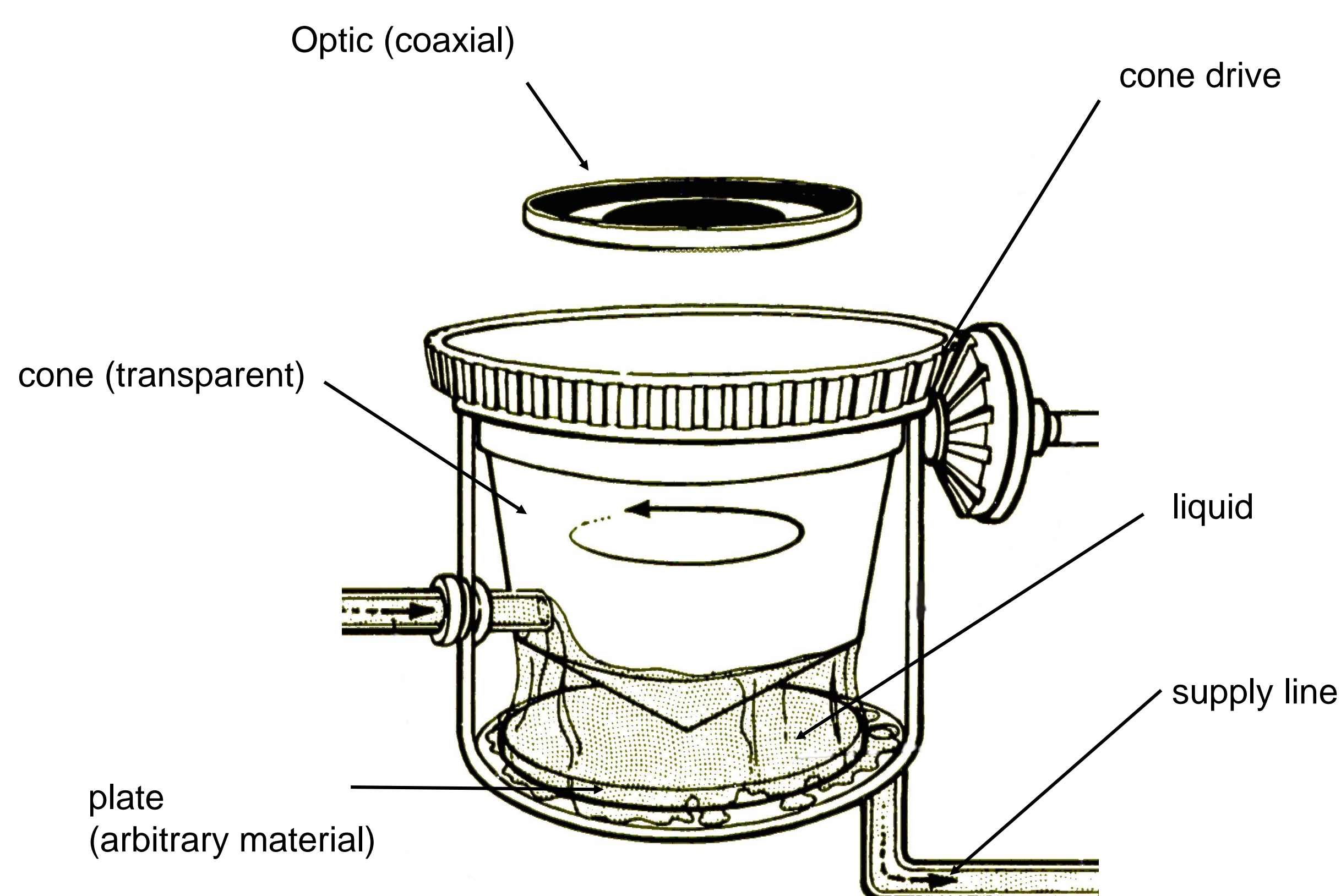


# A Cone-Plate-Rheometer System for the Measurement of Stress related Phenomena in Biology



## Working principle:

A cone is spaced above a fixed plate. The cone angle may range between 0,5-2,5°. The volume between cone and plate is filled with liquid. The cone rotation transmits shear forces on the plate via the liquid. The special design and arrangement ensures a constant shear stress over the whole sample (plate) surface. It allows also a laminar flow on the plate surface over a wide range of rotation speeds. This does not apply for the zone under the cone top.



