**Summary**

Plasma serine proteases (MASP-1, MASP-2, MASP‑3, C1r, C1s, thrombin) have been successfully produced and characterized. The proteases were high-purity, no bacterial contamination has been detected and they were compatible with cell culture. We adapted the HUVECs to the biosensor surface, and optimized the system to both the cell culture- and the optical detection requirements. Then we fine-tuned the circumstances of the measurement and tested the system with known endothelial cell activators. When we obtained reproducible and dose-dependent signals using thrombin and histamine, we tested the plasma serine proteases. MASP-1, MASP-2, C1r and kallikrein activated endothelial cells in a dose-dependent and characteristic manner. This proves, on the one hand, that our method is capable of the real-time, high-throughput, label-free screening of the endothelial cell activation, and, on the other hand we described for the first time, that MASP-2, C1r and kallikrein has cell activating properties, which may have important biomedicinal consequences.