Acute local blood flow regulation refers to intrinsic regulation, or control, of arterial vascular tone at a local level, meaning within a certain tissue type, organ, or organ system. This intrinsic type of control means that the blood vessels can automatically adjust their own vascular tone, by dilating (widening) or constricting (narrowing), in response to some change in the environment. This change occurs in order to match up the tissue's oxygen demand with the actual oxygen supply available in the blood as closely as possible.

For example, if a muscle is actively being utilized it will require more oxygen than if it was at rest, so the blood vessels supplying that muscle will vasodilate, or widen in size, to increase the amount of blood, and therefore oxygen, being delivered to that muscle.

There are several mechanisms by which vascular tone, and therefore blood flow, is controlled. The sympathetic nervous system and a variety of hormones, for instance, both exert some degree of control over vascular tone. However, the local intrinsic regulatory system described here is completely independent of these other mechanisms.[1] Many organs or organ systems have their own unique mechanism of local blood flow regulation, as explained below.