other hand, is best for the case of the heavily plated, lightly loaded ship. The heavier the armor, the shorter and broader, proportionately, must be the hull chosen to do the best work. The fact that the shorter and broader, though for a given displacement the lighter, ship demands greater engine-power, brings another complication into the problem; and it is for the naval architect and engineer to seek the form which, on the whole, will be best for his purpose. On the whole, it is found that, for war-vessels, the heavier the armor to be carried, the fuller the form to be chosen: in other words, the value of a ship for purposes of war is not to be judged at all by the magnitude of the so-called 'constant of performance' (cube of the speed, multiplied by the two-thirds power of the displacement, divided by the indicated horse-power). A ship with a high coefficient may be a very bad vessel for war purposes, even though easily propelled through the water. This is a very important principle in naval architecture, and is the more to be kept in view from the fact that it has been customary for many years to judge the value of a design by the magnitude of this constant or some similar quantity. The application of a correct method of comparison shows the Belerophon, a short ship of 300 feet length, to be superior as a war-vessel to the Minotaur, — a ship of 400 feet length, and of much finer form. The smaller ship was 'handier,' attained the same speed, carried an equal battery better protected, had the same engine-power, and cost less than three-quarters as much as the larger. But her coefficient was about 15 per cent lower. This comparison effected a revolution in the naval design of Great Britain. The later iron-clads are built with a length only about five times the breadth, though steaming 16 and 17 knots.

It is found, on carrying out the investigation, that the short, broad ship, which should be given, nevertheless, fine 'entrance' and 'run,' may often be subject to less resistance than a rival craft of greater length and less beam. This was shown by Froude's experiments on the Ajax and a rival form. The magnitude and position of the 'bow wave' relative to the stern of the ship is one of the important modifying conditions. Should that wave take the right position, the resistance may be much less than where it comes in the wrong place. The action of the screw, in relieving the pressure of the water under the stern, is another serious consideration. Froude found, that, if it could be placed one-fourth or one-third the ship's beam from the stern of the vessel, the resistance to propulsion would be very much decreased. The introduction of a lengthened middle body may or may not aid; but no principle or formula has yet been found to determine what the effect will be.

Of the three principal elements of resistance, the friction of the skin of the ship, the wave-making effect, the eddy resistance, the first is usually the greatest. In very fast vessels the second and third may approximate to equality with the first. At low speeds the friction may be nine-tenths the total: at high speeds, such as now are becoming common, the frictional resistance may become as low as one-half the total. Comparing war-vessels, it is seen that fine-lined ships having thick armor would require to be of enormous length, size, cost, and power, while the same offensive and defensive power may be obtained in full-lined ships at much less sacrifice of all desirable qualities.

No insuperable obstacles exist to-day to the production of armored war-vessels capable of defying all the ordnance of the world, and of carrying their own armament at a speed of 18 or 20 knots into the waters of any enemy. The cost of such vessels has become so great, however, that progress in this direction has apparently nearly or quite ceased for the present. The engineer and naval architect is prepared to do his part of the work whenever the nation shall call upon him.

This was the closing lecture of a course covering the general subject of hydromechanics, and was considered a very fitting final address.

MEDICAL MISSIONARY WORK IN CHINA.

In 1881 Dr. Elizabeth Reifsnyder graduated in medicine from the Woman's medical college of Pennsylvania. Two years afterward she went as a medical missionary to Shanghai, where she is in charge of a new and handsome hospital. On Oct. 25, 1884, she performed the first ovariotomy ever done in northern China. The subject was thirty-one years of age, and travelled about five hundred miles to see Dr. Reifsnyder. The tumor weighed thirty-three pounds, and eleven days after the operation the patient sat up.

A successful operation like this soon made her famous, and the Chinese published accounts of the case. From one of these pamphlets the annexed cut is reproduced. It is evidently an ideal sketch by a native artist of great capacity, and vies in its amusing misrepresentation with some of the manufactured conversations of the modern interviewer.

It is *al fresco;* and evidently two passers-by — an Englishman and a Scotchman, to judge by their looks — have been attracted by the sight, and are watching it from the street. But the doctor's attitude and dress are the most amusing things in

the 'composition,' as it may well be called. She is kneeling with one knee on the patient's knees; and her Derby hat, French shoes, train dress, and extraordinary coiffure and earrings would proclaim her rather a devotee of fashion than of science. The assistant, whose left arm is apparently dislocated, and the cheering relics of former patients displayed on the top shelf of the showcase, complete a picture that is unique in medical illustrations, so far as we are familiar with them.

Dr. Mildred M. Philips, in a communication to the Alumnae association of the college, gives a translation of the character seen in the cut, a part of which is as follows: —

"A knowledge of the *Rhyming medical adviser* is considered a sufficient qualification to be a practising physician. Such ignoramuses [as those thus qualified] recklessly prescribe for disease, and ignorantly trifle with men's lives. If a patient dies, it is charged to his fate, and the doctor is not held responsible by the law. If a patient survives, he praises the skill of the doctor."

The article in the pamphlet from which the cut is taken gives a short account of the operation, and then adds, "If this disease had not met with this doctor, it could hardly have been relieved. If this doctor had not met with this disease, who could have known any thing of such divine skill?

"When Chinese doctors hear of this, their tongues will become immovable, and their heads will hang down."

DOCTORS AND THEIR WORK.

ENGLISH medical annals contain many names both familiar and honored the world over. It has not been a difficult matter, therefore, for Mr. Bettany to prepare a fair history[1] of the progress of medical science in England during the past three hundred years. Beginning with Harvey and Sydenham, and ending with Sir James Paget and Sir Joseph Lister, the author has sketched the lives of a succession of scientific men, eminent in the various departments of medicine and surgery, of whom any country may well be proud. It is, perhaps, from such memoirs as these that the history of progress in medicine can be most pleasantly traced. The personal element in science is often neglected, but always repays investigation. And nothing is more entertaining than to notice how the pure scientific spirit in search of facts

[1] *Eminent doctors.* Their lives and their work. By G. T. BETTANY. London, *Hogg*, 1885. 8°.