## Important system features:

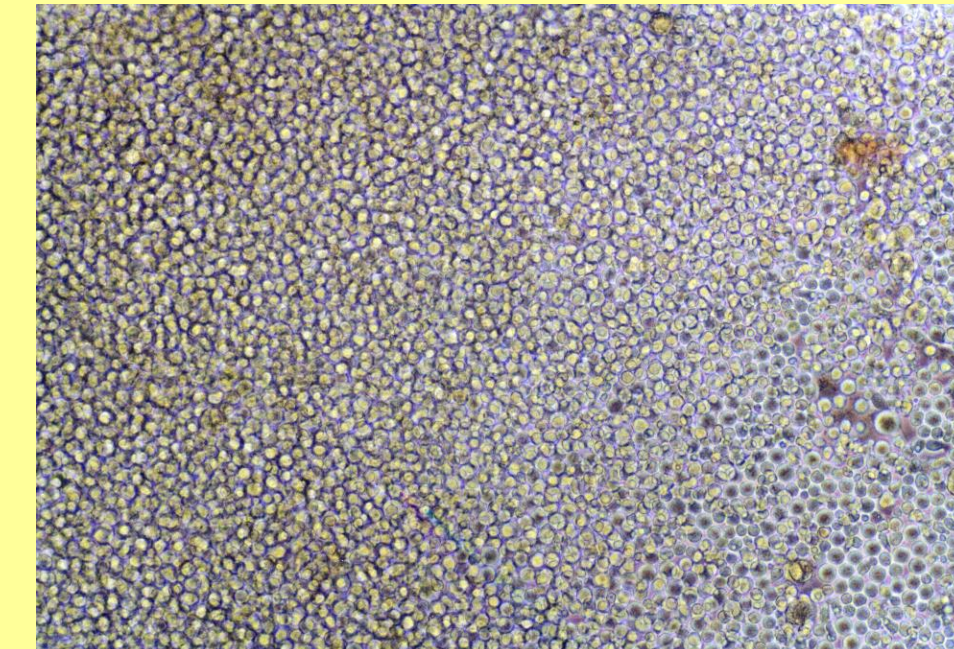
- shear stress and temperature can be adjusted individually
- a CCD-Camera is integrated in the microscope optic which allows to record images or image sequences and to use mathematical filters
- the online monitoring of the sample (plate) surface and a chronological correlation of process parameters
- the program „rheoControl“ includes the system control
- the system can be adapted to specific customers needs

## Cone – plate - rheometer used for e.g. in vitro diagnostics:

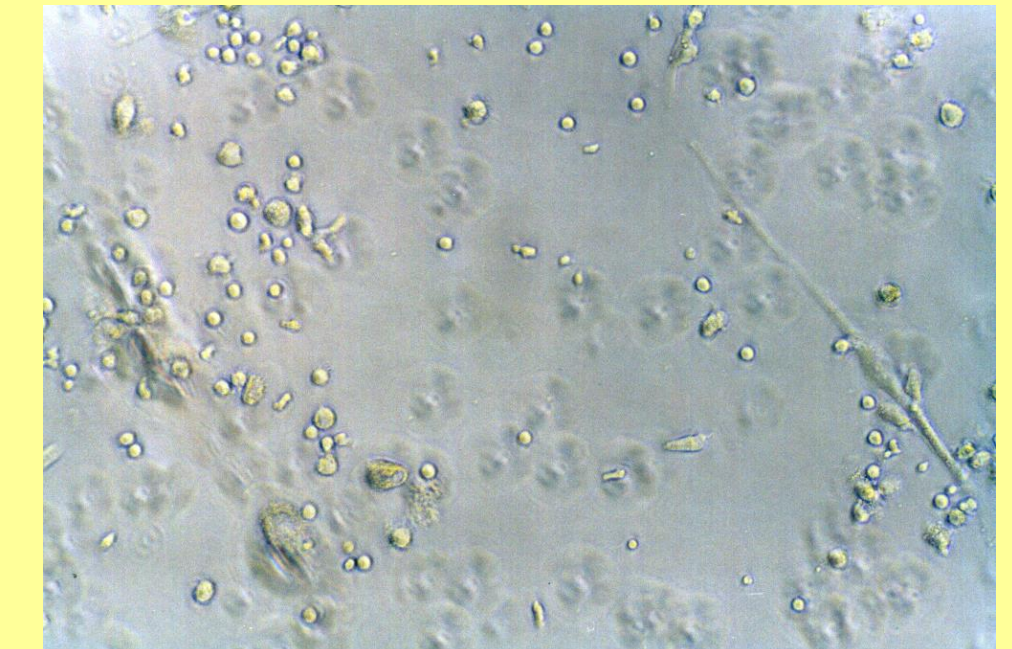
- of cell-cell-binding,
- of cell-substrate-binding,
- for specified cell binding to enabled surfaces (biomimicry),
- of thrombogenesis,
- for the biocompatibility check and
- for the general examination of:
  - biocompatibility
  - haemocompatibility

