

They certainly show that the time for optimistic congratulations is not yet reached.

The other general conclusion of the report that such falling off in health during college life, as did appear, is due rather to predisposing causes, than directly attributable to college life itself, brings out some very interesting contributions to the scanty generalizations we already possess, concerning the relations between health and social environment. First as to heredity: A total of 35 per cent report a tendency to disease inherited from one or both parents. Those inheriting tendency from one parent only present some slight falling off in good health when compared with the entire average; while for those inheriting from both 58.3 per cent are in good health; 41.7 in poor, the average for all being 83 and 17 per cent respectively. For the 65 per cent inheriting tendencies from neither the figures are 85 and 15. As to relative change there is for those inheriting from both a relative decrease of 19.5 per cent in those having excellent health; an increase of 24.6 per cent in those having poor; the corresponding figures for those inheriting from neither being an increase in good health of 2.6 per cent, a decrease of poor of 1.6. The following tables show the effects of exercise, worry and study upon health:

EXERCISE.

Hours taken.	Health.	
	Good.	Poor.
	Per cent.	Per cent.
0-2.....	75	25
2-6.....	83	17
6 and over.....	84	16

WORRY.

Concerning.	Health.	
	Good.	Poor.
	Per cent.	Per cent.
Study.....	80	20
Personal affairs.....	75	25
Both.....	68	32
Neither.....	92	8

The differences in the last two results furnish one of the most interesting contributions yet made to the student of sound sanitary, social, and moral conditions.

STUDY.

Amount.	Health.	
	Good.	Poor.
	Per cent.	Per cent.
Moderate.....	85	15
Moderate to severe.....	83	17
Severe.....	79	21

The report upon the whole is surprisingly full. For the social student, however, it presents

certain notable deficiencies. The physical, social and moral environment of the students during college requires infinitely more investigation. The details concerning intellectual surroundings are comparatively full, though the number of hours of study should be given instead of the indefinite terms, 'moderate,' 'severe.' The inquiries concerning social surroundings are virtually confined to the inquiry as to whether the person 'entered society,' a little, a good deal, or none. Such vague expressions are worse than none. The question is as to how the student spent the hours of social recreation, and how many were so spent. The complete answer of this question, it is hardly too much to say, would throw more light on the hygienic problem than almost all else. It should include information as to whether the institution is female only or co-educational; what its social relations are to the town in which it is situated, the nature of the town; whether the young women live in dormitories, in cottages, in selected homes, or in ordinary boarding-houses; what regulations, if any, the faculty have made concerning study hours, and the hours not spent in study; whether the institution has a matron; whether her duties extend to moral and social matters, or to physical only; whether the institution has a gymnasium, etc. Complete answers to such a protocol of questions as these suggest would show what was meant by saying that 81 regard bad sanitary conditions as cause of their diseases, 135, constitutional weakness, and 73, emotional strain. If the association will study the conditions of the problem along this line, and frame questions accordingly, they will deserve still more at the hands of both the scientific educator, and the social student. Meanwhile we will be thankful for what we have.

JOHN DEWEY.

THE CLAPP-GRIFFITHS BESSEMER PLANT.

THE Bessemer process of converting molten cast-iron into steel by oxidizing and removing its carbon and silicon by blowing immense volumes of air through it, appears to be entering a new phase. Aiming for many years almost solely at the production of rails, the captains of the Bessemer industry found it much easier to satisfy the demands of purchasers as to the quality of their product than those of their employers as to its quantity. Hence arose the present type of Bessemer plant, in which no expense of construction is spared which promises to increase the quantity and thus to diminish the cost of the product. To-day, however, the uses of Bessemer steel are being rapidly extended and diversified. While most of the new demands

can be most naturally and economically supplied by the large Bessemer works in our manufacturing centres, the magnitude of whose operations enables them to profitably employ the best talent and machinery and to produce at the smallest cost, geographical conditions occasionally favor the erection of small steel works; for example, where a special demand for Bessemer steel, too limited to warrant the erection of full sized works arises in a place remote from all existing Bessemer works, and where pig-iron is cheap, owing to the immediate vicinity of iron blast-furnaces. Here it might be cheaper to convert the local pig-iron into steel at local works, even if they be so small that the cost of treatment is somewhat high, than to transport the iron to distant works, have it there converted into steel, and then bring it back to the starting point.

To meet such cases several small and comparatively cheap arrangements of the Bessemer plant have been designed, and one of these, the Clapp-Griffiths, has kindled quite a glow of interest in this country, which judicious and energetic fanning and puffing bid fair to convert into a veritable craze. Since the arrangement aims at a comparatively small output, some sacrifice of rapidity and cheapness of working are properly made in order to diminish the cost of the plant itself. The costly rotating converters of the ordinary plant are replaced by the cheap Swedish stationary converter. The blast is introduced, not as in the ordinary converter at the bottom of the deep bath of metal, but near its upper surface, so that, having little resistance to overcome, blast at low pressure, and hence furnished by cheap blowing apparatus, may suffice. Moreover, towards the end of the operation and while the steel is being tapped out of the converter, the blast is admitted very slowly, to avoid 'over-blowing'; and a hole is provided in the shell of the converter at such a height that the slag runs out through it during the converting operation. I mention these latter details because they are supposed to play an important and unlooked-for part in the chemistry of the process; indeed, the plant itself, of good but not remarkable design, is of interest to the readers of *Science*, chiefly because it is claimed that it removes silicon more uniformly and completely than the ordinary Bessemer plant does. The effect of phosphorus in rendering steel brittle has long been known to increase with the proportion of carbon present. A percentage of phosphorus which would have little effect on steel containing only 0.15% carbon would change steel with 0.5% carbon from a valuable ductile metal to a worthless brittle one. While some have maintained that silicon *counteracts* the effects of phosphorus, many have long be-

lieved that like carbon it greatly *exaggerates* them. This belief is somewhat strengthened by the fact that phosphoric samples of Clapp-Griffiths steel, when low in both carbon and silicon, are surprisingly ductile. But whether their ductility be due merely to low carbon or to the combination of low carbon with uniformly low silicon, it is interesting to inquire whether it be due to conditions which can be regularly imitated in the large scale Bessemer works; if it be, then, since the magnitude of their operations enables them to produce more cheaply, an important if not the chief ulterior result of the development of the Clapp-Griffiths plant and practice will probably be to teach the metallurgists of our large works how to produce more uniformly ductile steel from given pig-iron, and, aiming at a given degree of ductility, to employ more phosphoric, and hence cheaper, pig-iron than heretofore. Let us, therefore, consider the explanations which have been advanced of the results obtained in the Clapp-Griffiths practice.

1. The uniformly thorough desilicidation has been attributed to the unusually low blast pressure employed. While it is conceivable that, by increasing the tendency of carbon and oxygen to dissociate this might favor the oxidation of silicon, this explanation seems far fetched and insufficient. But, if low blast pressure be the cause, the ordinary Bessemer works can employ it by making their vessels wider and the bath of metal shallower than at present.

2. It has been attributed to admitting the blast near the top instead of at the bottom of the bath of metal; this is supposed to cause a local excess of oxygen in the upper part of the bath with the formation of iron-oxide (the copious evolution of red smoke at the commencement of the operation is adduced as evidence of this) which is supposed to attack silicon rather than carbon. But the early appearance of iron-oxide in the flame of the Clapp-Griffiths converter may indicate, not that it is a more active, but actually a less active agent than in the ordinary converter (I will not pretend to say what its true significance is). If we confine our ideas to a very minute quantity of metal immediately in front of any one tuyere of the ordinary converter we realize that, in this restricted space, oxygen is nearly, or perhaps quite, as much in excess as it is in a similar space in front of a Clapp-Griffiths tuyere. If iron-oxide forms in the latter, it will also, and perhaps to an equal extent, in the former. We do not see it escaping from the ordinary converter, probably because it is reduced by the carbon and silicon and slagged by the silica it encounters in its long upward path through the superincumbent metal, while in the Clapp-Griffiths converter, dragged along by the blast, its

travel to the upper surface of the metal is so short that it does not have opportunity for complete reduction and slagging. Now iron-oxide can only remove silicon by being reduced by it, or by combining with already formed silica and thus preventing its reduction. Its appearance in the flame of the Clapp-Griffiths converter at a period when it is absent from that of the ordinary converter may indicate, not that it is formed more copiously, but that it is reduced and slagged less completely in the former than in the latter.

