throw the strings into vibration, and consequently would themselves be gradually extinguished, since otherwise there would be a creation of *vis viva*. The optical application of this illustration is too obvious to need comment."

Already ten years before Kirchhoff gave to the researches into the spectrum their popular celebrity and practical importance, Stokes [1] had made an extensive ex-

[1] The memoir of Sir G. Stokes "on the change of the refrangibility of light," in the 'Philos. Transactions' (May 1852), forms a landmark in optical science, and whilst dealing with the less obvious —though very frequent and general —phenomena of fluorescence and phosphorescence, really indicated the line of reasoning which has become so fruitful and suggestive in his own hands and in those of other eminent natural philosophers. On page 549 of that memoir he wrote: "All believers in the undulatory theory of light are agreed in regarding the production of light in the first instance as due to vibratory movements among the molecules of the self-luminous body. . . . Nothing then seems more natural than to suppose that the incident vibrations of the luminiferous ether produce vibratory movements among the ultimate molecules of sensitive substances, and that the molecules in turn, swinging on their own account, produce vibrations in the luminiferous ether, and thus cause the sensation of light. The periodic times of these vibrations depend upon the periods in which the molecules are disposed to swing, not upon the periodic time of the incident vibrations." Referring, then, to the dynamical difficulties which attach to such a view, he proceeds to point out "that we have no right to regard the molecular vibrations as indefinitely small. The excursions of the atoms may be, and doubtless are, excessively small compared with the linear dimensions of a complex molecule. It is well known that chemical changes take place under the influence of light, especially the more refrangible rays, which would not otherwise happen. In such cases it is plain that the molecular disturbances must not be regarded as indefinitely small. But vibrations may very well take place which do not go to the length of complete disruption and yet which ought by no means to be regarded as indefinitely small. . . . Certainly we cannot affirm that in the disturbance communicated back again to the luminiferous ether none but periodic vibrations would be produced having the same period as the incident vibrations. Rather, it seems that a sort of irregular motion must be produced in the molecules, periodic only in the sense that the molecules retain the same mean state; and that the disturbance which the molecules in turn communicate to the ether must be such as cannot be expressed by circular functions of a given period, namely, that of the incident vibrations." Stokes then refers to the probable internal vibration of the atoms in the compound molecules, as "it is chiefly among organic compounds . . . having a complicated structure that internal dispersion (fluorescence) is found."