## Cell-substrate-binding / biocompatibility

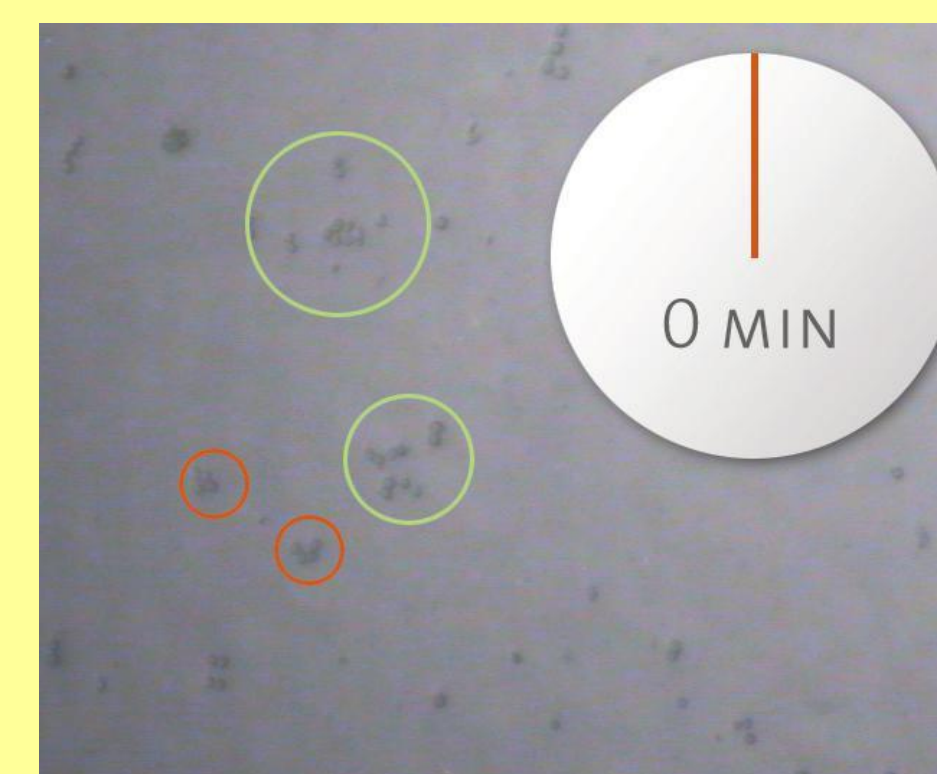
### Human bone marrow cells in the rheological system



