the molecular processes involved in a chemical reaction, but also to fix, within certain limits at least, the energy of dissociation of certain gases. Thus, the simple dissociation process,

$$H_2 \rightleftarrows 2H,$$

in reality must be much more complicated in operation than the unimolecular bimolecular dynamic equilibrium postulated by this equation given in the text-books. Whilst the efficiency of collision in causing reaction of complex molecules such as $2NO_2 \rightleftarrows N_2O_4$ is usually high, that of atomic recombination is very low, and if we regard a pair of normal atoms in close proximity to one another as the extreme case of dissociation, the absence of an electric moment in the system forbids the quantised emission of radiation. Thus reactions such as $2H \rightarrow H_2$, $2Br \rightarrow Br_2$, only occur in the presence of a third body or a surface, and the energy of combination transmitted to the third body is frequently emitted as chemiluminescence, a phenomenon readily observed with atomic hydrogen. The energy of combination of atomic hydrogen is found to be sufficiently great to excite the OH molecule to emission, but not the mercury line λ2537 A. in mercury atoms; this places the energy of dissociation of hydrogen between 94,000 and 112,000 cal per gram molecule.

Atomic hydrogen, readily prepared by Wood's method, is a convenient source of many chemiluminescent experiments. The afterglow of a number of gases, notably oxygen, nitrogen dioxide and nitrogen, when excited by the electric discharge, may all be regarded as chemiluminescent reactions in that the gases possess enhanced chemical reactivity in the glowing state. The glow of nitrogen dioxide and nitric oxide and the afterglow of Lord Rayleigh's active nitrogen are particularly brilliant, but the chemical processes involved are at present obscure. It seems at least definitely established that active nitrogen contains at least two chemically reactive species, both atoms and excited molecules. The cohesion of solid surfaces may be regarded as a species of chemical reaction in the solid state, and several of these reactions are found to be chemiluminescent; although frequently classified as tribo- or crystaloluminescent reactions, the crystallisation of arsenious oxide and sugar exemplify this class of reaction.

Other quasi-chemical reactions which are luminescent include the fluorescence and phosphorescence excited in various substances, especially in solid solutions, by electron bombardment, some of the effects produced by the bombardment of minerals such as kunzite by high speed electrons being particularly brilliant. Finally, we may observe the chemiluminescence obtained with certain bacteria such as *B. fluorescens* and the reaction between luciferin and luciferase, the basis of biological light.

Obituary.

MR. S. S. BUCKMAN.

THE son of Prof. James Buckman, a well-known botanist and geologist of his day, Sydney Savory Buckman, born in 1860, early followed in his father's footsteps. His attention was particularly directed to the Brachiopoda and Ammonites of the Inferior Oolite, and so early as 1883 he contributed a paper on the former to the *Proceedings of the Dorsetshire Natural History Field Club*. Buckman will, however, be chiefly remembered for his work in connexion with the Ammonites, which he showed could be used as zone fossils for subdividing the Jurassic strata. His study of these was extensive, and a monograph of those from the "Inferior Oolite Series" (never really completed) formed one of the Monographs of the Palæontographical Society (1887–1907), while he further traced their evolution through the successive strata, and in so doing was led to create a multitude of genera and species far beyond what had hitherto been deemed necessary.

In connexion with all this work and subsidiary to it, Buckman published very many papers and memoirs on the classification of Ammonites and Brachiopods. When his connexion with the Palæontographical Society was severed, Buckman began in 1909 a work on "Yorkshire Type Ammonites," consisting of photographic figures of the types accompanied by the original descriptions. This was carried on until his eyesight failed six months ago. The geological structure of the Inferior Oolite also received his attention, and he traced foldings in the beds that in some cases corresponded with those known to exist in the underlying Palæozoic rocks, thus bearing out Godwin-Austen's principle of the continuity of folding with its economic consequences.

The physical geography of south-western England was the subject of a paper (*Natural Science*, 1899) far too little consulted by later writers, in which Buckman treated of the "Development of Rivers; and particularly the Genesis of the Severn." The capture of the headwaters of the Thames by the Severn has, perhaps, never been better set forth. Buckman's extensive and original work became absorbed to such an extent into contemporary geological thought that few of the younger generation of geologists realise how much they owe to him.

The value of Buckman's labours was recognised by the Geological Society, of which he was elected a fellow in 1882, by the award of the Murchison Fund in 1897, of the Lyell Fund in 1903, and the bestowal of the Lyell Medal in 1913. His researches stimulated many a geologist, and not in England alone, to a more detailed study of the rocks and their fossil contents, and all such he was ever ready to help in the most unselfish way. His death on Feb. 26 last was greatly regretted by all privileged to know him, and his memory will be cherished as one of the kindest of men.