INTELLIGENCE AND BIOSPHERE

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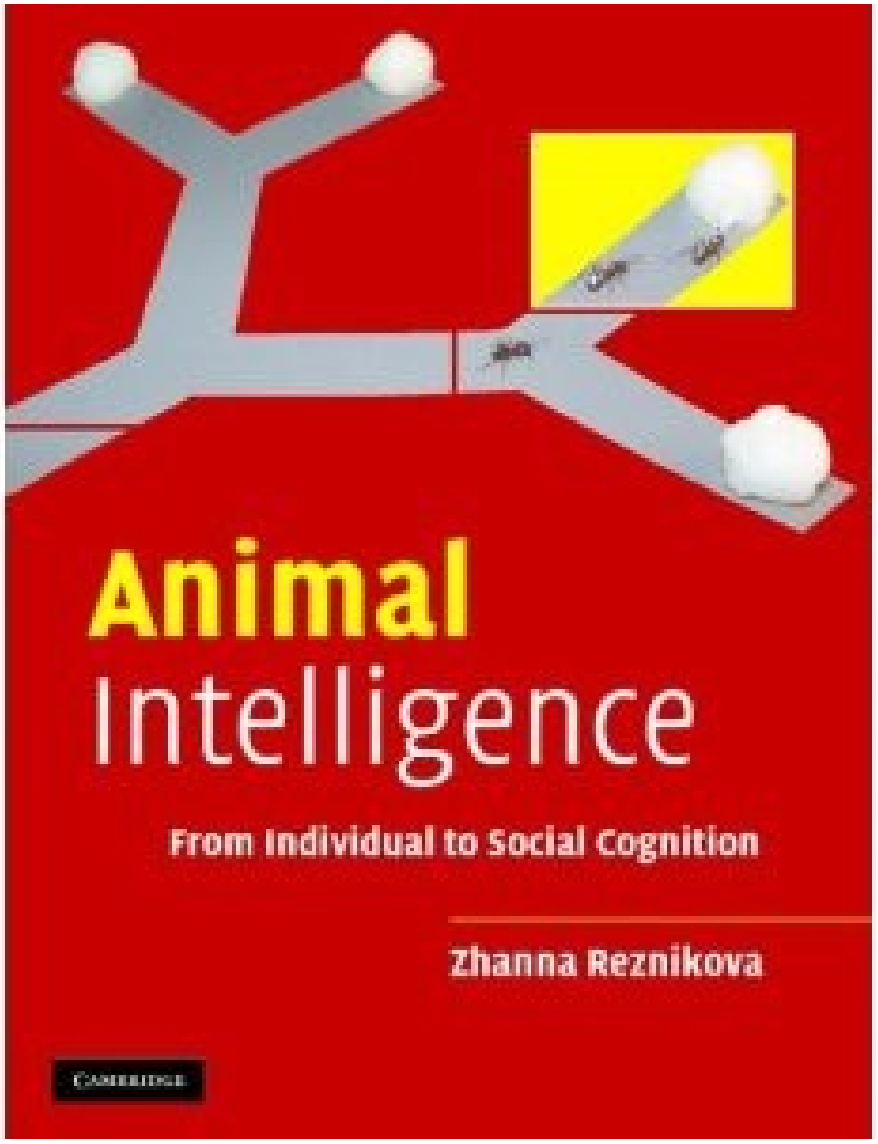
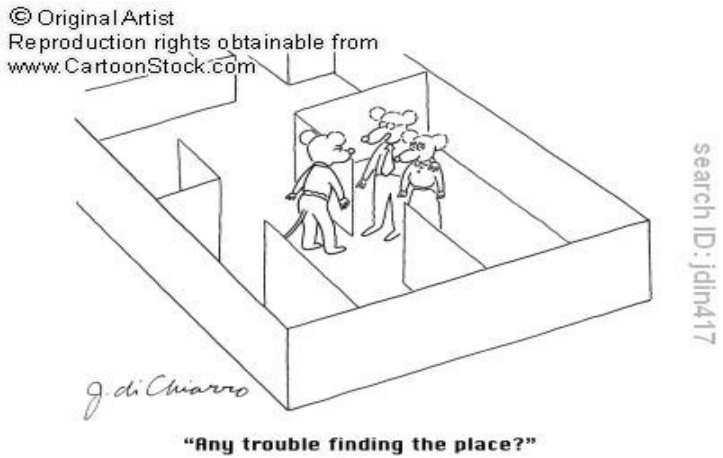


