

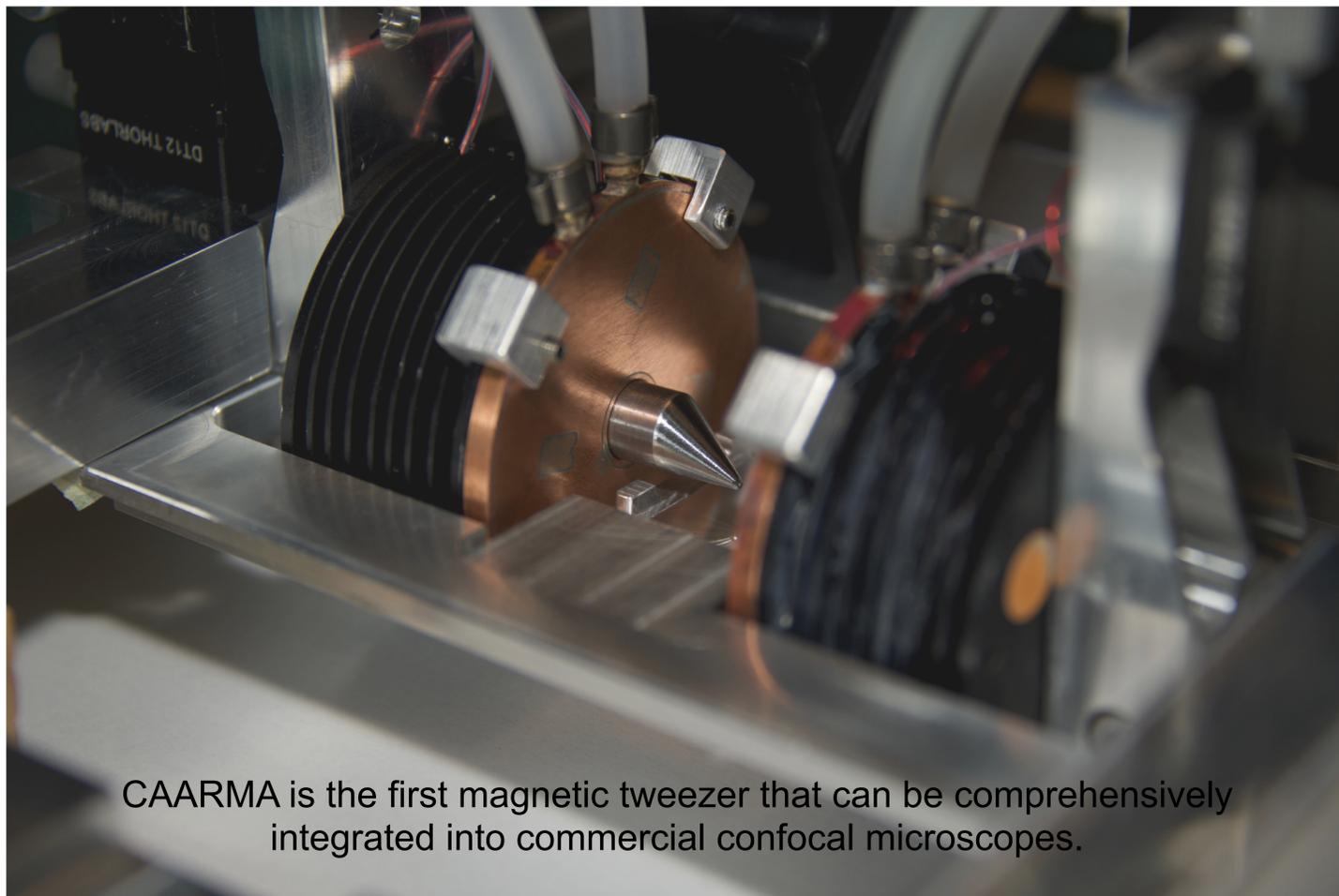
# CAARMA: a magnetic tweezer for biological applications

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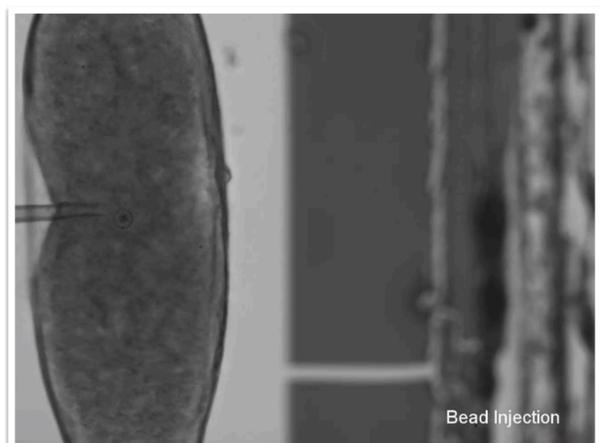
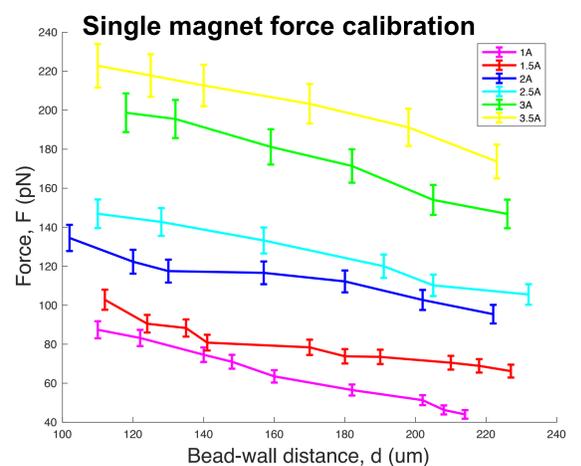
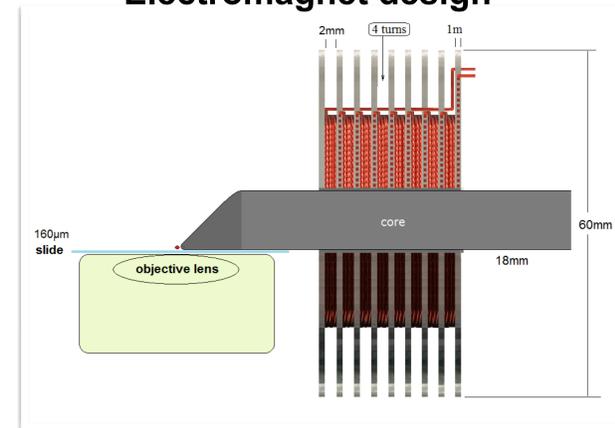
CAARMA is a perfect tool for studying the mechanical properties and the force-regulated processes in living organisms.



