A NEW FACTOR IN LYMPH FLOW

(Abstract)

A. V. Arlton

Before discussing the new factor, it might be well to review the old ones. They are as follows:

1. **Gravity.**—Perhaps this factor is not important in the flow of lymph. In itself gravity does not urge the flow of lymph onward; it is rather a retarding factor, especially in animals that are erect or intermittently erect. The factor varies with the position of the body.

2. **The Valves of the Lymph Vessels.**—The lymph vessels have many valves within them. Directly, the valves do not urge the flow of lymph forward; they simply keep the lymph from flowing backward. With this function the valves are rather auxiliary structures in the flow of lymph.

3. **Difference in Pressure.**—The pressure at the two ends of the lymphatic system is not the same. The flow of lymph is from a region of comparatively high pressure to one of low pressure. The pressure is greater in the small lymph vessels than in the larger vessels. Some of the plasma of the blood filters through the walls of the blood capillaries, due to the beating of the heart and the elasticity of the larger blood vessels of the arterial system. Besides filtration there are other factors at work in the formation of lymph; namely, diffusion, osmotic pressure, and an active secretory process of the endothelial cells of the capillary walls. These factors are fairly constant in the formation of lymph and are as constant factors in the flow of lymph.

4. **Movements of Various Kinds.**—

(a) Peristaltic movements of the lymph vessels. Such movements have not been observed. They presuppose thicker muscular walls than are found in lymph vessels. These two reasons seem to indicate that there are no peristaltic movements in the lymph vessels. Peristalsis cannot be considered a factor in lymph flow.

(b) Movements of the receptaculum chyli. Though no such movements have been observed, this part of the lymphatic system appears to be under the influence of dilatory

and inhibitory nerves. The evidence seems to point to the movement of the receptaculum chyli, and it would, therefore be a factor in lymph flow.

(c) Movements of sacs and lymph hearts. In certain animals there are pulsating organs which act in the manner of the heart of the circulatory system, expanding and contracting, forcing the lymph onward.

(d) Intestinal movements. The peristaltic movements and segmental movements of the intestinal tract aid in the flow of lymph by pressing upon the lymph vessels of the tract. The valves of the lymph vessels prevent backward flow.

(e) Movements of respiration. When inhaling, a vacuum tends to form in the thoracic cavity. This draws the lymph upward through the thoracic duct. Contemporaneously, there is a pressing down of the diaphragm, which decreases the size of the abdominal cavity. This tends to force the lymph in the lower portion of the thoracic duct upward. The movements of respiration are an important factor, and a constant factor.

(f) Movements of the body. Every movement of the muscles of the body presses upon the lymph vessels between them. The lymph is urged forward, because the valves in the lymph vessels prevent backward flow.

5. **Suction Action.**—This is a new factor. Ever since I was in the grades have I wondered what caused the flow of lymph in the lymphatic system of man. It was about the year 1905 that I first saw and used a suction pump for hastening filtration in a chemical laboratory. Almost at once did I see the similarity between the mechanism of the pump and the manner in which the thoracic duct joins the venous system. In 1920 I constructed from different sizes of laboratory rubber tubing an apparatus simulating the jugular and subclavian veins and the thoracic duct as it unites with the two veins. The two rubber tubing "veins" were attached to two separate hydrants, and the tube representing the thoracic duct was allowed to hang suspended into a bowl of water. The hydrants were turned on. As the water ran through the artificial veins, water could be drawn

up through the tube representing the thoracic duct. As far as I know this is the first time that such a factor has been demonstrated. It is not claimed that the new factor is the most important factor in lymph flow, but that it is one of the important factors.