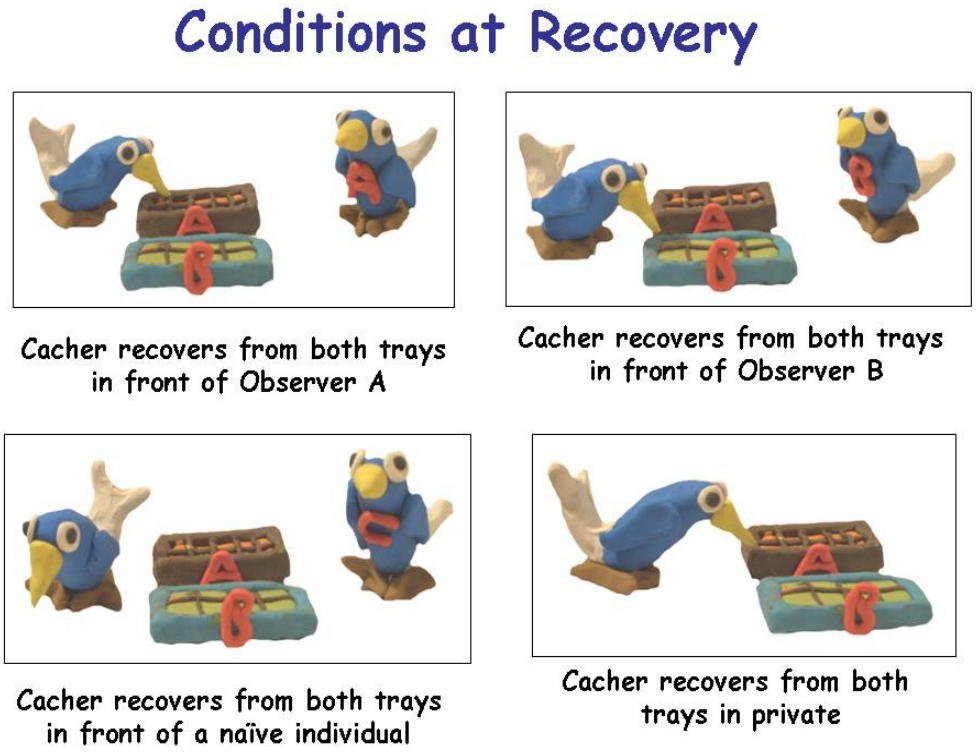
During the last decades the development of cognitive ethology has offered hints that some non-human species surpass our species in many narrow cognitive domains.

It is possible that our species surpass others by the relatively universality of our intelligence

SPECIFIC COGNITIVE ADAPTATIONS AT A SPECIES LEVEL

Pigeons as "art-critics" (Watanabe)



