This letter is in response to the Point-Counterpoint series “The muscle pump is/is not an important determinant of muscle blood flow during exercise” that appeared in the July issue (vol. 99: 371–375, 2005; doi:10.1152/japplphysiol.00381; http://jap.physiology.org/content/vol99/issue1/2005).

The muscle pump indeed raises muscle blood flow during locomotion

Letter to Editor: Because well-trained running humans can develop cardiac outputs of 35 l/min with heart rates of 190 beats/min and stroke volumes increased to 189 ml (2), Clifford et al. (1), in their rebuttal, should have explained how vasodilatation, without a muscle pump, could account for such high flows through the active skeletal muscle. They should not have been so cavalier in declaring that “The emperor has no clothes”—the muscle pump is not an important determinate of muscle blood flow during exercise.” Laughlin and Joyner (3), in a 2003 Invited Editorial, stated, “It is possible that the muscle pump is of greatest importance in perfusion of active skeletal muscle in dependent limbs of humans.”

Clifford et al. (1) also state, “By definition, the muscle pump can only influence blood flow as long as venous pressure is reduced.” This unsupported definition does not apply to a pumping system that would increase the downstream venous pressure to increase right ventricular end diastolic volume and then stroke volume and cardiac output. There is a reason that venous valves evolved. As a corollary, atrial contraction increases flow into the ventricle near the end of diastole to increase the end diastolic volume to increase cardiac output. Their function is also minor during normal activity but becomes important during strenuous exercise. My Cardiovascular Interactions Project includes a six-compartment, closed-circuit mathematical model that helps understand the complex interactions between the heart and peripheral circulation during exercise (4). The muscle pump indeed raises muscle blood flow during locomotion.

REFERENCES

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