Correspondence.

"Audi alteram partem."

THE JUBILEE OF ANÆSTHETICS.

To the Editors of THE LANCET.

SIRS,—With reference to the allusion made by Sir Joseph Lister at the British Association on the jubilee of anæsthetics I should like to say that the Society of Anæsthetists have not been unmindful of this important date and are taking steps to celebrate the occasion. In order that this may be done in a fitting and proper manner it is, of course, very desirable that we should solicit the coöperation of the profession at large, and I would take this opportunity, therefore, of asking those who are interested in this great anniversary to place themselves in communication with our secretaries—Mr. Walter Tyrrell and Mr. Carter Braine.

I am, Sirs, yours faithfully.

G. H. BAILEY,

Hanover-square, W.,
Sept. 23rd, 1896.

President of the Society of Anæsthetists.

"WHY IS THE LEFT HEART STRONGER THAN THE RIGHT?"

To the Editors of THE LANCET.

SIRS,—The problem which Dr. Harry Campbell presented under the above heading in THE LANCET of July 4th, and which he there attempted to solve, seems to me becoming obscured by the criticisms of Dr. Haig and Dr. Morison. Dr. Haig remarks: "Surely it is gravity that makes the great difference between the work required of the left heart and that of the right." Since gravity acts downwards, and in the upright position most of the large arteries in man are, on the whole, below the level of the heart, gravity would help the blood to flow away from the left heart and decrease rather than increase its work. In the horizontal position it would act indifferently. Gravity would doubtless increase the work of our left heart if we habitually stood on our heads. Dr. Morison¹ says: "I cannot agree with Dr. Campbell that 'the complexity of a system of tubes does not necessarily increase the resistance to fluid circulation in it.'" The following consideration will, I think, justify Dr. Campbell's statement. Suppose v = the velocity of fluid in a tube A of radius R. If F = the friction per unit length of the tube A, F varies as $\frac{v^2}{R}$. If the tube A bifurcate into two tubes B and C, each of equal section with that of A, it is obvious that the velocity of the fluid in each of these tubes will be $\frac{v}{2}$. If F' be the friction per unit length of these tubes with a velocity $\frac{v}{2}$ of the contained liquid F' varies as $\left(\frac{v}{2}\right)^2$, that is as $\frac{v^2}{4R}$ or for the two tubes as $\frac{v^2}{2R}$. Hence, by increasing the complexity of a system of tubes in which fluid is flowing it is possible to decrease resistance. In the case I have given the resistance is halved.

If the tube A bifurcate into two tubes B and C whose radii are $\frac{1}{\sqrt{2}}$ of that of A, the frictional resistance will remain unchanged. If the radii of B and C be less than this, the total frictional resistance of B and C per unit length will be greater than that of A. Dr. Morison seems to me also in error in supposing that "the weight of the blood to be moved" is an essential cause of the cardiac difference in question.

If a train of 50 tons weight were loaded with another 50 tons its weight would be doubled, but it would not be twice as difficult to push, and if friction could be eliminated a heavy train would be as easy to keep moving as a light one. The greater mass of blood in the systemic circulation by the greater total of friction points it presents might, however, increase the systemic resistance. Perhaps it was

in this sense Dr. Morison meant that increase of mass implied increase of resistance. Dr. Campbell's contention that a special resistance is interposed in the precapillary area of the systemic circulation to secure a sufficient blood pressure and facilitate variations in local distribution is, I think, doubtfully true, though full of the spirit of truth. That the resistance through friction "is relatively greater in the minute arteries than in the capillaries on account of the flow being more rapid in the former," as Dr. Foster states in his "Text-book of Physiology," is easy to admit; but for the same reason it ought to be still greater in the larger arteries, which he denies.

Is the chief resistance in these terminal arteries? It is not an essential condition for arterial distention. The Nile rises and overflows its banks though the Delta is a wide and free exit. I believe the left heart is stronger than the right because the systemic arterial system is narrowed throughout for the express purpose of increasing resistance and rendering possible and necessary a specially high blood-pressure. This high pressure is *useful* for facilitating local variations in blood-supply, as Dr. Campbell suggests, and it is *essential* to prevent a limb from becoming bloodless through gravity when elevated much above the heart, thus leaving us free to assume any attitude—I am, Sirs, yours faithfully,

Eltham, Sept. 5th, 1896.

D. W. SAMWAYS.

To the Editors of THE LANCET.

SIRS,—The answer to Dr. Alexander Haig's contention that it is gravity that "makes the great difference between the work required of the left ventricle and that of the right" is simply that the left ventricle has much the most work to do in the horizontal as well as in the vertical posture. What the influence of gravity on the work of the heart may be opens up a discussion which would lead us too far afield. I will merely point out that the argument Dr. Haig draws from the waterworks is based upon a false analogy. The water company has simply to drive the water up to a given height, and there is a very great difference between pumping a fluid up a tube against gravity and forcing it along a tube which after having ascended descends again. The force required to drive a fluid through a rigid U-shaped tube is exactly the same whether the bend be turned upward, downward, or horizontally, for in the first two cases the retarding tendency of gravity on the ascending current exactly neutralises its accelerating tendency on the descending current. This is the principle of the syphon. Were the bloodvessels rigid gravity would exercise no influence on the circulation, but being elastic they yield to pressure in the manner indicated by Dr. Haig, and this introduces a factor which space will not permit me to discuss. All I will say is that any influence which gravity exerts on the work of the left ventricle must be small. Thus while in the upright posture it works against the ascending flow in the arterial half of the carotid arc, it favours the flow in its descending venous half, and *vice versa* in respect of the descending aortic circuit. Or, neglecting altogether the influence of gravity on the venous flow, we may set the accelerating tendency of gravity on the large descending arteries of the body against its retarding tendency on the ascending arteries of the head and neck. In considering influence of body posture and of the elevation of the arms on the work of the left heart Dr. Haig neglects the effect of muscle contraction.

Turning now to Dr. Alexander Morison's second letter, I would first remark that it appears to me to leave altogether untouched my refutation of his first letter. As Dr. Morison frequently misreads my article I will briefly re-state its main argument. I contend that a special resistance, absent from the pulmonary segment, is placed in the arterial half of the systemic segment for a special physiological purpose; that the object of this resistance is to obtain a high systemic arterial pressure, this being needful for securing the necessary variations in the supply of blood to different systemic areas; that were there no need for such variations, and were the pulmonary and systemic vascular segments constructed on identical lines, differing only in respect of size, the pulmonary segment would offer much more resistance than the systemic, and the left side of the heart would be weaker than the right. I carefully avoided discussing the nature of this special resistance—how far, for instance, it might be due to differences of lumen in the two systems, and how far to differences in vaso constrictor activity. I may now, however, remark that it is largely due to the small bore of the systemic as compared with that of the pulmonary

¹ THE LANCET, Aug. 29th, 1896.