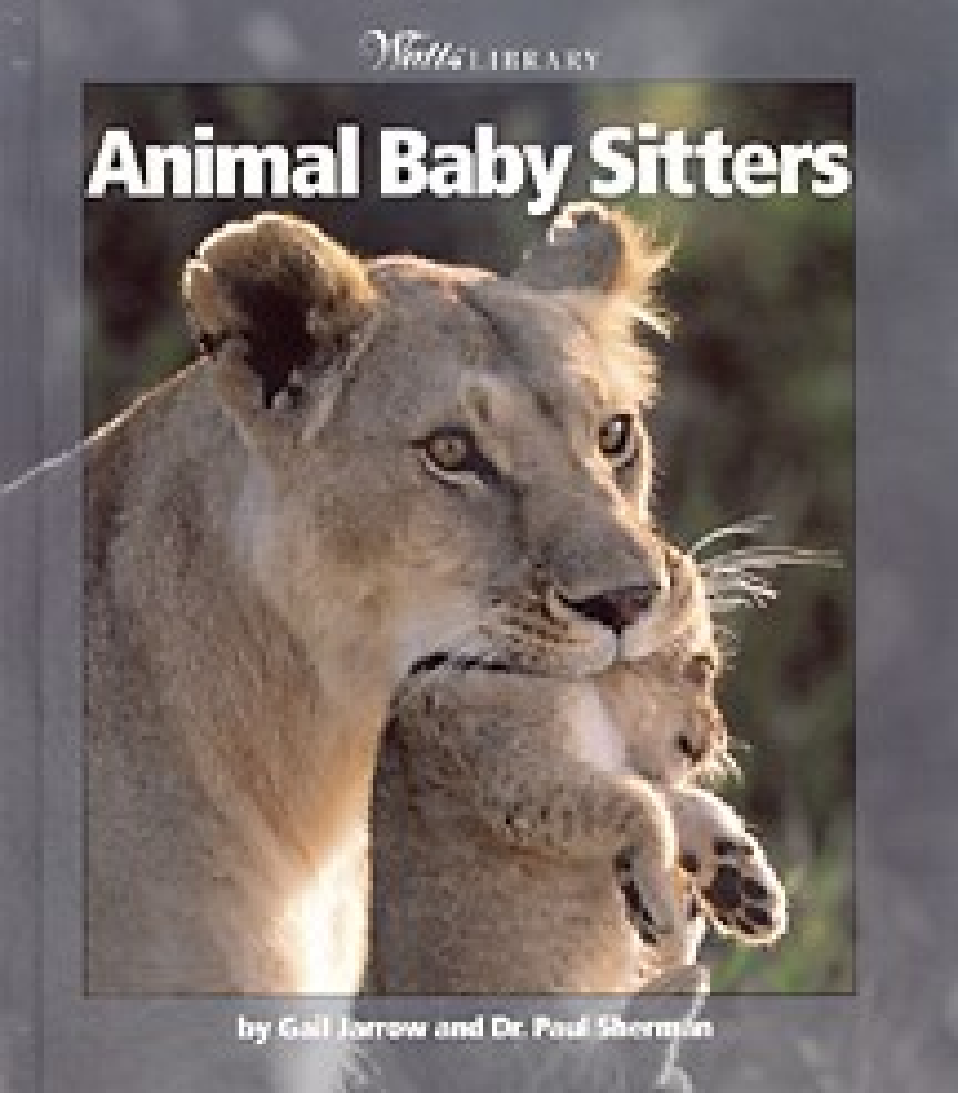


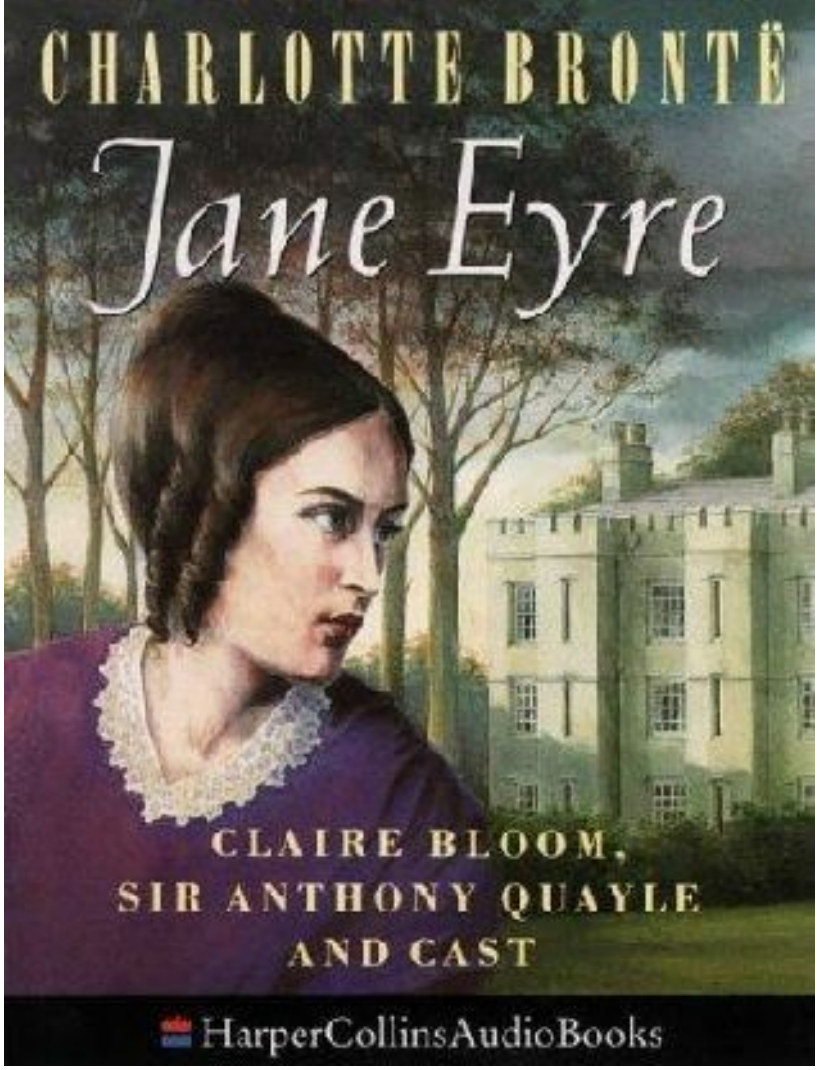
Memory and "theory of mind" in birds (N. Clayton)

Spatial intelligence in rats

Cognitive specialization at a population level: Formula of happiness (Reznikova, 2007, 2012)

In some situations behavioural, social, and cognitive specialisation can be congruent.



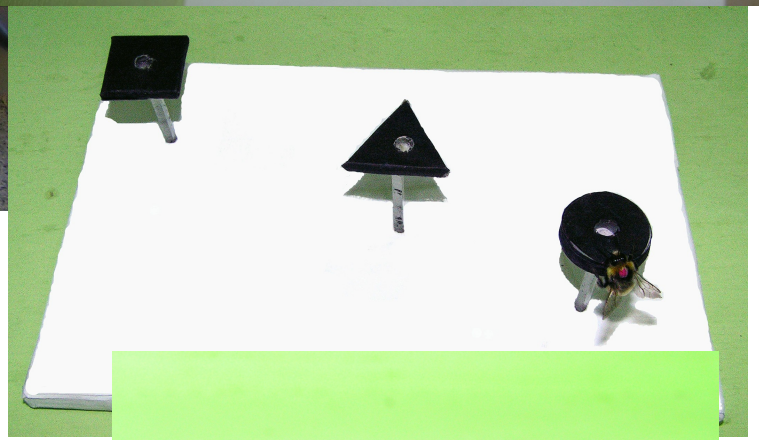


Social specialization: if one must be sacrificed, why me?

Subordinate members of cooperatively breeding communities sacrifice their energy and possibly cognitive skills to dominating individuals serving as helpers or even as sterile workers.

Social specialization:

Patriotic duties usually come into conflict with intellectual meditation



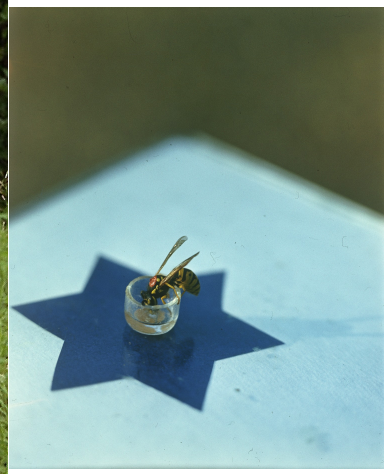
Behavioural specialisation

(an example from our lab):
Naive bumblebees display inherited preference for artificial flowers of different shape and size.

Cognitive specialization is based on the ability of some individuals to learn faster within specific domains, that is. to form associations between some stimuli easer than between other stimuli and thus learn more readily certain behaviours.

The presence of ‘cognitive specialists’ facilitates tuning of integrative reactions of a whole animal community to unpredictable influences in its changeable environment.

Let us consider several examples of cognitive specialization.

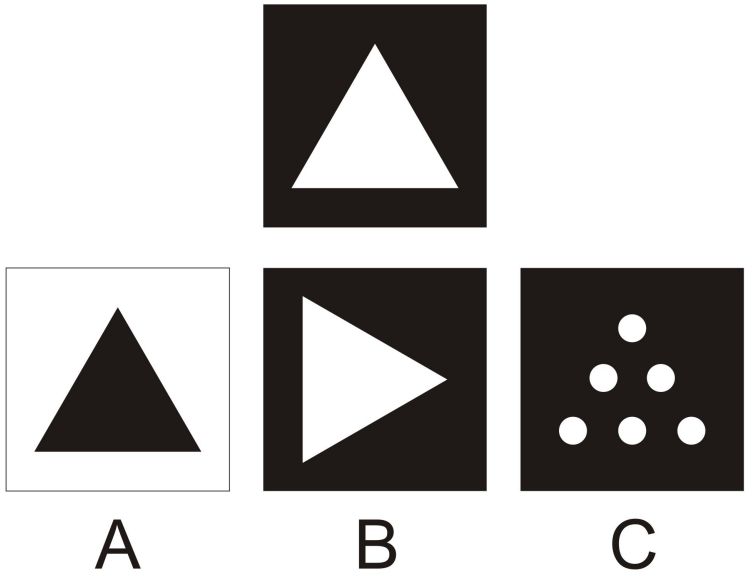


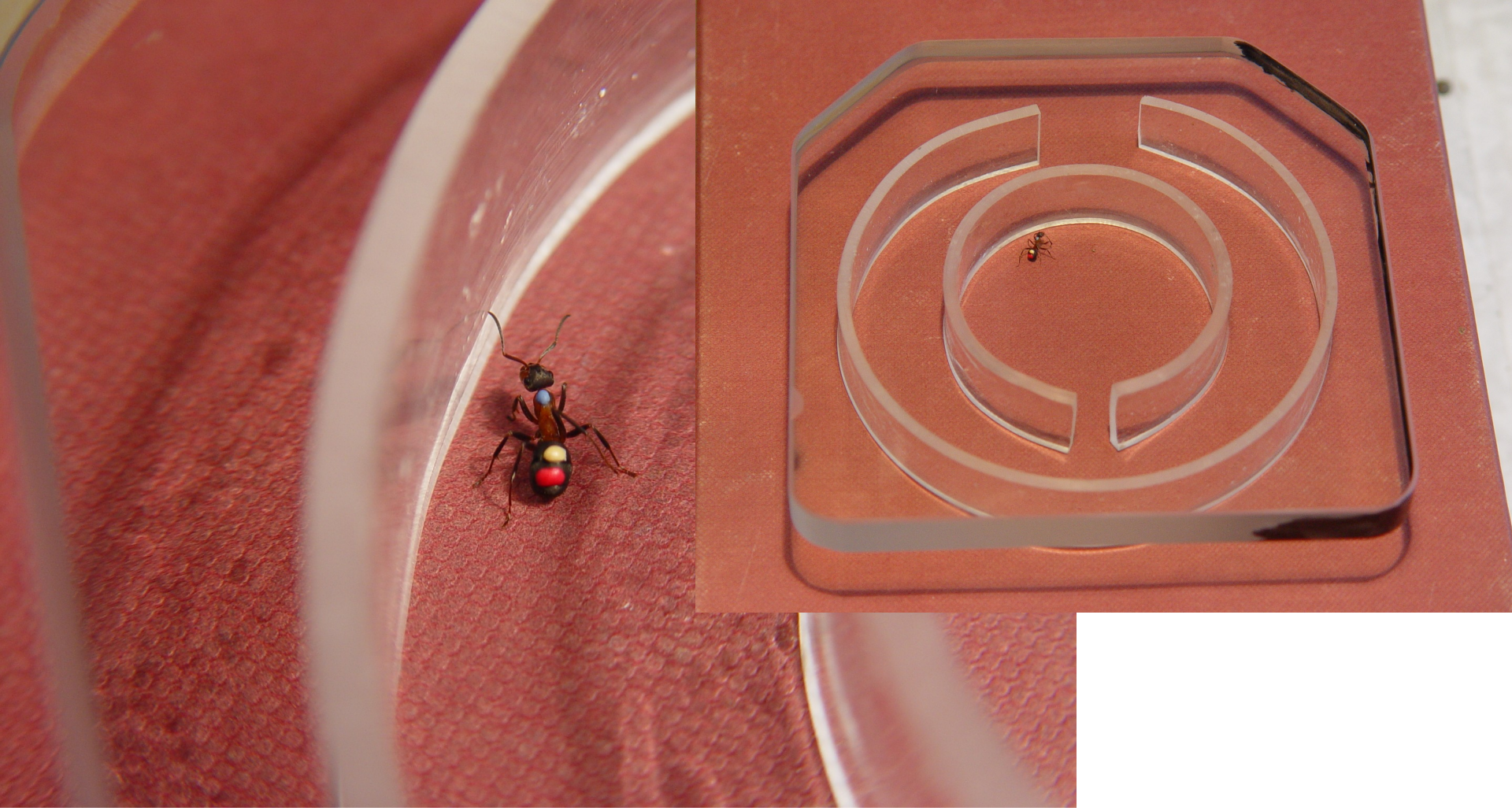
Cognitive specialization

Mazokhin-Porshnyakov's lab in Moscow: abstraction and categorization in honey bees and wasps

KNOWLEDGE IS POWER?...NOT FOR ALL

all members of the hive successfully learn simple problems of discrimination.
Tasks that require concept formation are solved by a few "gifted" bees only.





