immense majority of scientific workers, and the few materialists who presume to speak in the name of their scientific brethren have no brief so to represent them. The cool assumption that biologic science is coterminous with physics is difficult to correctly characterize—politely. The refutation of that dogma has been made a hundred times and no adequate answer to these refutations has ever been made. Take one of these refutations, Beale's *Protoplasm;* no dispassionate and logical mind, knowing aught of the history of science or the laws of logic, can deny that the arguments and facts there set forth leave the dogmas of scientific materialism smashed to utter and everlasting smithereens.

An amusing corollary of the scientific dogmatists is that "consciousness and volition cannot cause structure or anything else," and that function is always the result of structure. This is, of course, necessary to the materialistic dogma, but "it can be stated without fear of refutation" that no one, not even Professor Brooks, ever observed a single fact of physiology, plant or animal, in which function did not precede structure, and surely before he could write his denial his 'consciousness and volition' set to work the machinery that moved his pen. Are the pseudopods of the amœba 'structures?' Did not the function of amœboid locomotion precede the locomotion of truly structural organs, such as feet and fins? Did not the desire for movement precede amœboid movement? Did not the desire create the structureless pseudopods? If function is always the result of structure, what then created the structures, *e. g.*, the million structures of the unborn fetus? The logic of the situation is that as 'consciousness and volition' have no organs, so far as any scientist knows, of which they are the outcome, it follows that consciousness and volition are only 'the empty shadow of changes that go on in the physical basis'—*i. e.*, they do not exist. If the facts do not tally with our theory so much the worse for the facts—let's flatly deny them existence. Of 'beliefs held because they cannot be disproved,' the most perfect of illustrators are surely those children in science who dogmatically wage Quixotic warfare against dogmatism.

Of the many charming self-contradictions of Professor Brooks' delightful letter that I should like to mention, none is more suggestive than his 'demand' that we accept as our sole scientific creed the desire to find out "whether life is or is not different from matter," and "whether thought is or is not an agent," and yet the beginning, middle and end of his entire letter is, one might say, soaked in the dogma, determined in advance, that there is no 'whether' at all, and that it 'is flatly contradicted by most investigators.' His contempt for those who still entertain the 'whether' is,—to put it most courteously—the limit of childish *naïveté.*

GEORGE M. GOULD.

PHILADELPHIA, October 15, 1895.

THE INVERTED IMAGE ON THE RETINA AGAIN.

PROFESSOR BROOKS' statement concerning the inverted image on the retina, in a late number of SCIENCE, has called to my mind an experiment in optics which I stumbled upon as a boy one Sunday night in church when the sermon had extended beyond my powers of listening. As I have not seen an account of the experiment in the usual statements regarding the demonstration of the inverted image on the retina, I venture to give the matter for whatever it may be worth.

My attention having been attracted by the 'beams' of light which seemed to shoot off towards the ceiling and toward the floor from one of the gas jets of a chandelier, I aimlessly pushed against the *under* eyelid with my finger, and was surprised to see one of the beams of light, the *upper* one, shorten and lengthen, according to whether I opened or shut the lower lid. On repeating the experiment with the *upper* lid, I obtained the same results on the beam which appeared to pass *downward* from the gas jet. By closing one eye and carefully squinting with the other at the distant gas jet and working my eyelids in the manner above described, it was at once evident that the outer termini of these beams were cut squarely off, and that the end farthest from the gas light was in some way by refraction hinged to the edge of my eyelid. In short, as these red 'rays' formed part of the opposite sides of a cone, with the gas light at their apex, and the base at the contact of the edge of my eyelids

upon the cornea, it was evident that the whole phenomenon, gas light included, was in my eye so far as sight was concerned. In short, since, when a movement of the lower lid lengthens or shortens the 'rays' which appear to shoot upward toward the ceiling, and a movement of the upper lid *vice versa*, one can see that the image in his eye is inverted, because the sides of this cone and the background of the room are reversed.

If one will work this experiment to the point of perceiving that the picture of the outside world is entirely in his eye, he may come, as I did, to the fearful demonstration that even in 'full light' outside of his eye all is in a certain sense total darkness. It is a dreadful momentary concept, more dejecting than the fear which attends the coming on of blindness from destroyed vision. J. B. Woodworth.

Cambridge, Mass., October 12, 1895.

It follows from Mr. Woodworth's observation that the image on the retina is inverted. The 'rays of light' are not, of course, objective, but are due to imperfect accommodation. The light from a gas jet passing through the lower half of the pupil is in part refracted downward, affects the lower half of the retina, and is projected as rays extending upward. The same inference can be drawn from an examination of *Purkinje's figures* (the blood vessels of the retina), subjectively and objectively; or, indeed, by pushing the eyeball upward, in which case objects seem to move downward.

It is commonly believed that the external world sends up through the nerves little images of itself which are examined by the mind. This seems to the present writer a 'dejecting concept.' *Per contra*, the fact that the world in which we live is a mental construction assigns to mind its due place in the universe.

J. McK. C.

'CRYING WITH TWO EARS.'

In Science for October 11th (page 487), Professor J. McK. C. corrects an inaccuracy in Professor Brooks' statement concerning the inverted image. He closes his criticism with the paragraph: "A similar paradox is the fact that with two images on the retinas we see things singly. This may also be treated without undue seriousness by the question: 'If we hear a baby crying with two ears, why do we not think it is twins?'" What terrible sort of baby is it that cries with two ears? I protest against such a little monster. Is it not sufficient that a baby cry with one throat, and that we hear it with two ears? And are there not times when we think it is triplets? W. H. Fishburn.

Second Presbyterian Church,
Columbus, O., October 12th, 1895.

INACCURATE ZOÖLOGY.

The Editor of Science—*Sir:* It appears to me that zoölogists should endeavor, whether for their own good or that of the science they cultivate, to see that popular zoölogical works are prepared by zoölogists, instead of being compiled by persons comparatively ignorant of the subject. Perhaps the most effectual means to this end consists in pointing out the inaccuracies of works which have not been written with sufficient knowledge, so that the public may be more careful about what it accepts. No one appreciates more than the present writer the great difficulty of ensuring perfect accuracy, and it is not suggested that those who might be criticised have not done the best in their power; the point is, rather, that the services of specialists should in every case have been secured.

Even so, curious errors will sometimes appear; perhaps usually due to the writer trying to cover too much ground. Thus in the *Standard Natural History* there is a figure of a *Pulvinaria*, called '*Coccus adonidum*;' this latter name belonging really neither to a *Coccus* (as now understood) nor a *Pulvinaria*, but a *Dactylopius!*

A few days ago the new *Standard Dictionary of the English Language* (Funk & Wagnalls Co., 1895) was received, and on looking over it I at once stumbled on the following curious items:

(1.) The cotton scale-insect is 'a bark-louse (*Pulvinaria innumerabilis*).' There is no recognized cotton scale-insect in this country, though there are scale-insects which affect cotton. *Pulvinaria innumerabilis* is not a cotton species, but affects maples in the North. *Cottony* scale is doubtless what was intended.