the thermometrical scale of heat according to the expansion of liquids (which is the measure of temperature here adopted), was constructed with a reference to Newton's law of radiation of heat; and thus the law is necessarily consistent with the scale.

In any case in which the parts of a body are unequally hot, the temperature will vary *continuously* in passing from one part of the body to another; thus, a long bar of iron, of which one end is kept red hot, will exhibit a *gradual* diminution of temperature at successive points, proceeding to the other end. The law of temperature of the parts of such a bar might be expressed by the ordinates of a *curve* which should run alongside the bar. And, in order to trace mathematically the consequences of the assumed law, some of those processes would be necessary, by which mathematicians are enabled to deal with the properties of curves; as the method of infinitesimals, or the differential calculus; and the truth or falsehood of the law would be determined, according to the usual rules of inductive science, by a comparison of results so deduced from the principle, with the observed phenomena.

It was easily perceived that this comparison was the task which physical inquirers had to perform; but the execution of it was delayed for some time; partly, perhaps, because the mathematical process presented some difficulties. Even in a case so simple as that above mentioned, of a linear bar with a stationary temperature at one end, *partial differentials* entered; for there were three variable quantities, the time, as well as the place of each point and its temperature. And at first, another scruple occurred to M. Biot when, about 1804, he undertook this problem.[1] "A difficulty," says Laplace,[2] in 1809, "presents itself, which has not yet been solved. The quantities of heat received and communicated in an instant (by any point of the bar) must be infinitely small quantities of the same order as the excess of the heat of a slice of the body over that of the contiguous slice; therefore the *excess* of the heat received by any slice over the heat communicated, is an infinitely small quantity of the second order; and the accumulation in a finite time (which depends on this excess) cannot be finite." I conceive that this difficulty arises entirely from an arbitrary and unnecessary assumption concerning the relation of the infinitesimal parts of the body. Laplace resolved the difficulty by further reasoning founded upon the same assumption which occasioned

[1] Biot, *Traité de Phys.* iv. p. 669. [2] Laplace, *Mém. Inst.* for 1809, p. 332.