The purpose of this study was to characterise an ex-vivo adult porcine retina-retinal pigment epithelium (RPE) perfusion organ culture model. Fresh porcine full-thickness retina-RPE-choroid tissue samples were clamped into tissue carriers and mounted in two-compartment containers. The retinal and choroidal sides were continuously perfused with culture medium. $pO_2$, $[Na^+]$, $[K^+]$, $[Cl^-]$, $[\text{glucose}]$, $[\text{lactate}]$, and pH were measured in the medium. Tissue samples were examined after 24h, 4, 7, and 10 days in culture. The morphology of the retina and the RPE was examined by light and electron microscopy (LM, EM). The retinal cellular integrity was further examined by immunohistochemistry (Ki 67, GFAP, rhodopsin, synaptophysin, syntaxin, NF 200, TUNEL-test). Fresh porcine full-thickness retina-RPE-choroid tissue samples and tissue samples in static organ culture served as controls. LM, EM, and immunohistochemistry showed intact retinal and RPE cytoarchitecture kept in perfusion culture. Photoreceptor outer segments showed first signs of degeneration after 24h, significant signs of apoptosis and necrosis appeared in the retina after 4 days in perfusion culture. Control tissue samples kept in static culture showed disintegration of the retinal cytoarchitecture after 4 days in culture. The data show that adult porcine retina-RPE tissue can be

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maintained morphologically intact in perfusion organ culture for at least 10 days. Although first signs of degeneration set in after 24h the structural preservation of the tissue in perfusion organ culture is superior to that in static culture. The perfusion culture model of the retina refines organotypic in vitro test systems and may help to reduce the number of necessary animal experiments in retina and RPE research. It offers new perspectives for the safety testing of substances designed for intraocular application.