acid preparations round, smells a strong smell, and feels safe.

This notion probably arose from the fact that carbolic acid is a very good deodorizer and a very good antiseptic, and that the popular mind has failed to distinguish between these properties and those of a disinfectant. Indeed, it may be said that the scientific mind made the same mistake until the ubiquitous germ theory made its appearance to explain, among other things, just what a disinfectant was. A disinfectant must, according to this theory, be a germicide; and, if it is to be of any use, it must kill the germs quickly, and when used in comparatively small quantities. The question before us is to decide how far carbolic acid fulfils this indication. The first experiments [1] made with a view to answering this question were those of Rosenbach,[2] who, in 1873, showed by experiments on unhealthy pus that a 0.5-per-cent solution of carbolic acid did not act on this substance as a disinfectant, but that a 5-per-cent solution did. About the same time Devaine [3] proved that a 0.5-per-cent solution had no effect on the anthrax bacillus. Similar experiments by Braidwood and Vacher,[4] and Dougall,[5] seem to show conclusively that vaccine virus is not changed when subjected to the prolonged action of a 1-per-cent solution of carbolic acid, and that in some cases it was not affected by a 2-per-cent solution. Sternberg [6] has also shown that nothing less than an 0.8-per-cent could be relied on to destroy the micrococci of pus and septicaemia.

The latest researches on this subject are those of Gärtner and Plagge.[7] These gentlemen, under the supervision of Koch, carried on a careful and elaborate series of experiments on thirteen different species of micrococci, using solutions of 1 per cent, 2 per cent, and 3 per cent. One part of pure culture was shaken up with forty-nine parts of the carbolic-acid solution, and allowed to stand for a longer or shorter time.[8] Then a small portion of the mixture was placed in conditions favorable to growth. It was found that under these circumstances the 1-per-cent solution did not act at all as a germicide, that the 2-per-cent solution failed to kill the germs in two out of the thirteen cases, and that the 3-per-cent solution acted in all cases as a disinfectant. A further series of experiments showed that a 3-per-cent solution of carbolic acid would probably act as an efficient disinfectant when applied to the hands, to surgical instruments, to dressings, etc.

Earlier experiments [1] by the same authors, as well as some of Braidwood and Vacher's experiments, showed that in a gaseous state about 12.5 grams per cubic metre would be needed to disinfect damp clothing, and 15 grams per cubic metre to disinfect dry clothing.

In view of these experiments, it seems very clear that carbolic acid is of no value whatever when used in any ordinary quantities to disinfect sick-rooms, water-closets, clothing, etc., and is of doubtful utility in any case unless the object to be disinfected can be thoroughly soaked in a solution at least as strong as 3 per cent.

F. S. BUNKER.

[1] An exhaustive *résumé* of the literature on this subject is to be found in the *Medical news*, xlvi. 317-320.

[2] *Med. record*, viii. 427.

[3] *Comptes rendus*, lxxvii. 821-825.

[4] *Brit. med. assoc.*, Scientific reports, London, 1876.

[5] *Brit. med. journ.*, 1879, ii. 726-728.

[6] *Amer. journ. med. sc.*, lxxxv. 321-344.

[7] *Archiv. klin. chir., Berlin*, xxxii. 403-413.

[8] In the different series of experiments the times were 8, 15, 30, 45 seconds, and 1, 3, and 5 minutes.

MALTHUS AND HIS WORK.

Two recent productions have come to our notice, having for their chief subject the Malthusian theory of population. Mr. Bonar's book [2] contains a painstaking and intelligent account of Malthus' 'Essay on the principle of population,' and the discussions which preceded and followed it; an impartial review of his other writings and controversies; and a brief narrative of his personal life. Mr. Nossig's series of papers [3] presents a pretentious medley of learning unaccompanied by insight, of that arrogance towards old wisdom which a superficial acquaintance with modern knowledge often induces in a shallow mind, and of that amusing species of childishness which manifests itself in writing down formulas having a profoundly mathematical appearance to express obvious truisms or crude scientific fancies.

One cannot help feeling, on reading an article like Nossig's, — written by an educated man, and published in a scientific journal of high standing, — that the way in which the doctrine of Malthus has fared with a considerable part of the reading and writing world is most discreditable to the average human mind. That a doctrine pregnant with the weightiest practical consequences in human affairs should for a century be disputed in every way, — with wisdom and with folly, with logic and with sophistry, by fair means and foul, — is not surprising; but that its opponents should still so often fail to grasp the meaning of the doctrine itself is

[1] Deutsch. verein für oeffentliche gesundh. pflege.

