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Structure and function of the open circulatory system of spiders—a study applying histochemical and optophysiological methods

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Spiders possess like many other invertebrates an open circulatory system. But does this imply that haemolymph flows are homogeneously distributed within the open blood space? Or are spiders able, although capillaries and venous vessels are missing, to adapt blood supply to the oxygen requirements of tissues?

The structure and function of the circularory system in the tarantula *Eurypelma californicum* and the semi-transparent spider *Pholcus phalangioides* was studied using histochemical and optophysiological methods.

We focussed (1) on the regions in the extremities where the haemolymph leaves the arteries and enters the open part of the circulatory system and (2) on the venous backflow.

Corrosion casts and in-vivo injections revealed both in *Eurypelma* and *Pholcus* several side branches of the main leg artery. At the end of these branches the haemolymph enters the open blood space. Some experiments indicate that they may control blood supply for the neighbouring tissues by changing their diameter.

Immunohistological labeling of haemocyanin in *Eurypelma* showed that main blood flows in the open space are restricted to specific regions, which turned out to contain clusters of cells with high mitochondrial (succinic-dehydrogenase) activity.

Cellular oxygen requirements and haemolymph supply are obviously correlated (Paul et al., 1991, *Naturwissenschaften* **78**: 134).

In *Pholcus* a strong autofluorescence of the haemocytes and digital image processing allow to image venous haemolymph paths in vivo. Again a heterogeneous distribution was found. Cells with high oxygen capacity are probably better supplied with blood.