stance of the application of the above methods may be given. Certain species of bacteria during the course of their vital processes are capable of emitting light. If, however, the cells be broken up at the temperature of liquid air, and the crushed contents brought to the ordinary temperature, the luminosity function is found to have disappeared. This points to the luminosity not being due to the action of a ferment—a 'Luciferase'—but as being essentially bound up with the vital processes of the cells, and dependent for its production on the intact organization of the cell. These attempts to study by frigorific methods the physiology of the cell have already yielded valuable and encouraging results, and it is to be hoped that this line of investigation will continue to be vigorously prosecuted at the Jenner Institute.

And now, to conclude an address which must have sorely taxed your patience, I may remind you that I commenced by referring to the plaint of Elizabethan science, that cold was not a natural available product. In the course of a long struggle with nature, man, by the application of intelligent and steady industry, has acquired a control over this agency which enables him to produce it at will, and with almost any degree of intensity, short of a limit defined by the very nature of things. But the success in working what appears, at first sight, to be a quarry of research that would soon suffer exhaustion, has only brought him to the threshold of new labyrinths, the entanglements of which frustrate, with a seemingly invulnerable complexity, the hopes of further progress. In a legitimate sense all genuine scientific workers feel that they are 'the inheritors of unfulfilled renown.' The battlefields of science are the centers of a perpetual warfare, in which there is no hope of final victory, although partial conquest is ever triumphantly encouraging the continuance of the disciplined and strenuous attack on the seemingly impregnable fortress of Nature. To serve in the scientific army, to have shown some initiative, and to be rewarded by the consciousness that in the eyes of his comrades he bears the accredited accolade of successful endeavor, is enough to satisfy the legitimate ambition of every earnest student of Nature. The real warranty that the march of progress in the future will be as glorious as in the past lies in the perpetual reinforcement of the scientific ranks by recruits animated by such a spirit, and proud to obtain such a reward.

JAMES DEWAR.

SCIENTIFIC BOOKS.

Notes on Naval Progress. July, 1902. Office of Naval Intelligence. Washington, Government Printing Office. 1902. 8vo. Paper. Pp. 502; over 100 illustrations, plates, maps, tables, etc.

This very large and exceedingly valuable document constitutes No. XXI., General Information Series, of the Office of Naval Intelligence, a division of the Naval Organization which has now for many years been justifying its existence by great and increasing efficiency. Under the supervision of Captain Sigsbee, the present Chief Intelligence Officer, it is evidently fully maintaining its standing. The contributors to this bulky volume are usually young officers of the navy who exhibit that talent for exact, concise and comprehensive composition which is the distinguishing characteristic of a good official report, and that excellence in style which seems so common a talent with military and naval officers. The two probably necessarily go together and are the outcome of familiarity with, often a minute study of, the reports and writings of great commanders quite as much as of careful drill at the governmental technical schools.

The volume in hand contains notes on ships and torpedo-boats, on ordnance and armor, on engineering progress, electricity, wireless telegraphy, the naval manœuvres of 1901, the naval budgets of great powers for 1902–3, and on modern battle-ships, including particularly the *Vittorio Emanuele.* The papers are all written by experts in their several departments and are as full of information as is an egg of meat.

Foreign naval powers are still increasing the magnitude and the offensive and defensive values of their battle-ships and cruisers and the big British and French navies especially are making progress with their 'submarines' and their 'submersibles.' Both report favorably on the types already constructed and indicate steady improvement. The former is testing the Holland craft. 'No. 1' is afloat and performs well. She can travel four hundred miles unexposed to fire. A 'periscope' permits a lookout being kept when completely submerged. The French *Triton* made a twenty-four hour trial, largely submerged, and during a part of the time in bad weather, and worked well. Many torpedo-boat destroyers are reported as attaining thirty knots on their contract trials. These vessels seem to be subject to large risk of accident.

In ordnance the tendency continues toward larger sizes of quick-firing guns and toward greater length for all classes of ordnance. In armor, the progress reported is in the direction of more efficient hardening and of a reduction in the thickness demanded to resist a stated impact of shot. In small arms, the small calibers persist and the 'automatic' system of continuous self-operation is being steadily perfected. A smokeless powder is now adapted for each class of ordnance, large and small, and this kind of explosive has become standard. The chemist is still seeking new and still more manageable and powerful compositions. Capped projectiles for heavy ordnance are successful, and a new device permits the production of a dense smoke at the point of explosion of the shell to confuse the enemy and disconcert his batteries. Torpedoes are still holding an important place in the field of investigation as well as in warfare, and there are no indications of the abandonment of this weapon.

Water-tube boilers, high steam-pressures (fifteen to twenty atmospheres and upward), with triple and quadruple expansion engines, are the rule and triple screws are gaining ground under the stimulus of the example set by our own navy and the arguments of its Engineer-in-Chief, Admiral Melville. The steam-turbine is being steadily developed and reduced to useful service on a large scale in both the naval and the merchant service. Liquid fuels are being exploited, and coal-handling devices, for use at sea as well as in port, are being brought into practicable forms.

There has been 'a striking extension' of the use of electricity in the internal minor services of the naval vessels of all nations, for the distribution of light and in the operation of guns and of machinery generally. The alternating current does not seem as yet successful. Voltages are usually low, but with a tendency toward elevation above the usual standard, which is about 80 volts minimum. Voltages of 120 and upward have been employed with a tendency toward 200 as a maximum limit.

Wireless telegraphy has progressed wonderfully, particularly in its range of action. The system is still imperfect, but is constantly being brought into practicable and useful form. All nations are experimenting with one or another of five best-known systems.

Comparison of the type-ships of existing navies seems to be favorable to the naval engineering and architecture of the United States, as illustrated in its latest constructions; but it is evident that competition is developing sharply in all leading navies, and the outcome among those of the greater powers seems likely to prove to be almost as largely dependent upon the liberality permitted by the legislative department as upon the genius of engineers, constructors and combatant officers.

R. H. THURSTON.

SCIENTIFIC JOURNALS AND ARTICLES.

THE closing (October) number of volume 3 of the *Transactions* of the American Mathematical Society contains the following papers: 'On the groups of order p^m, which contain operators of order p^{m-2},' by G. A. Mil-