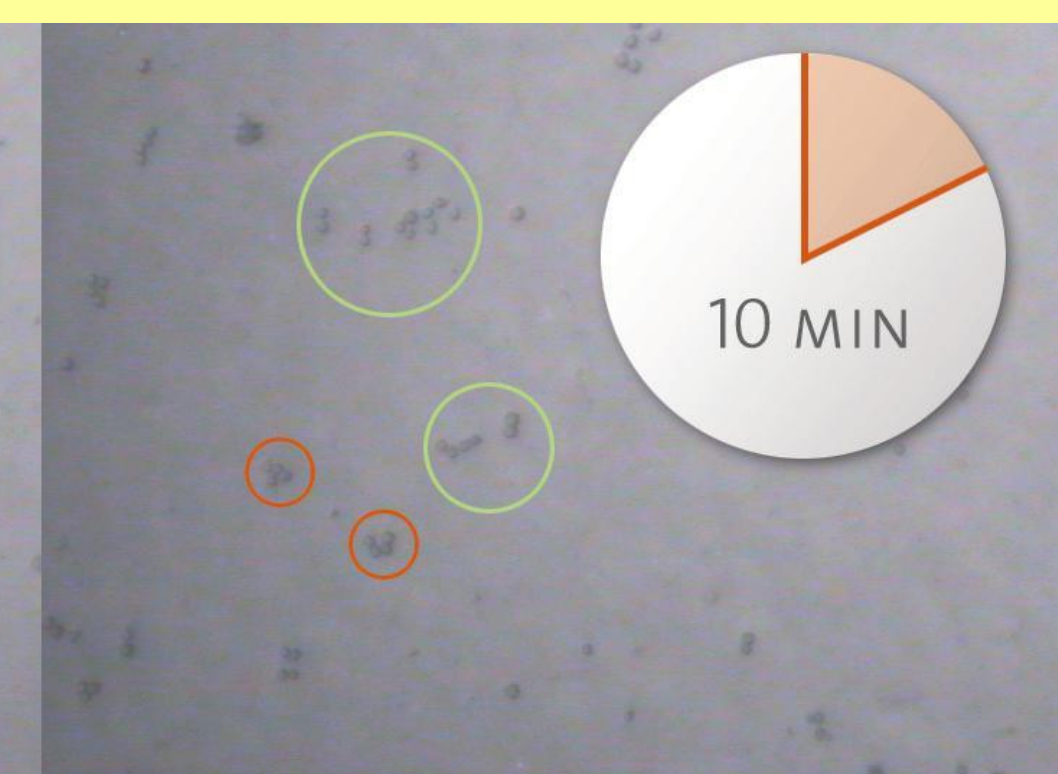
Control (cells on glass sample)  
no shear stress  
after 3 hours



Sample with shear stress (cp Titanium)  
(shear stress  $\tau = 0,5 \text{ dyn/cm}^2$ )  
Exposure time 3 hours



0 MIN



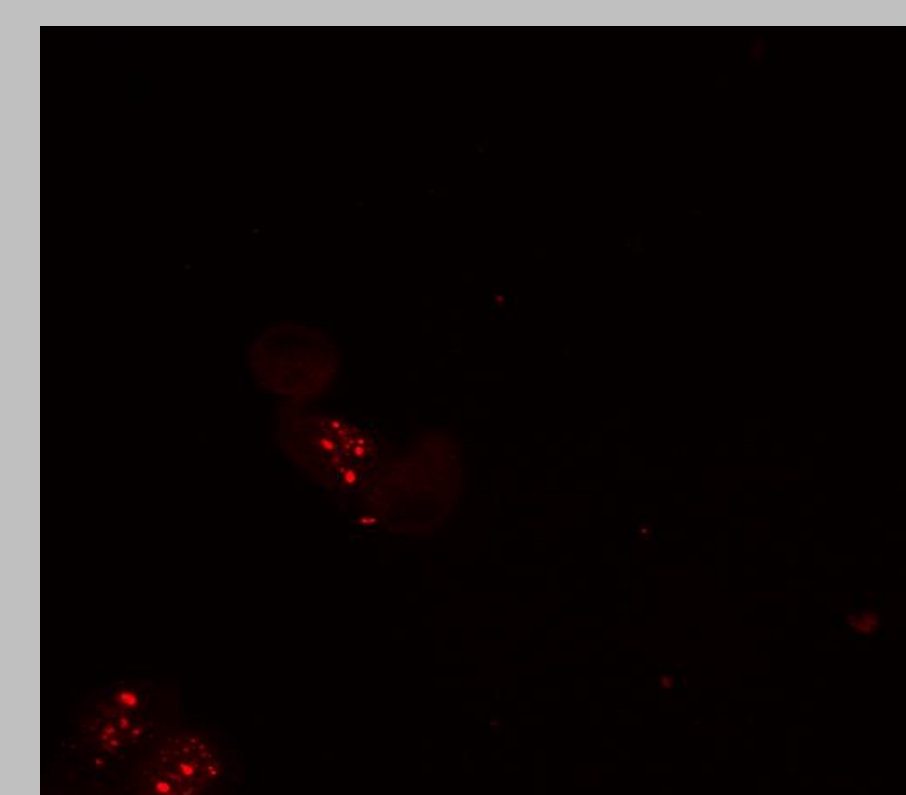
10 MIN

Use of mathematical filters to evaluate image sequences with respect to number and orientation of human bone marrow cells inhabiting a CoCr-sample

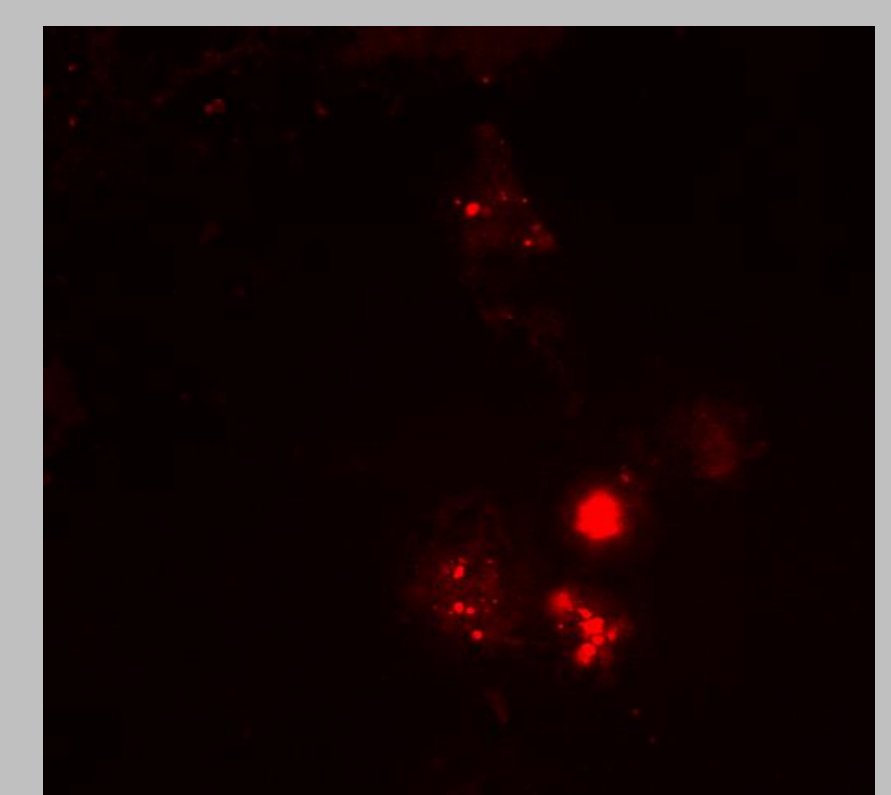
## Biomimetic Surface Modification

### CD-34 positive precursor cells

Immune cytological demonstration of adherent CD-34-positive precursor cells after application of shear stress



Control (cells on glass sample)