[2] *Malthus and his work.* By JAMES BONAR. London, *Macmillan*, 1885. 8°. (New York, Harper.)

[3] *Ueber die bevölkerung.* By ALFRED NOSSIG. *Kosmos*, 1885.

discouraging and humiliating to any one who has high hopes of the intellectual development of mankind.

Mr. Bonar's book will, it is to be hoped, tend to remove one of the causes of this persistent failure to understand Malthus, which, it is charitable to suppose, has been operative in the case of Mr. Nossig, as it has been in that of better men. The simple task of reading what Malthus wrote is one which his critics have frequently omitted to perform. Mr. Bonar adduces the striking instance of no less a man than Nassau William Senior, who "confessed with penitence that he had trusted more to his ears than to his eyes for a knowledge of Malthusian doctrine, and had written a learned criticism, not of the opinion of Mr. Malthus, but of that which 'the multitudes who have followed, and the few who have endeavored to oppose,' Mr. Malthus assumed to be his opinion." Now, Mr. Bonar's book may be expected to have, in two ways, some effect in removing this kind of ignorance: for, on the one hand, he gives a sufficiently full account, not only of Malthus' theory, but of his book, to show that Malthus had considered the subject from every point of view, and had collected and discussed with pre-eminent sagacity a large array of facts affecting and affected by his doctrine of population; and, on the other hand, his account of the history of the book and its author is calculated to awaken sufficient interest to lead many to read Malthus himself.

A few specimens of Mr. Nossig's work will serve to illustrate its character. "The methods and the economic stand-point of Malthus may be recognized from the way in which he groups the subjects of his investigation. On the one side he places man and his tendency to multiply; on the other, the earth and its productivity. These ideas he isolates, *without recognizing a reciprocal influence between man and the soil.*" It would not be a gross exaggeration to say that there is scarcely a page of Malthus in which this reciprocal influence is not recognized. Malthus continually considers the power of agricultural and social improvement to increase the productivity of a given territory; but he continually insists that it is impossible for this power to keep pace for a long period with the increase of population, which would result from a state of general comfort, without the presence on a large scale of preventive or destructive checks.

Nossig goes on to say that it was in this way easy for Malthus to deduce that "simple mathematical scheme which, among others of his followers, John Stuart Mill accepted. This distinguished thinker, however, who so clearly expounded the difference between the various methods of sociological investigation, . . . overlooked (*hatte übersehen!!*) the fact that his master based his whole theory upon the erroneous geometrical method." The idea of Mill's 'overlooking' the fact that the Malthusian theory, which he accepted, was based upon a method he condemned, is ridiculous. The notion that it *was* based upon the 'geometrical method' has no logical foundation whatever, and has for its sole apparent origin the fact — an unfortunate one, as Malthusians in general will admit — that Malthus gave a conspicuous place in his exposition to a mathematical expression which was intended rather to facilitate the comprehension of the effects with which he was dealing than to convey any thing like an exact statement of the phenomena. But taking the matter at its worst, and supposing (what is thoroughly false) that the contrast of the geometrical increase of population with the arithmetical increase of food were an essential part of the Malthusian doctrine, there is not the faintest trace of the 'geometrical method' in the mode by which Malthus arrived at it. He deduced his law of population from observation of man and the world.

Mr. Nossig finds it no harder to explain Darwin's than Mill's acceptance of Malthus' views: "Darwin was no sociologist, and in the theory of Malthus he saw only a detached item (*moment*) of actual natural relations; hence he accepted it." Space will not permit us to show how Mr. Nossig misapprehends Darwin's own doctrines, and misapplies his misapprehensions to Malthus; but the reader will probably absolve us from the duty of detailed criticism of a writer who thinks he is saying something relevant to the Malthusian problem when he cites the fact that while in two years a human pair can at most double their numbers, a grain of wheat can in the same time be increased a thousand-fold, and thereupon inquires, "Does there, then, actually exist in nature the tendency to make the products which serve for the nourishment of human organisms multiply less rapidly than these organisms?" But if any one thinks that the commission of this favorite *bêtise* of anti-Malthusians is in some way pardonable, he may perhaps find himself able to determine the genus of writers to which Mr. Nossig belongs by the following passage in the constructive portion of his production. In the formulas E denotes the 'evolution' of the human society in question, g denotes the social force of gravitation (or conservatism), and T the force which is 'represented by the struggle for existence:'

