difference, and to the *unmeasured* heat which is locally developed in the living vegetable cell by the action of direct light.

If, in forming a thermic scale of different kinds of cultivation,* we begin with those plants which require the hottest climate, as the vanilla, the cacao, banana, and cocoa-nut, and proceed to pine-apples, the sugar-cane, coffee, fruit-bearing date-trees, the cotton-tree, citrons, olives, edible chestnuts, and vines producing potable wine, an exact geographical consideration of the limits of cultivation, both on plains and on the declivities of mountains, will teach us that other climatic relations besides those of mean annual temperature are involved in these phenomena. Taking an example, for instance, from the cultivation of the vine, we find that, in order to procure *potable* wine,† it is requisite that the mean annual heat should exceed 49°, that the winter temperature should be upward of 33°, and the mean summer temperature upward of 64°. At Bordeaux, in the valley of the Garonne (44° 50′ lat.), the mean annual, winter, summer, and autumn temperatures are respectively 57°, 43°, 71°, and 58°. In the plains near the

alia est caloris vis, quem radii solis nullis nubibus velati, in foliis ipsis et fructibus maturescentibus, magis minusve coloratis, gignunt, quemque, ut egregia demonstrant experimenta amicissimorum Gay-Lussacii et Thenardi de combustione chlori et hydrogenis, ope thermometri metiri nequis. Etenim locis planis et montanis, vento libe spirante, circumfusi aeris temperies eadem esse potest cœlo sudo vel nebuloso; ideoque ex observationibus solis thermometricis, nullo adhibito Photometro, haud cognosces, quam ob causam Galliæ septentrionalis tractus Armoricanus et Nervicus, versus littora, cœlo temperato sed sole raro utentia, Vitem fere non tolerant. Egent enim stirpes non solum caloris stimulo, sed et lucis, quæ magis intensa locis excelsis quam planis, duplici modo plantas movet, vi sua tum propria, tum calorem in superficie earum excitante."—Humboldt, *De Distributione Geographica Plantarum*, 1817, p. 163–164.

* Humboldt, op. cit., p. 156–161; Meyen, in his *Grundriss der Pflanzengeographie*, 1836, s. 379–467; Boussingault, *Economie Rurale*, t. ii., p. 675.

† The following table illustrates the cultivation of the vine in Europe, and also the depreciation of its produce according to climatic relations. See my *Asie Centrale*, t. iii., p. 159. The examples quoted in the text for Bordeaux and Potsdam are, in respect of numerical relation, alike applicable to the countries of the Rhine and Maine (48° 35′ to 50° 7′ N. lat.). Cherbourg in Normandy, and Ireland, show in the most remarkable manner how, with thermal relations very nearly similar to those prevailing in the interior of the Continent (as estimated by the thermometer in the shade), the results are nevertheless extremely different as regards the ripeness or the unripeness of the fruit of the vine, this difference undoubtedly depending on the circumstance whether the vegetation of the plant proceeds under a bright sunny sky, or under a sky that is habitually obscured by clouds: