rises again. This freezing once brought about, further and more intense cold has no effect. Brown and Escombe endorsed de Candolle's idea, suggesting that protoplasm may exist in two conditions, the *static* and the *kinetic* in the former becoming so stable as to be absolutely inert, devoid of any trace of metabolic activity, and yet conserving the potentiality of life.

It is extremely difficult to decide which of the two theories provides the most satisfactory explanation of the observed phenomena. The conditions which mark the commencement of germination help us, however, to come to a conclusion, though difficulties are met with in either hypothesis. For germination to occur, moisture must be absorbed by the seed; absorption of oxygen and exhalation of carbon dioxide speedily follow, enzymic action supervenes, and the digestive changes in the reserve food materials can be readily traced. But what is the first result of the absorption of water is not so clear; is it the resumption of the kinetic condition by the protoplasm, the life of which in all other parts can be seen to be dependent on water, or is it the setting up of the activity of the enzymes, which enables metabolic, and possibly respiratory, changes to take place, such chemical action stimulating the latent life to manifestation?

Certain observations tend to show that the activity commences with changes in the embryo or germ. Van Tieghem, many years ago, endeavoured to excite into activity the endosperm of the castor-oil bean after removing from it every particle of the embryo. In most cases he failed, but in some he claimed to have been successful. The writer, many years afterwards, repeated his experiments, and found that the endosperm could only be quickened when a small portion of the germ was left in contact with it. The changes in this case originated in the embryo. Further observations showed that the earliest sign of germination in the latter is a change in certain cells of its epidermis, which take on the appearances that usually indicate the conversion of a zymogen into an enzyme. The germ appears to start the change by the secretion of an enzyme. It seems justifiable to associate this secretion with the re-assumption of life by the embryo, because, though many enzymes occur in the seed outside the latter, they do not initiate their changes until later. In this particular seed, vital activity is subsequently soon manifested in the tissue of the endosperm, which becomes the scene of very active chemical change, its residual protoplasm growing and secreting certain constituents, particularly sugars, which the resting cells do not contain.

Brown and Morris showed that a somewhat similar procedure can be observed in the barley grain. The first visible changes are the secretion of enzymes by the scutellum of the germ. The germination once started, other enzymes make their appearance in the endosperm, some arising especially from the aleurone layer underlying the testa.

A scrutiny of the results of Dixon's experiments on heating the resting seeds points also to the protoplasm as the initiator of the changes. Exposure of his seeds to 105° C. must have destroyed any preformed enzymes unless the cells were absolutely devoid of water, a condition hardly likely to be reached. The germinative power fell gradually, or nearly regularly, as the heating was raised to this point, but much remained. When, however, a very slightly higher temperature was reached, about 107° C., the seeds lost it with great suddenness and very irregularly. The injury inflicted by the last two degrees was very different from that which was sustained as the temperature gradually rose to 105° C., and was hardly explicable on the theory of enzyme destruction. It did not, at any rate, correspond to the progress of their destruction in the laboratory.

Some experiments recently carried out by Miss White in Prof. Ewart's laboratory at Melbourne bear upon this aspect of the problem. She endeavoured to accelerate the germinative processes in seeds which had but little power of germination by supplying them with additional quantities of enzymes dissolved in the water with which they were kept moist, the coats of the seeds being perforated here and there to allow absorption to take place. Though she examined many in various conditions, the result was always negative. It proved impossible to accelerate germination by supplying additional quantities of enzyme.

Experiments made by supplying resting seeds with reagents such as dilute organic acids, which stimulate their secretion of enzymes, also have been found to be without result.

The idea that enzymes initiate and maintain the process of germination appears, therefore, to be erroneous, and the older view of the sufficiency of the idioplasm of the cells still holds the field, in spite of the difficulties that have been raised by the experiments with temperature. The theory of static and kinetic states of protoplasm explains little or nothing; it is really scarcely more than a statement of the problem in new terms.

J. REYNOLDS GREEN.

DR. W. J. RUSSELL, F.R S.

WILLIAM JAMES RUSSELL was born in May, 1830, at Gloucester, where his father was a banker. He was educated at private schools—Dr. Wreford's at Bristol, and afterwards at Mr. Bache's at Birmingham. In passing, it may be noted that this was before the educational revival that produced and was furthered by the Public Schools Commission of 1859, and that in those days there were very many private schools where scholarship was carried to quite as high a level, and when the conditions of out-of-school life were in some respects much better than in most of the public schools of the time.

After leaving school in 1847, Russell entered University College, London, where he studied chemistry under Thomas Graham and Williamson. In 1851 he was appointed the first demonstrator of chemistry under Frankland in the then newly-founded Owen's College, and helped to plan and superintend the building of the first chemical laboratory of the college. This laboratory, built on what had been the garden attached to the original college building (Mr. Cobden's old house in Quay Street), was the cradle of the great Manchester School of Chemistry, which has become as famous in its way as the Manchester School of Politics. After two years at Owens College, Russell went to Heidelberg, where he worked under Bunsen from the autumn of 1853 to the end of the session 1854–5. During his stay at Heidelberg, he graduated as Ph.D. After his return to England, he lectured at the Midland Institute, Birmingham, and near the end of 1857 came again to London to act as assistant to Williamson, his former teacher, at University College. He was associated with Williamson for several years, a considerable part of the time being occupied with working out and bringing to a convenient practical form a method of gas-analysis whereby the corrections involved in taking account of variation of pressure and temperature were in great measure eliminated. The results of this investigation were embodied in several papers published in the Journal of the Chemical Society and elsewhere, and the form of apparatus finally arrived at was the forerunner of the most improved modern types of gas-analysis apparatus and instruments for the application of the measurements of gases to quantitative analysis.

From 1868 to 1870, Dr. Russell was lecturer on chemistry in the Medical School of St. Mary's Hospital. In the latter year he was appointed to a similar office at St. Bartholomew's and retained this appointment until 1897. After his retirement, he continued his experimental work, and until very recently was actively occupied at the Davy-Faraday Laboratory. He died at his house at Ringwood, after a very short illness, on the twelfth of the present month (November, 1909).

At the time of his death, Dr. Russell was one of the oldest Fellows of the Chemical Society, having been elected in 1851. He served on the council from 1863 to 1867, and from 1870 onwards his official connection with the society was unbroken: he was a member of the council from 1870 to 1872; vice-president, 1872 to 1873; secretary, 1873 to 1875; treasurer, 1875 to 1889; president, 1889 to 1891, and since the last date a permanent vice-president. The society, which was only ten years old when Russell joined it, celebrated the jubilee of its foundation in 1891, during his term of office as president. It naturally devolved upon him to take the leading part in the proceedings, and all who were present must have been struck by the admirable manner in which he acquitted himself. He had to make many speeches, long or short, and they were always simple and appropriate. Without wasting words, or any apparent striving after effect, he managed every time to say exactly what wanted saying.

He was elected a Fellow of the Royal Society in 1872; he served twice on the council, and was a vice-president from 1897 to 1899. He was an original member of the Institute of Chemistry, founded in 1877, was president from 1894 to 1897, and served various other offices between 1878 and 1904.

Dr. Russell's connection with Bedford College (London) extended over many years of his life, and was of very great value to the college. It began with his being appointed professor of natural philosophy in 1860. He retained this office until 1870, and opened in 1860 the first laboratory accessible to women-students for practical work at science. He was a member of the council of the college from 1878 to 1903, being chairman from 1887, and also chairman of the college board of education from 1895. During Dr. Russell's chairmanship, the college was twice enlarged, and at the end of his term of office the necessity for still further extension had become so pressing that it was decided to start a fund to provide an entirely new building. He was an active supporter of this movement, and contributed liberally to the fund.

Dr. Russell's contributions to the methods of gas-analysis have been mentioned already. Among other investigations, we may refer to those relating to the atomic weights of nickel and cobalt (1863 and 1869), which were important in consequence of the way in which results obtained by very different methods were employed to check each other; a series of papers in conjunction with Dr. Samuel West, F.R.S., on a new method of estimating urea, which gave rise to a valuable clinical method; papers (conjointly with Mr. Lapraik) on absorption spectra, and notably one on the absorption bands in the visible spectra of colourless liquids, which was the pioneer paper in a branch of inquiry that has been most ably followed up by Prof. Noel Hartley, F.R.S., Mr. E. C. C. Baly, F.R.S., and others; a remarkable series of papers on the action of metals, resins, wood and other materials on a photographic plate in the dark. Some of the results of this investigation were given to the Royal Society as the Bakerian lecture for 1898. By well-directed and persevering experiments, the effects observed were traced to the generation of peroxide of hydrogen. In another set of experiments on the figures formed by the deposition of dust, Dr. Russell demonstrated the curiously definite course of the convection currents of air that rise from a heated solid body.

A report made to the Science and Art Department, in conjunction with Sir William Abney, on the action of light on water-colours was published as a Blue Book in 1888. It involved a very careful investigation of the subject, and was highly appreciated by artists. A committee consisting of the president and other prominent members of the Royal Academy in reporting on it said that they "unanimously desired to record their sense of the very great value and of the thoroughness and ability with which so laborious an inquiry had been conducted."

In manner, Russell was quiet and entirely free from anything approaching self-advertisement, but he was genial and hearty with his friends, and was gifted with a sympathetic laugh that it was always refreshing to hear. As some indication, both qualitative and quantitative, of the estimate formed of him by his fellows, it may not be out of place to mention that, as a young man, he was the first secretary, treasurer, and keeper of the archives of the B Club—originally a society of young chemists which grew out of Section B of the British Association, first took definite shape at the Oxford meeting in 1860, and kept itself alive between the meetings of the Association by consuming monthly beef-steak puddings at the "Cheshire Cheese"—and that, in later life, he was elected to serve on the committee of the Athenæum Club. His death will be felt as a sore personal loss by very many. He was liked by all who knew him, and by all who knew him intimately he was held in affectionate esteem.

Dr. Russell married, in 1862, Fanny, daughter of the late A. Follett Osler, F.R.S., of Edgbaston. He leaves one son, and a daughter married to Dr. Alexander Scott, F.R.S. G. C. F.

NOTES.

THE *Standard* for November 22 contains a full list of the House of Lords, classified according to their qualifications. It is disappointing to find only two names—those of Baron Rayleigh and Baron Lister—under the heading "Scientists," while "Educationists" are only represented by Baron Ashcombe, member of council of Selwyn College; Baron Killanin, member of Senate of Royal University of Ireland; and the Earl of Stamford, formerly professor of classics and philosophy at Codrington College, Barbados. There are thirty-five railway directors, thirty-five bankers, and thirty-nine so-called "captains of industry" on the list, and a column and a half under "Military and Naval Services."

AT the meeting of the Royal Society of Edinburgh on Monday, November 22, the Makdougall-Brisbane prize for the biennial period 1906–8 was presented to Mr. D. T. Gwynne-Vaughan for his papers (1) "On the Fossil Osmundaceæ," and (2) "On the Origin of the Adaxially Curved Leaf-trace in the Filicales"; and the Gunning Victoria Jubilee prize for the third quadrennial period 1904–8 was presented to Prof. G. Chrystal, for "A Series of Papers on 'Seiches,' including 'The Hydrodynamical Theory and Experimental Investigations of the Seiche Phenomena of Certain Scottish Lakes.'"

THE Livingstone gold medal of the Royal Scottish Geographical Society has been presented to Sir Ernest Shackleton, in recognition of his work in the Antarctic.