An used to diagnose health or illness, but

Design

An average male with 75 kg at 1. 8 m has about 5 L of blood 10. By volume, the erythrocytes (red blood cells) constitute about 45% of whole blood, the plasma about 54.

3%, and leukocytes (white blood cells) about 0. 7% 33. These percentages are visualised in Figure 5. Blood plasma is water by 95% of its volume.

It contains dissolved protein (6-8%), glucose, clotting factors, electrolytes, hormones, carbon dioxide and oxygen 44. When clotting factors are removed, blood plasma is called blood serum instead 26. The common technique to obtain blood plasma is centrifuge spinning. Where a sample is spun for around 15 min at 1300-1800 x g 23. The weight of the different components will the separate them according to Figure 6.

Blood Plasma is commonly used to detect Biomarkers. Biomarkers are a broad range of medical signs that can be measured accurately and reproducible. Medical signs might be an increased count of certain antibodies that can be found in the blood plasma as reaction to a certain illness. Medical signs stand in contrast to medical symptoms, which indicate how health is perceived by patients themselves.

It has to be kept in mind, that a biomarker is a characteristic of a biological process and is therefore not necessarily correlated to the individual’s perception of health. The only relevant indicator of health is the patient’s perception, which is known as clinical endpoint. Biomarkers can still function as surrogate endpoint, when there is solid scientific evidence, that the biomarker consistently and accurately predicts clinical outcome. Only in these cases can biomarkers be used to diagnose health or illness, but still

cannot replace clinical endpoints. 39 A comprehensive analysis of biomarkers is then performed with a photonic biosensor 14. When designing a system that is supposed to work with blood, its hemocompatibility must be guaranteed.

Hemocompatibility refers to systems, that do not force an immune reaction or blood coagulation 16. To ensure this, materials have to be surface treated so that no reactions can occur. To analyse hemocompatibility most researches only investigate the parameters hemolysis and biofouling. Hemolysis is the rupturing of red blood cells, which leads to its contents spilling into the surrounding plasma and therefore giving the blood plasma a red colour 17.

A recent paper by Szydzik et al. finds a more sophisticated approach to evaluating hemocompatibility 40. The paper identifies, that some proteins in the blood plasma react to hydrodynamic changes by processes of protein conformational unfolding, surface adhesion and platelet aggregation 40. A steady-state simulation of different geometries of microfluidic valves revealed, that the v-shape is the most hemocompatible design, because of lower strain rates 40. Therefore, the v-shape structure is adapted for the microfluidic valves in this project.