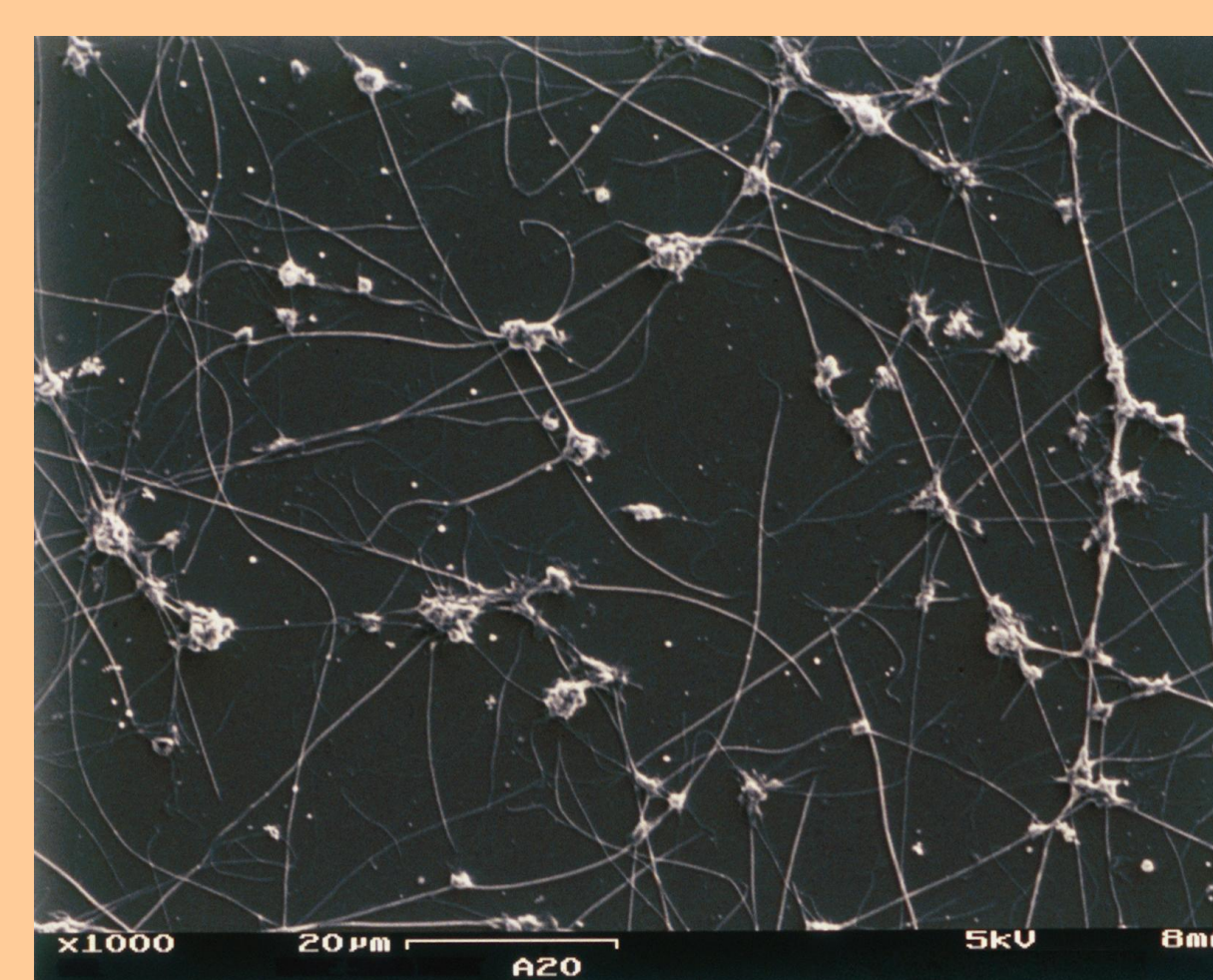


Titanium coated glass sample  
afterwards dotated with nitrogen (N)

