Years War and was captured by Austrian troops. Again his fame saved him. He was well received by Maria Theresa, the Archduchess of Austria (who became Empress when her husband became Holy Roman Emperor), and Emperor Francis. Maupertuis was soon exchanged, and returned to Berlin where he became a member of the Academy of Sciences and, in 1745, its president, a post he held for eight years. Maupertuis published on many topics, including mathematics, geography, astronomy, and cosmology. In 1744 he enunciated the *least action principle*, which states that nature chooses the most economical path for moving bodies, light rays, etc.

Although Maupertuis had some physical examples to support the principle, he advocated it for theological reasons. Maupertuis was convinced that this comprehensive law of conservation demonstrated “God’s intention to regulate physical phenomena by a general principle of highest perfection.” He went so far as to claim the principle to be a universal law of nature and that it provided a metaphysical proof of the existence of God. Maupertuis wasn’t the first one to advance the *least action principle;* it had surfaced in various guises for centuries, even as far back as Aristotle. After Maupertuis enunciated the least action principle, his protégé, Samuel König accused him of plagiarizing Leibniz’s work and Voltaire satirized him in verses. Maupertuis could not understand why their friendship and adulation had so quickly turned to malice and harsh criticism.

The least action principle demonstrates a fundamental divergence in the way physicists and mathematicians look at nature. Maupertuis and numerous scientists and philosophers were ready to embrace it as a rule so grand, simple and economical that it might encompass all the phenomena of nature. That’s like looking for a simple answer to what has to be the most complex of all questions: “What is nature all about?” Physicists look for patterns in nature and try to invent ways of describing those that are useful. Physicists don’t wait to make these descriptions until they are absolutely certain they know what they all mean. A particular theory will be considered useful if correct predictions can be made based upon it. It may even happen that there is more than one theory derived from the same observable patterns. Some of these may in certain ways even be contradictory, yet useful. What this probably means is that both theories are approximations to a better theory not yet developed.

Even though mathematicians may be inspired by observations of nature in formulating some theory, they do not measure the worth of that theory by its ability to predict, but rather on grounds such as its internal consistency, simplicity of foundations, and richness of logically derivable results. Indeed, mathematical theories may be valuable even if they contradict some aspect of observable nature. Mathematical proofs of propositions are assurances that the propositions are consistent within the mathematical system in which they originate. A proof is not the same as a validation. It is a valid logical argument of a statement that may or may not be true about some aspect of nature, of which the mathematical system is a model.

But all models are incomplete and are necessarily inaccurate descriptions of nature. Nature is too complex to fit totally and comfortably into one mathematical model. That is the lesson of the invention of non-Euclidean geometry. Prior to that, mathematicians and physicists were pretty much in agreement that Euclidean geometry was the definitive model by which all the patterns of nature could be described. It just wasn't so. Physicists will continue to observe nature's patterns, find theories to describe them and hopefully make useful and correct predictions based on them. In doing so they can use various mathematical models, as long as it is remembered that models are all they are. What has been said at various times, in various ways by various people is appropriate here: Mathematical models are not true; they are advantageous.

While in Prussia, Maupertuis' studies took a turn towards biology. Through the millennia and in all parts of the world the notion developed that all things in the universe came about through divine creation. However, there were a few brave and usually isolated souls who proposed alternative explanations. The idea that species could change into other species was put forward at least as far back as ancient Greece, but the notion didn't attract much attention until it resurfaced in the 18th century. Before Charles Darwin, Maupertuis may have been the first to propose a general theory of evolution, including the ideas of mutation and the concept of “natural selection.” In *Essai de Cosmologie* (1750) he suggested the idea popularized in the 19^{th} century by Herbert Spencer, “survival of the fittest.”

In his *Système de la nature* (System of Nature, 1751), Maupertuis developed the first theoretical speculations into the modern idea of dominant and recessive genes. He studied the occurrences of polydactyly, that is, extra fingers, among several generations of a Berlin family. He demonstrated that polydactyly could be transmitted by either parent, and he explained the trait as the result of a change in the “hereditary particles” possessed by them. He also calculated the probability of the trait’s future occurrence in new family members. In 1756, he left Berlin to return to France by way of Switzerland. He first went to Toulouse and from there to Basel, arriving in May 1758. He was warmly welcomed by Johann II Bernoulli, but was too ill to proceed. He died at age 60, and was buried at Dornach.

Quotation of the Day: “Chance one might say, turned out a vast number of individuals; a small proportion of these were organized in such a manner that the animals’ organs could satisfy their needs. A much greater number showed neither adaptation nor order. These last have all perished – thus the species which we see today are but a small part of all those that a blind destiny has produced.” – Pierre de Maupertuis