movements of the cells. Whether this parallelism is due to a direct or merely to an indirect causal relation cannot at present be determined with certainty. It seems not unlikely that the ameboid movements, the spreading out of the cells and the dissolution of the granules are caused by certain metabolic changes which are induced in each instance by similar conditions. (The blood-cells of Limulus are a favorable object for demonstrating the effect of mechanical conditions upon blood cells leading to thrombosis and they can be used to advantage in courses of experimental pathology such as is given by the writer at the University of Pennsylvania.)

24 (116). **"On a course on the pathological physiology of the circulation,"** with demonstration of instruments, specimens, etc.: **W. G. MACCALLUM.**

In general in the teaching of pathology the anatomical alterations produced by disease are dwelt upon, and little attention is devoted to the detailed study of the alterations in function produced by these diseases. A course was arranged during the past year at the Johns Hopkins University to cover this ground and half of the new laboratory of experimental medicine was planned to give facilities for this work.

The aim of the course was to reproduce experimentally such diseased conditions as are seen by the students in the wards of the hospital so that they might be studied with the aid of any or all of the methods at the command of the physiologist and of the pathologist. The study of the anatomical changes which are usually found in such conditions was carried on together with these experiments.

It was planned to attempt the study of only a limited portion of the subject each year, and during the past term the diseases of the circulatory system have occupied the attention of the class. Next year it is intended to study the digestive system in a similar way.

Only those lesions were produced of which experimental study was certain to be of value — thus in the case of the pericardium, while various infections might have been used to give rise to an exudate, the blood-pressure relations, changes in heart-beat, heart-sounds, etc., were studied during the distention of the pericardium with water.

Similarly it was thought sufficient to study mechanical injuries of the heart-valves rather than to attempt their production with the aid of bacteria. Therefore, while the actual lesions were studied in the museum and histologically, the injuries to the valves were produced by cutting the valves with a special blunt hook having a knife edge on the inner side of the curve. The pressure relations were then rendered visible to the students by the curves traced in inks of different colors from cannulas inserted at various points in the circulation. Stenoses were produced by the application of a screw clamp about the orifice of the heart concerned and tracings taken in a similar way. These experiments are similar to those described by v. Basch and Moritz, but they are not subject to the criticism that they are made on a model of glass and rubber.

Murmurs could be heard and traced very accurately by the use of a stethoscope with very small bell, which could be applied directly to the ventricles or along the vessels. Thrills could be felt and the dilation and excessive activity of any portion of the circulatory apparatus directly observed. In this way there were produced and studied aortic stenosis and insufficiency, mitral stenosis and insufficiency, pulmonary stenosis, and tricuspid stenosis and insufficiency.

Lesions of the myocardium were simulated both by the mechanical destruction of the muscle substance and by the injection into it of such coagulating substances as alcohol, and the effects studied by the same method. Obstruction of various branches of the coronaries was also studied in detail.

The effect of the closure of various blood vessels was demonstrated as well as the effect of the dilation and contraction of capillaries in different regions, and the character of the capillaries of the lungs in this respect was studied. The mode of obliteration of blood-vessels after ligature and the accomodative changes which take place when the blood-supply is diminished and when collateral circulation is demanded were also considered.

The short course ended with the study of aneurysm, arteriosclerosis, and the experimental formation of thrombi and of infarcts on the introduction of foreign bodies as emboli.

The advantage which accrues to the student seems to be chiefly in his obtaining an intimate and first-hand knowledge of all the

details of processes commonly seen clinically but about which much theorizing must be done in the wards.

25 (117). **"On the blood-pressure relations in mitral insufficiency and stenosis": W. G. MACCALLUM** and **R. D. MCCLURE.**

In the course of experiments like those described in the preceding communication, blood pressure in various portions of the circulatory apparatus was recorded after mitral insufficiency had been produced by introducing a curved knife hook into the left auricular appendage and cutting some portion of the mitral valve — a systolic murmur could then be heard especially loud over the auricle and along the pulmonary veins with usually a thrill felt over the auricle. Interest attaches especially to the exact explanation of the hypertrophy of the right ventricle since, as Gerhart points out, there is an obvious obstruction to the flow of blood through the mitral orifice into the ventricle.

This is true only when the left ventricle at once accomodates itself to the condition by dilating to receive the excessive amount of blood which accumulates in the auricle, that is, the amount thrown into it from the right ventricle plus the amount regurgitated, and then succeeds in expelling it all. Unless this happens the auricle is unable to empty itself and a condition arises in which the amount of blood circulated is smaller than normal, the remainder being stagnant in the pulmonary circulation and the right ventricle is found to be driving a uniformly smaller amount of blood into a cavity (the pulmonary circulation) in which there is some stagnant blood and into which more is forced from the left ventricle during systole. The elevation of pressure from this stagnation need not be great and in the experiment where these conditions seem to prevail the pressure in the pulmonary is not much elevated. Ordinarily, however, the left ventricle dilates to receive the excessive blood, then regurgitates some and discharges nearly the normal amount into the aorta. The right ventricle then attempts to discharge into the pulmonary circulation the same large amount at the moment when the stronger left ventricle is also forcing into that cavity the amount constantly regurgitated. The pulmonary pressure is again not much elevated — not more than before but