

under conditions of increased work, contracts completely, so that the chamber is emptied at the end of systole. From what I have said it will be seen that this is not the case. One can go further and prove for one's self that even under ordinary conditions the mammalian heart does not completely expel all the blood within the ventricles. By taking a dog that has been curarised and subjected to artificial respiration, opening the chest wall, making an incision at the very apex of the left ventricle, so as just not to completely enter the cavity, then it is easy to push the little finger into the cavity through the thin apex without the loss of a drop of blood. The heart action is not recognisably disturbed by this procedure, and it can be felt that while the walls of the ventricle in the lower two-thirds up to the apices of the papillary muscles, close completely round the finger, there is a clear space in the upper third which is not and cannot be emptied of blood.

Although it may seem at first sight to have no direct bearing upon the subject of this evening's discussion, nevertheless it is worth while to make a few remarks upon this subject, inasmuch as it is so intimately associated with conditions of hypertrophy without valvular disease. It is quite possible that where there is increased work to be performed by the heart, there is some economy of the action of the organ when there exists a certain amount of residual blood, in and dilatation of the ventricles. Taking the ventricular chamber as a sphere,\* there is this to be noted concerning the relationship between the circumference of the sphere and its contents, namely, that as a sphere expands its cubic contents increase out of all proportion, I was going to say, to increase in circumference, or more truly, the ratio between increase in cubic contents and increase in circumference is by no means an arithmetic ratio.

If the circumferences be taken as abscissæ, and the corresponding volumes as the ordinates, the curve of successive

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\* The sphere is the nearest geometrical figure that can be employed here for purposes of illustration.