of light. The following suggested examples may perhaps be of interest. They are not put forward as possible "objections" to the theory, but with the same intention as prompted the supposed "exceptions" to the second law of thermodynamics. The latter, although they did not disturb the application of the law in its proper sphere, led to drastic limitations to its general validity (e.g. the "sorting demons" of Maxwell).

Consider first a cube of unit volume, constructed of rigid material absolutely impervious to heat. Suppose the cube contains a gas the temperature of which, measured by an observer rigidly attached to the box, is T . What will be the temperature as measured by another observer moving relative to the first with a uniform velocity v in the direction of one of the edges of the cube? The volume of the cube as measured by the second observer will, according to the theory of relativity, be reduced to $1/\sqrt{1-v^2/c^2}$. If the same laws hold for the gas for both observers, the temperature of the gas would seem to be $T(\sqrt{1-v^2/c^2})^{\gamma-1}$. We note in passing that this depends on γ , the ratio of specific heats, and thus on the structure of each of a definite number of molecules of gas contained in the cube. If the gas is supposed to be the mixture $2\text{HI} \rightleftharpoons \text{H}_2 + \text{I}_2$, the extent of dissociation depends only on the temperature and not on the volume, and could be measured by the change in intensity of a beam of light passed through the box in a direction at right angles to its motion, and received by the second observer. The consideration of the case in which the cube is at rest and the second observer in motion would naturally follow. The detailed consideration of this case would appear to involve the transformation of the statistical equations for the energy and entropy of the gas in terms of the position and momentum co-ordinates of the molecules, but I must defer detailed discussion of this matter at the moment.

In the next case we will consider a possible definition of "simultaneity" not involving the use of rays of light. A chemical reaction taking place with a measurable velocity in a given position as measured by an observer at rest is employed. A solution is divided into two equal parts. One remains with the observer at rest, the other is taken by a second observer anywhere he pleases. When an event occurs simultaneously with respect to the two observers the chemical reaction is stopped and the solutions are brought back to the original position and analysed. Let us say that if equal amounts of substance have been changed the events were simultaneous. What objection is raised to this definition? As a further case, we may consider both observers provided with equal weights of radium, and instructed to measure time by counting the number of α -particles emitted from a given instant. This change is found by experiment to be independent of external conditions. If we assume the use of rays of light as a standard method, it follows that the rate of disintegration (and the rate of a chemical reaction) will depend on the velocity. A possibility of testing this by experiment with a centrifugal machine at once suggests itself. I find by calculation, however, that according to the theory of relativity the rate of emission of α -particles would not, in the most favourable circumstances, be changed by more than about one particle per second per gram of radium (see also A. H. Compton, *Phil. Mag.*, 1920, vol. xxxix., p. 659).

Attention may perhaps be directed to the calculation of Bucherer (*Physikal. Zeitsch.*, 1920, vol. xxi., p. 451), who shows that the displacement of spectrum lines may be calculated without the assumption of a general theory of relativity from the principles of thermo-

dynamics. The deflection of light by the sun may yet be shown to depend on the condensation of æther—a hypothesis first put forward by Newton (Boyle's "Works," ed. by Birch, 1744, vol. i.). Neither of these tests appears to be crucial.

The possibility of an upper limit of temperature, when a particle attains by thermal processes a velocity c , is complicated by the change of mass with velocity. In the case of electrons it is further complicated by the doubt as to whether they can be set in motion at all by thermal means, which follows from the values of the specific heats of metals at low temperatures.

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Variations of Eucalyptus Foliage.

THE eucalyptus tree is a common object in the gardens of Torquay, where it grows freely, though subject to having its tender branch-ends killed occasionally by frost-laden winds. In the King's Gardens here there are two of these trees of the same age which are remarkable for the contrast in the appearance and character of their foliage. One is bearing almost entirely long scimitar-shaped leaves that are petiolate and grow alternately on the branches with that pendulous habit which so characterises these plants. Its companion has a more robust appearance, and bears only the more or less elongated heart-shaped leaves that are erect, opposite, and sessile, with more of the grey-blue gummy exudation that gives them the common name of blue gum trees. It has been noticed that this plant had lost its leading shoot when very young, so that its mass is formed of branches grown from lateral buds. A few trunk shoots have appeared this season among the lower branches on the northern side of the companion tree first mentioned that bear the opposite, sessile leaves characteristic of the young plants, and a recently pollarded tree in a private garden near has developed two shoots from apparently the same lateral bud on the north side of the tree, that bear respectively the two forms of foliage, while a sheltered and uninjured tree in the Terrace Gardens of some 30 ft. in height has only the pendulous type of leaf upon it.

These observations, while bringing to notice a remarkable instance of reversion to seedling or ancestral characters, seem to indicate that with these plants light and temperature under the effects of injury influence their development relative to temporary or permanent reversion.

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Old Road Maps.

THE reference in NATURE of September 16, p. 90, to John Cary's old road map prompts me to send particulars of an old and rare book, "A Pocket-Guide to the English Traveller: Being a Complete Survey and Admeasurement of all the principal Roads and most considerable cross Roads in England and Wales," by Thomas Gardner, 1719. There are one hundred copper-plate engravings showing the roads, with the bridges, woods, inns, churches, beacons, gallows, etc., passed *en route*. The scale is, for the actual roads, about one inch to the mile, and every mile is numbered. This book has been in my possession for more than forty years, and I have never met anyone who has seen another copy. It is dedicated to "His Most Serene Majesty George, King of Great Britain, France and Ireland, etc."

C. CARUS-WILSON.

September 17.