Atomic force microscopy was used to characterize the mechanical properties of adult human, horse, camel and chicken red blood cells (RBC) as well as fetal human RBC.

Force-distance curves were obtained in 0.9% NaCl and autologous plasma at room temperature (RT), 32°C and the species’ body temperature giving elasticity as apparent Young’s modulus (E) as well as adhesion of the RBC. The measurements in plasma were performed on adult human, fetal human and horse RBC only.

A Si3N4 cantilever with a non-coated 8nm tip was used to physically indent the RBC up to a given setpoint of 1nN. The obtained force-distance data were processed by employing the Hertz model at a contact point of 500nm indentation depth.

In NaCl at RT, horse and camel RBC showed the highest E followed by fetal human and adult human RBC. In chicken, the results depended on whether the nucleus or the peripheral region was indented. Indentation of the peripheral region resulted in E values slightly higher than those of adult human RBC.

Temperature and medium played an important role. Generally, in plasma E was lower compared to NaCl. With increasing temperature, E decreased both in NaCl (human RBC: ~200 to 500Pa at RT; ~100 to 200Pa at 37°C), and in plasma (human RBC: ~100 to 200Pa at RT; ~50 to 150Pa at 37°C).

Adhesion could only be observed in NaCl. It tended to increase with temperature. In plasma, adhesion was not present anymore.