CAARMA is the first magnetic tweezer that can be comprehensively integrated into commercial confocal microscopes.

- Modular design;
- No specific skills for use;
- Easily integrated into home-built setups and commercial microscopes;
- Controlled application of force onto magnetic probes;
- Countless applications in life science, biophysics, polymer science and many other research fields.

## Electromagnet design



## Acknowledgements

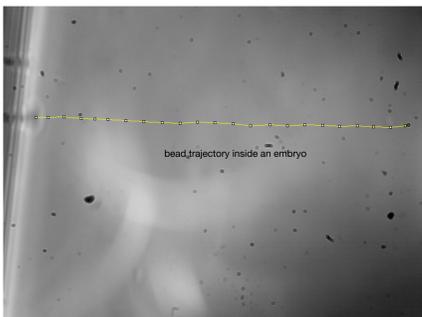
The authors would like to thank Silvio Scherr and the mechanical workshop for the realization of dedicated mechanical parts.

## References

- Kollmannsberger, P., Fabry, B. Review of Scientific Instruments, 78, 114301 (2007).  
 Hosu, B.G., Jakab, K., Banki, P., Toth, F.I., Forgacs, G. Review of Scientific Instruments, 74, 9 (2003).  
 Yang, Y., Lin, J., Meschewski, R., Watson, E., Valentine, M.T. Reports, 51 (11), 29 (2011).  
 Doubrovinskia, K., Swana, M., Polyakova, O., Wieschaus, E.F. PNAS, 114, 1051 (2017).  
 Wessel, A.D., Gumalla, M., Grosshans, J., Schmidt, C.F. Biophys. J., 108, 1899 (2015).

## CAARMA is employed to study:

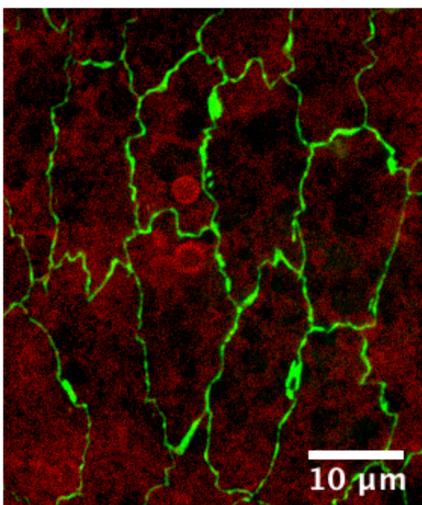
### • Microrheology inside early-stage fruit fly embryos



The cytoplasm of the embryo is about three orders of magnitude more viscous than water with a mean viscosity of about  $0.76 \pm 0.12$  Pa s.

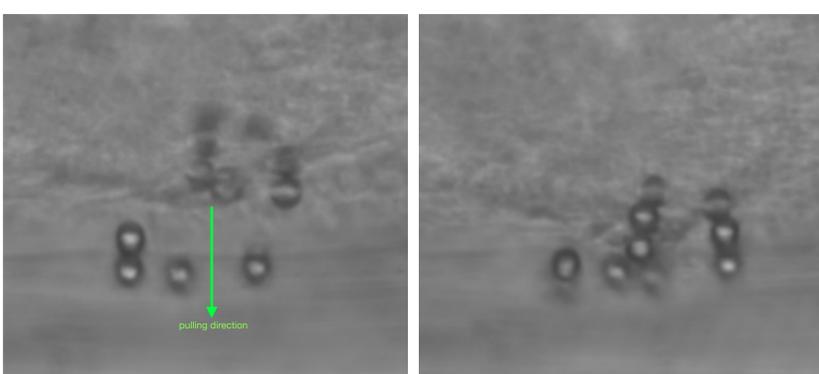
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### • Forces involved in living tissue during dorsal closure (DC) in *Drosophila melanogaster*.



2.8 µm Dynabeads injected inside amnioserosa (AS) cells and pulled against the cells membrane to measure the force produced by AS cells during DC.

### • Forces involved in the yolk cell during endoderm closure (EC) in *Drosophila melanogaster*.



5.4 µm Dynabeads injected inside the yolk cell and pulled against the cell membrane to measure the force produced by the myosin waves during the EC.