

OBSERVATION OF THE HYPOPHYSIO-PORTAL VESSELS OF THE LIVING RAT

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(Received 13 July 1948)

The hypophysio-portal circulation was first described by Popa & Fielding (1930). They believed the blood in it flowed from the hypophysis to the hypothalamus. Wislocki & King (1936) and Wislocki (1938) suggested, on indirect evidence, that the blood flow is from the median eminence of the tuber cinereum to the pars distalis. Since Wislocki & King's work there has been much uncertainty as to the direction of flow in this system of vessels. Available evidence regarding the blood flow may be summarized: (1) histological appearance of the vessels (Wislocki & King, 1936; Green, 1948*a*); (2) observations on glands in which the vessels had been incompletely filled with india ink (Green & Harris, 1947); (3) the site of arrest of fat emboli within the system (Morato, 1939); (4) slow injection of india ink in dead animals with observation of filling of the vessels (Green, 1948*a*); (5) india ink injections made into the aorta of anaesthetized rats with intact, hemisected or transected pituitary stalks, followed by immediate decapitation. Observations on the filling of the vessels with ink indicated the blood flow to be towards the pars distalis (Harris, 1948); (6) direct observation of the direction of blood flow in the living animal.

Clearly the last type of evidence is the most satisfactory, but so far such observations have been confined to Amphibia. Houssay, Biasotti & Sammartino (1935) observed the direction of flow in *Bufo arenarum*, and Green (1947) has likewise seen the flow in the hypophysial vessels of anaesthetized amphibians (*Rana catesbiana*, *Ambystoma tigrinum*, *Triturus torosus* and *Necturus*). Recently (Green, 1948*b*) it has been found possible to expose the hypophysis in *Rana catesbiana* under procaine anaesthesia and observe the course of blood flow for many hours. Since the operation is nearly bloodless and the animals are conscious, it is felt that conditions are almost ideal. As far as is known, no observations have been made on the circulation in living mammals.

METHODS

Rats were used since they possess long hypophysio-portal vessels, in a horizontal plane, which are readily approached and easily observed. Adult animals were anaesthetized with ether and tracheotomized. The facial artery and vein were ligated near the angle of the jaw and clamped dorsal to the angle of the mouth. The lower jaw was divided on either side through the angle and removed. As soon as haemostasis had been secured the soft palate was incised and removed except for a narrow rim. The periosteum of the skull was stripped beneath the sphenoid and anterior part of the basiocciput. The bone was then picked away with a dental scaling pick. A transverse venous sinus lies in the sphenoid beneath the stalk. This was opened and packed with beeswax. As soon as a clean field had been obtained the cancellous bone was scraped away until the shiny inner table could be seen. The remaining bone was then carefully picked away under a binocular dissecting microscope to expose the dura. The dura was pricked and the hole extended by tearing. For observation of the vessels an ordinary microscope was used ($\frac{2}{3}$ objective and $\times 9$ eyepiece, with oblique illumination from above).

RESULTS

A satisfactory exposure of the portal vessels was secured in twelve rats. It was seen that the median eminence of the tuber cinereum and pituitary stalk are clearly demarcated from the surrounding hypothalamus by their extreme vascularity. The rich capillary network of the median eminence extends into the pituitary stalk and collects to form the large portal trunks which may be observed to fan out into the sinusoids of the pars distalis. In all twelve rats the blood flow was seen to be from the median eminence towards the pars distalis. Under the $\frac{2}{3}$ objective the red blood corpuscles within the vessels were readily observed. In many cases the animals were in excellent condition and only lightly anaesthetized. A few, however, showed signs of surgical shock and an occasional vessel appeared thrombosed. These signs of damage were not associated with any change in direction of flow. The blood stream in the vessels appeared comparable in rate to that in the hypothalamic veins. The flow shows no signs of pulsation and is always of a uniform character. All the large vessels of the hypophysial stalk appear to carry blood caudally to the pars distalis from the dense capillary plexus of the median eminence. They cannot in any sense be regarded as T-shaped branches from the carotid artery.

DISCUSSION

These observations accord well with the concept of neurovascular control of the pars distalis (Harris, 1944; Green & Harris, 1947). Histological evidence indicates that a hypophysio-portal circulation is a constant feature in vertebrates from the Salientia to the Primates (Green, 1948*c*), even in those species in which the pars distalis is separated from the neurohypophysis by a dural septum (Harris, 1947; Green, 1948*b*).

It is felt that the above data provide the most direct and satisfactory evidence that the vessels of the hypophysial stalk are true portal vessels carrying blood from the median eminence of the tuber cinereum to the pars distalis.

SUMMARY

1. A method of exposing the hypophysio-portal blood vessels of the living rat is described.
2. The direction of the blood flow in these vessels is from the median eminence of the tuber cinereum to the pars distalis.

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