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# MAGNETIC RESONANCE IMAGING (MRI) OF THE HONEYBEE

Jean-Marc BONMATIN, Arthur Haegi, Frédéric Szeremeta

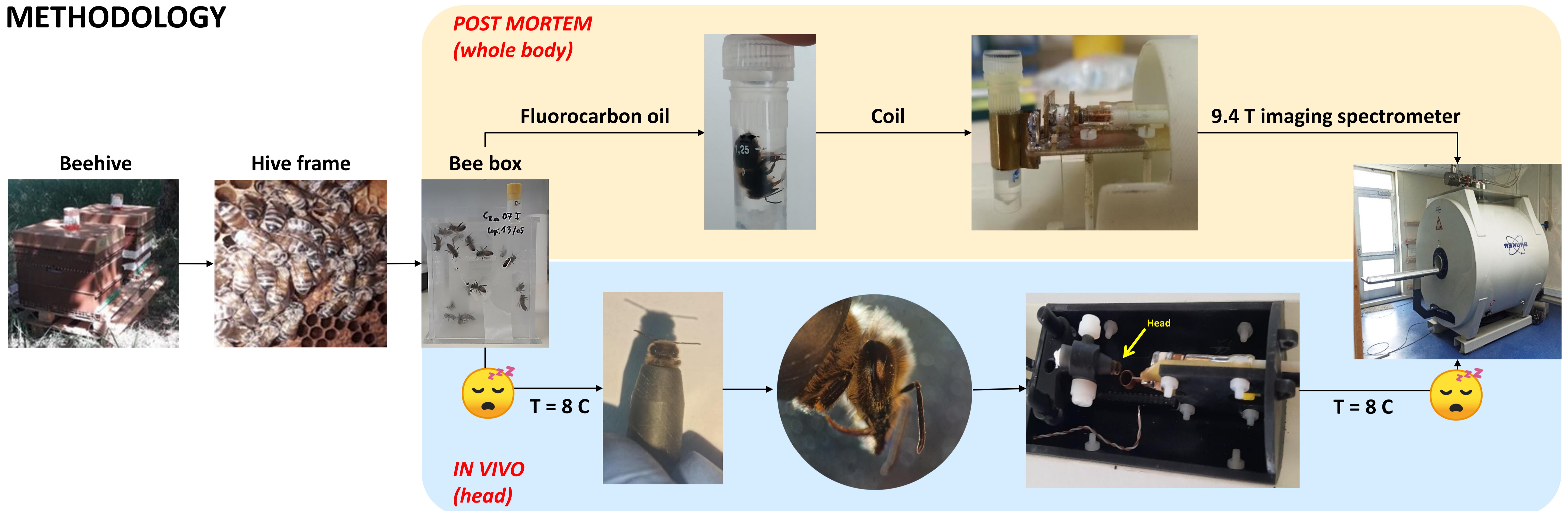
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## CONTEXT AND OBJECTIVES

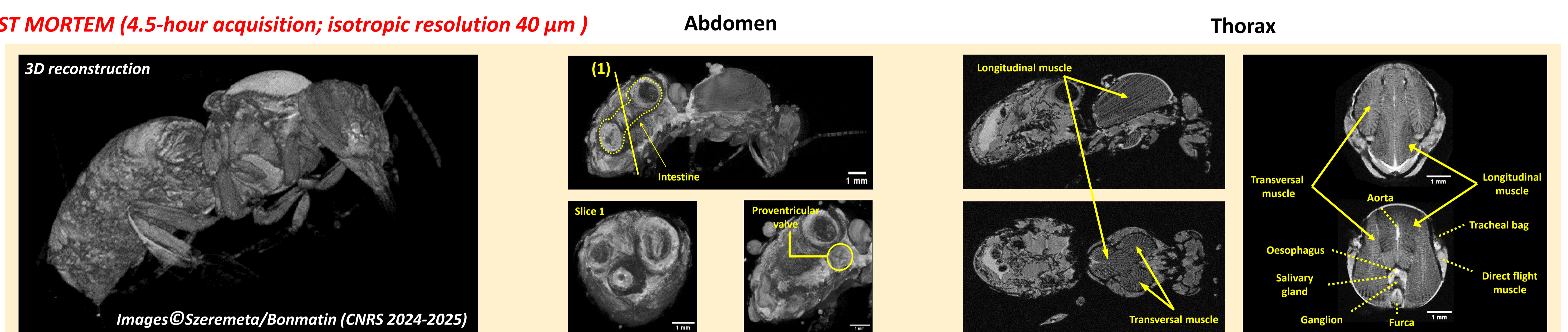
- MRI technology has the advantage of providing contrasted images of soft tissues such as muscles, organs and brain
- We developed methods for obtaining highly-resolved images of the whole honeybee and its organs by using high-field MRI (9.4 Tesla)
- These methods aim to study the soft tissues in the honeybee, both *post mortem* and *in vivo* and with/without pesticide

## METHODOLOGY

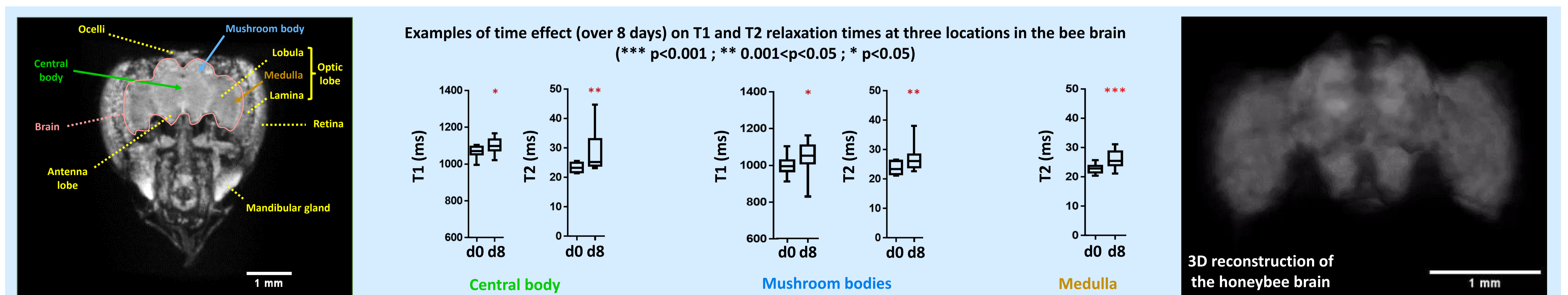


## RESULTS

➤ **POST MORTEM (4.5-hour acquisition; isotropic resolution 40  $\mu\text{m}$ )**



➤ **IN VIVO (1.5-hour acquisition; isotropic resolution 50  $\mu\text{m}$ )**



## CONCLUSION AND FUTURE PROSPECTS

- Our MRI methods allow very fine description of honeybee organs in abdomen, thorax and head. This without prior chemical fixation
- For instance, the brain volume was measured at  $1.3 \text{ mm}^3$  and the volume of mushroom bodies at  $0.027 \text{ mm}^3$
- These values are consistent with data from chemically-fixed honeybee brain (Haddad et al., 2004; Fu et al., 2024)
- T1 and T2 relaxation times are sensitive parameters to detect changes, for instance after 8 days in laboratory conditions (bee box)
- We measured the lethal dose 50% of imidacloprid (DL50 48h) at 12 ng/honeybee; DL50 decreased when exposure duration increases
- MRI *in vivo*, depicting changes in honeybees by imidacloprid, is under investigation (comparisons before/after chronic exposure)