

of what he himself writes, requires, I frankly admit, a larger share of "human ingenuity" than I possess. The present is not the first occasion on which Dr Nicholson has thought fit to criticise his critics. I freely admit the right of every author to reply to any statements of a reviewer through which he may reasonably feel aggrieved. But the reviewer has, at the same time, a right to expect sound argument and not mere cavilling. On the next occasion on which Dr Nicholson thinks fit to reply to a reviewer in the terms used in his letter, I trust he will succeed in justifying his use of the words "honesty," "fairness," etc., so prominently displayed in his present communication, as fully as he has succeeded in being both querulous and self-contradictory.—THE REVIEWER.]

---

*To the Editor of the Edinburgh Medical Journal.*

SIR,—As I had not an opportunity of fully replying to the gentlemen who made remarks on the paper that I lately read before the Medico-Chirurgical Society, would you insert the following paragraphs in your Journal?

Professor Sanders, in the course of his observations, used a sort of *a priori* argument in stating that no sound can be produced by contraction of the auricles. But how can we determine whether or not a sound is produced by contraction of the auricles except by listening to the action of the denuded heart in a living animal? And, in the course of our experiments, we have so frequently heard the second sound of the heart produced by contraction of the auricles, that the fact is placed beyond every possibility of a doubt. But it is admitted that the pre-systolic sound is produced by contraction of the auricles, which settles the matter so far as relates to the power possessed by the auricles of producing a sound during their contraction. And at what time is this sound produced? It is admitted that it is during the diastole of the ventricle that the auricles contract and bring the ventricle to the point of distension. And you say that the closing of the aortic valves, which produces a sound, takes place synchronously with the diastole of the ventricle. We have, then, in this case of morbid action—constriction of the mitral orifice—two sounds produced, according to your view, during the diastole of the ventricle, and one during its systole, for the ventricular contraction, as is well known, produces a sound.

But we must explain these phenomena according to the principle on which the action of the heart is maintained. We have stated that the first sound of the heart consists of that of the contraction of the ventricle and reaction of the aorta, which take place together in producing the full blood-wave. But when the action of the heart becomes much weakened or irregular from disease, this sound is heard with a slight break in it, which you term the first and second sounds of the heart; but in the normal and vigorous action

it is always united, and constitutes one prolonged systolic sound—the first sound of the heart. And the second sound, produced by the vigorous contraction of the auricles, immediately follows the first. But here, the auricles being later in contracting, the sound which they produced is brought more immediately into connexion with the ventricular sound. Hence you have three sounds instead of two.

Dr Balfour, in the course of his remarks, endeavoured to show that much difficulty must be experienced in determining the cause of the first sound of the heart in a case where two tiers of semilunar valves existed at the origin of the aorta—a remark totally inapplicable to the subject; for this difficulty did not obtain in the case of the alligator terrapin, where there is only a single tier of semilunar valves. We had, some time since, presented to Dr Balfour the heart of a sturgeon fish, in which class of animals muscular fibres are continued from the ventricle along the aorta for an inch or more; and, in adaptation to the increased power of the aorta, two tiers of semilunar valves are placed at its origin, evidently, as we stated, to resist the increased force of the blood recoiling against them as the aorta reacts or contracts to produce the full blood-wave. But we made no allusion to a sound being heard, or attempting to hear one.

We had previously shown the same preparation to some eminent physicians in London, and also in Paris; but these gentlemen had no difficulty in comprehending the meaning of the language we used.

The experiments we performed were too carefully conducted, and too accurately tested, to be liable to Dr Balfour's objection. And we surely have had much better opportunities of investigating this subject in the denuded heart of living animals, both in cold and warm-blooded, than those with which physicians are generally favoured; and the circumstance that the doctrines we advance are new, and calculated to produce a change in views that have been long accepted, ought not to militate against them. The question to be determined is, Are these statements based on facts? But we need not *re-enter* on the proposition that we have so fully illustrated, and which is acknowledged by mathematicians, philosophers, and other scientific men,—that you cannot propel a wave of fluid along an elastic tube like the aorta without the distended walls reacting and closing the valves at the orifice to produce the full wave. Whatever objections you may urge, you cannot deny this important law in physical science; and as the ventricle, on being fully contracted—shortened in its fibres—exerts a strain or slight retraction on the base of the distended aorta that produces its simultaneous reaction, the sound produced in closing the aortic valves is a systolic sound, and identified with the first sound of the heart, and the second sound is produced by the contraction of the auricles, and connected with the diastole of the ventricle.

G. PATON.