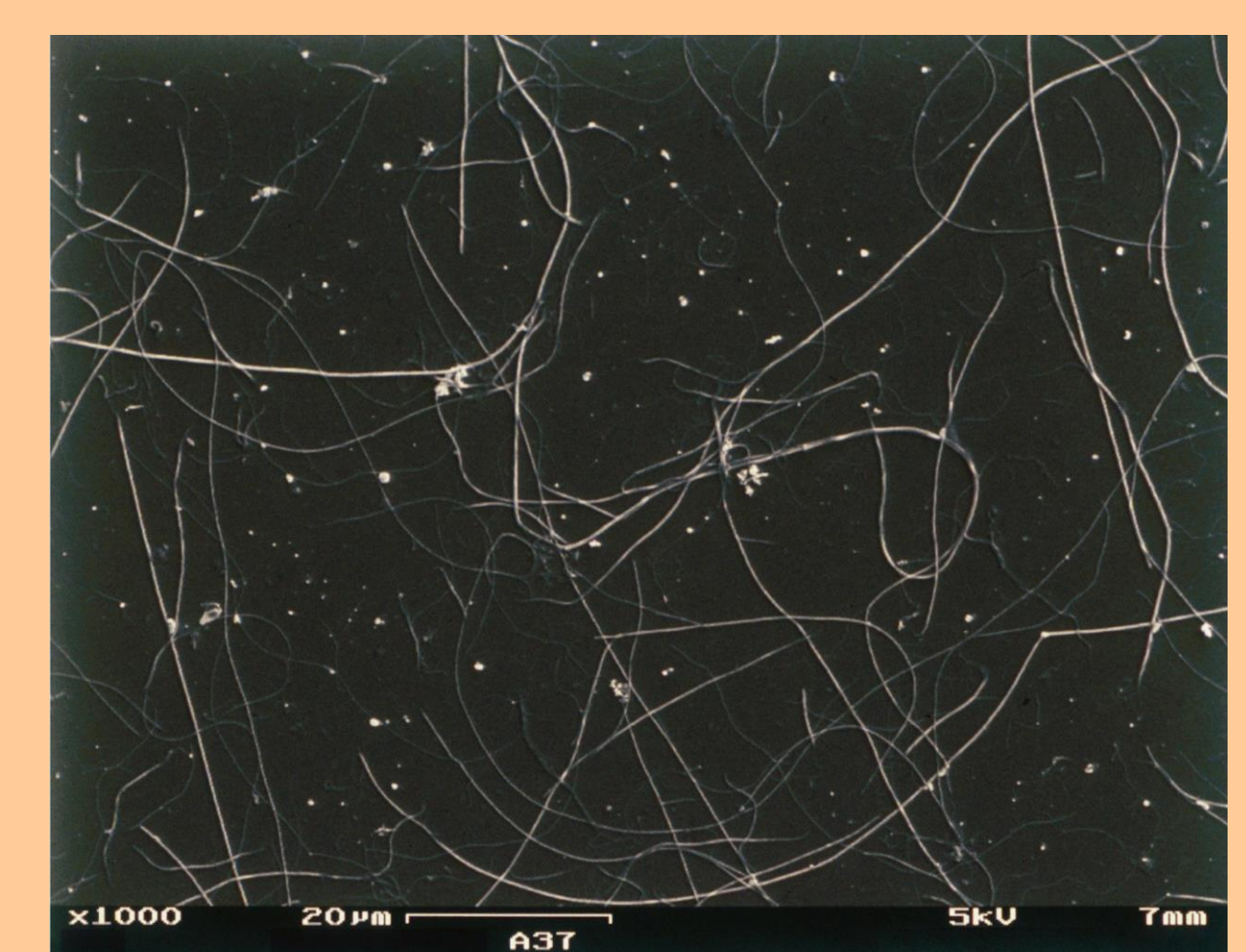
## Thrombogenesis / Haemocompatibility

### Reactivity of unconditioned or conditioned platelets exposed to subcritical shear stress with collagen I coated glass samples

Shear stress  $\tau = 8,4 \text{ dyn/cm}^2$ , Time of exposure  $t = 60 \text{ s}$



Freshly isolated and unconditioned platelets avidly bind to collagen I [SEM, 1000x]



Platelets freshly isolated and conditioned with antibodies against collagen receptor (anti GP-VI antibody) very rarely bind to collagen I [SEM, 1000x]

	Wild Type Mouse (WT) unconditioned				Wild Type Mouse (WT) conditioned antibodies against GP-VI (Coll-receptor)			
		Aggregates big	Aggregates small-medium	Comments		Aggregates big	Aggregates small-medium	Comments
high shear stress 8,4 dyn/cm²	thinly covered	16	76	medium sized Aggregates	almost un- covered	3	2	single Platelets, loose Aggregates
Low shear stress 0,5 dyn/cm²	densely covered	31	34	very big Aggregates	un- covered	0	0	

The shape of the aggregates (small-medium-large) depends on shear stress