"We know that $E = f(T, g)$. Now, T is a function of the reproductive force R, which function we shall express by ϕ, so $T = \phi(R)$: hence $E =$

$f[\phi(R), g]$. Hence it follows that the evolution itself is a function (F) of the reproductive force and the social force of gravitation, $E = F(R, g)$. In consequence of this we may say, conversely, $R = \Psi(E, g)$, where Ψ expresses the function represented by R." The last of these equations is marked III, being the third and last of the great formulas arrived at by Mr. Nossig.

We cannot take leave of Mr. Nossig without an apology to our readers for having given him so much space; but our defence is twofold. In the first place, it seemed worth while to stigmatize even so worthless a production when it had been accorded forty pages of space in *Kosmos;* and, secondly, although Nossig's childish endeavors at theory-making serve to expose his incapacity for scientific thought, his criticisms are not unfair specimens of a large part of anti-Malthus literature.

In speaking of Mr. Bonar's book there is less occasion for criticism than for description. It is not intended as an original contribution to the discussion, but as an account of the discussion as it has actually taken place; though, to be sure, there are not wanting passages in which the author gives his own judgment upon the merits of rival arguments. He narrates how Malthus' first essay on population arose out of debates between Malthus and his father on the opinions of William Godwin, and shows how the impression produced by this first essay decided the bent of its author's life, and how the second essay, published five years later (in 1803), differed from the first through being the embodiment of extensive personal observation as well as reading and reflection. This is followed by a detailed account of the larger essay, so far as it relates immediately to the question of population in a narrow sense; and after this we have a summary of Malthus' views on the greatest economic questions, not only as they appeared in his great essay, but also as he presented them in his other works. We shall not attempt to give a summary of a summary, but it may be worth while to direct attention to one or two points which will perhaps be surprising to those who fancy that humanity and moderation are a new thing in political economists. To such men it may sound strange to hear that "to Malthus the discovery of truth was less important than the improvement of society. When an economical truth could not be made a means of improvement, he seems to have lost interest in it." Nor will they be less surprised to learn that he had "the virtue of refusing to join the economical Pharisees, who would not admit the elasticity of economic laws, lest they should discredit their science." And though it is the followers of Ricardo whom Mr. Bonar here designates as the economical Pharisees, one may profitably ponder the words which Mr. Bonar quotes from a letter written by Ricardo to Malthus: "Our differences may, in some respects, I think, be ascribed to your considering my book as more practical than I intended it to be. My object was to elucidate principles; and to do this I imagined strong cases, that I might show the operation of these principles." The misfortune of the matter is not that the critics, but that the followers, of Ricardo imagined his book to be 'more practical than he intended;' and thus it has happened that economists of the present generation, finding as the most conspicuous effect of Ricardian teaching the prevalence of certain practical dogmas, have thought that in exposing the untenableness of these dogmas they were overthrowing the scientific method on which the theory of political economy had been built up.

The last three chapters of Mr. Bonar's book are devoted respectively to Malthus' views in moral and political philosophy, to 'the critics,' and to the biography of Malthus. The chapter on the critics is one of the most interesting in the book. The whole work shows evidence of the most minute and painstaking study: in fact, it would, we are convinced, have been decidedly more useful had the author not been quite so well informed as to the exact changes made in successive editions, and had he omitted many details which were necessary in the time of Malthus, but which are without interest now. The book might, without loss, have been greatly abridged; and, as the main service it will render is to make Malthus more readily accessible, this would have been an important improvement.

THE FORMS OF SHIPS FOR WAR AND FOR PEACE.

AMONG a collection of very valuable papers recently published by the British institution of civil engineers, is a report of a lecture of exceptional value by the great naval architect, Sir Edward J. Reed. The address was a short one, but very comprehensive. The speaker begins by comparing the conditions affecting the long and the short ship of equal weight-carrying power, showing that the character of the work for which the vessel is intended, and even the nature of the material of which its hull is composed, are circumstances affecting the form of maximum efficiency. The long ship of small wave-making action, but of great friction-producing power, is shown to be best for the case of light hull and heavy loading: the short, broad vessel, on the