3. It has been attributed to the partial removal of the slag (whose silica might have been reduced had it remained as it does in the ordinary converter) during the converting operation. But the slag can be removed from the ordinary large rotating converters as well, and without serious expense or trouble, by turning them down 90° and skimming it at any desired stage of the process.

4. Finally, there are scoffers who say, "We believe that the removal of silicon bears the same relation to that of carbon in your converter as in the ordinary converter. Your analyses, apparently intended to show that your converter specially favors the removal of silicon, do not even point in that direction. The ductility of your phosphoric steels is indeed due to their being uniformly low in carbon and silicon. But this in turn is due to your admitting the blast so slowly towards the end of your operation that you can hit the point of complete removal of carbon and silicon more accurately than we can in our large converters with our present practice of blowing rapidly to the very end. But many feasible plans at once suggest themselves by which we may accomplish this in the ordinary converters. Creditable statements that at least one large scale Bessemer works is actually producing steel as uniformly low in carbon and silicon as yours, strengthen this belief."

It is too early to decide positively which, if any, of these explanations is the true one. If any of them be, it is highly probable that the excellent metallurgical results of the Clapp-Griffiths practice will be successfully imitated by the large Bessemer works.

The validity of the claim that the Clapp-Griffiths steel is superior to that of identical composition made in the ordinary converter can only be admitted on the production of far more conclusive evidence than has yet been offered.

HENRY M. HOWE.

ACTIVITY OF THE MIND DURING SLEEP.

IN connection with the present activity in psychical research, the following extract from the recently published 'Life of Agassiz' (Boston, Houghton, Mifflin & Co.) is of interest:—

"He [Agassiz] had been for two weeks striving to decipher the somewhat obscure impression of a fossil fish on the stone slab in which it was preserved. Weary and perplexed he put his work aside at last, and tried to dismiss it from his mind. Shortly after, he waked one night persuaded that while asleep he had seen his fish with all the missing features perfectly restored. But when he tried to hold and make fast the image, it escaped him. Nevertheless, he went early to the Jardin des plantes, thinking that on looking anew at the impression he should see something which would put him on the track of his vision. In vain,—the blurred record was as blank as ever. The next night he saw the fish again, but with no more satisfactory result. When he awoke it disappeared from his memory as before. Hoping that the same experience might be repeated on the third night, he placed a pencil and paper beside his bed before going to sleep. Accordingly, toward morning, the fish reappeared in his dream, confusedly at first, but, at last, with such distinctness that he had no longer any doubt as to its zoölogical characters. Still half dreaming, in perfect darkness, he traced these characters on the sheet of paper at the bedside. In the morning he was surprised to see in his nocturnal sketch features which he thought it impossible the fossil itself should reveal. He hastened to the Jardin des plantes, and, with his drawing as a guide, succeeded in chiselling away the surface of the stone under which portions of the fish proved to be hidden. When wholly exposed, it corresponded with his dream and his drawing, and he succeeded in classifying it with ease. He often spoke of this as a good illustration of the well-known fact, that when the body is at rest the tired brain will do the work it refused before." (p. 181.)

DEATHS FROM WILD BEASTS AND SNAKES IN INDIA.

From time to time the Indian government issues reports on the yearly loss of life by snake-bite and wild beasts,—reports which still show a frightful mortality from these causes, and afford significant evidence that the present precautions and exertions of the government in this direction still fall wide of their object. The latest intelligence in the *Gazette* states that in 1883 about 22,000 men died from the above mentioned causes. The returns from the district authorities can by no means be considered complete and satisfactory, since in consequence of the apathy of the natives and the almost universal belief among them in kismet, or predestination, many cases are not reported at all

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