Cerebral blood flow is governed by the capillary pumps driven by electricity of neurons and their heat and CO\textsubscript{2} production. Hammock posture is the optimal one

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TO THE EDITOR: We applaud Dr. Zuj and colleagues (5) for their study describing the relative contribution of arterial CO\textsubscript{2} partial pressure (P\textsubscript{a}CO\textsubscript{2}) and brain level arterial pressure (BP\textsubscript{MCA}) for the syncpoe, prior- and post-head-down bed rest (HDBR). We appreciate their conclusion that cerebral blood velocity (CBV) is linearly dependent on P\textsubscript{a}CO\textsubscript{2} (considering limitations), whereas post-HDBR orthostatic responses were dominated by the reduction in BP\textsubscript{MCA}. We think the difficulties they encounter explaining these results stem from two misconceptions on which we have already alarmed: local blood flow regulation and venous return mechanisms (2–4). The former openly does not work in the case, since the dilatory effect of P\textsubscript{a}CO\textsubscript{2} on arterioles is not proven. From this misconception also comes the controversy between the apparent tone increase drawn from CBVF reduction and unchanged resistance area product until just prior to syncopoe. Considering the local blood flow regulation, the brain tissue is functionally closely related to the muscle one, which hints that the recently described capillary pump mechanism (3, 4) is also working in the brain. This explains not only CBVF linear dependency on P\textsubscript{a}CO\textsubscript{2} but also direct electrical stimulation of the neuronal capillary pumps. The instant impact is especially important for neurons, which are more sensitive to overheating than myocytes. This electrical stimulation perfectly explains for the first time the recent report that hyperemic response is four times stronger than the task-induced brain metabolism (1).

To illustrate the deleterious impact of the tremendous fallacy with the venous return mechanism in the orthostatic challenge [2, 4 (Ref. 3 therein)] we would ask: where is the place of the heart and its rate (HR) in the entire “story”? Authors say HR was monitored but evidently only to register its fall at the syncope. Where does the energy come from to elevate the venous blood to the heart level after it is delivered by the capillary pumps to the veins? Is it not “insulting” to the organ, with the formation of which life begins, to ignore its tireless efforts (increased rate) to elevate venous blood against gravity indirectly by hydraulic mutual induction, i.e., by arteriovenous pumps (AVPs) (2)? It is known that bed rest and more, HDBR atrophies the heart [2 (Ref. 9 therein)]. This atrophy hampers the action of AVPs, which is pulsation dependent. Said hampering is added to the one from the loosened muscles of the extremities on the tilt table (2). All this creates mismatching between blood supply to the veins and its elevation to the heart, which leads to increasing its storage below the level of the heart. That is the explanation of the syncope delay and its shortening post-HDBR.

It was proposed [2 (Ref.9 therein)] that in the head-up-leg-up (hammock) position the heart is the most unloaded, because in both body parts venous return is driven gravitationally and the heart is free from the most energy-consuming action—the inducive (transmural) transmission of energy to veins. In the head-down position, the body upper part is in unnatural position, in which venous return must be effectuated by induction through poorly valve-equipped veins. Hence, the specific energy for venous return is greater than for the lower part of the body in its normal (upright) position. In the 6° head-down “gold standard,” the atrophic effect comes from the fact that lower body is larger and longer than the upper one, and the economy of venous return energy in it is greater than the absolute losses in the upper part despite that the latter specific ones are greater. Losses in the upper part will be eliminated by placing it in natural position. Are humans mistakenly using hammocks as the most effective respite posture?

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