In highly social group-retrieving ant species (such as red wood ants) not all members of a colony can cope with maze problems. Instead, there are "top ten" individuals (less than 10%), which successfully navigate mazes

In cooperatively breeding meerkats there is a high variation between helpers in provisioning rates. Helpers bring scorpions to babies. Meerkats exhibit teaching of prey-handling skills and social learning of the use of new landmarks, so individual variability in learning capacities of helpers influence the prosperity of a group (Clutton- Brock, 2002; Thornton and Malapert, 2009).

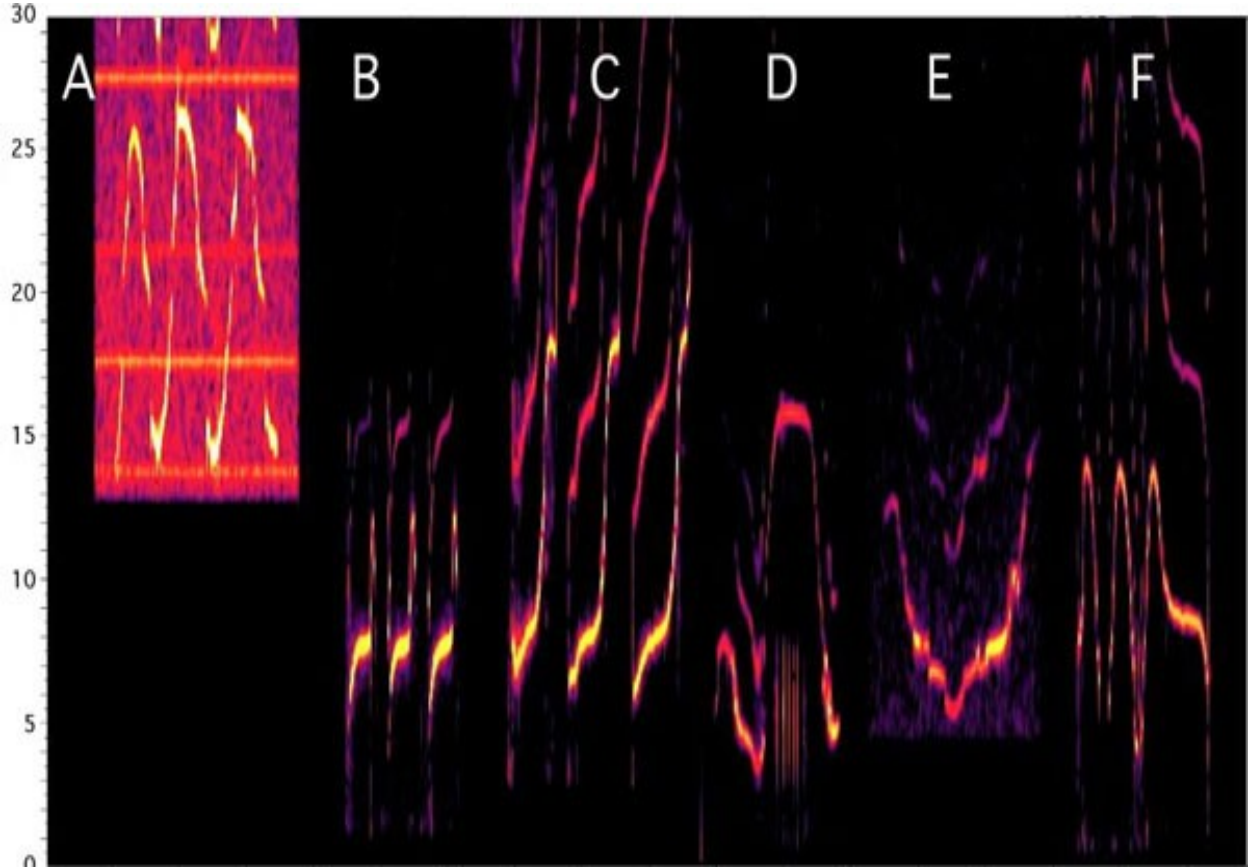
Cognitive capacities of many non-human species exceed the bounds of specific cognitive adaptations

To open new horizons we should:

(1) search for new methodological approaches

(2) search for natural living problems in animal life

Examples from "animal languages": Natural "languages" of animals, such as honey bees, dolphins and monkeys, are understandable only within narrow limits



Names in dolphins: Identity is encoded with a unique frequency modulation pattern that is learned or invented early in life and remains constant thereafter (see Sayigh et al. 2007)

New methods:

Information Theory approach

The main point: not to decipher signals
but to investigate the very process of information transmission by measuring time duration which the animals spend on transmitting messages of definite lengths and complexities.

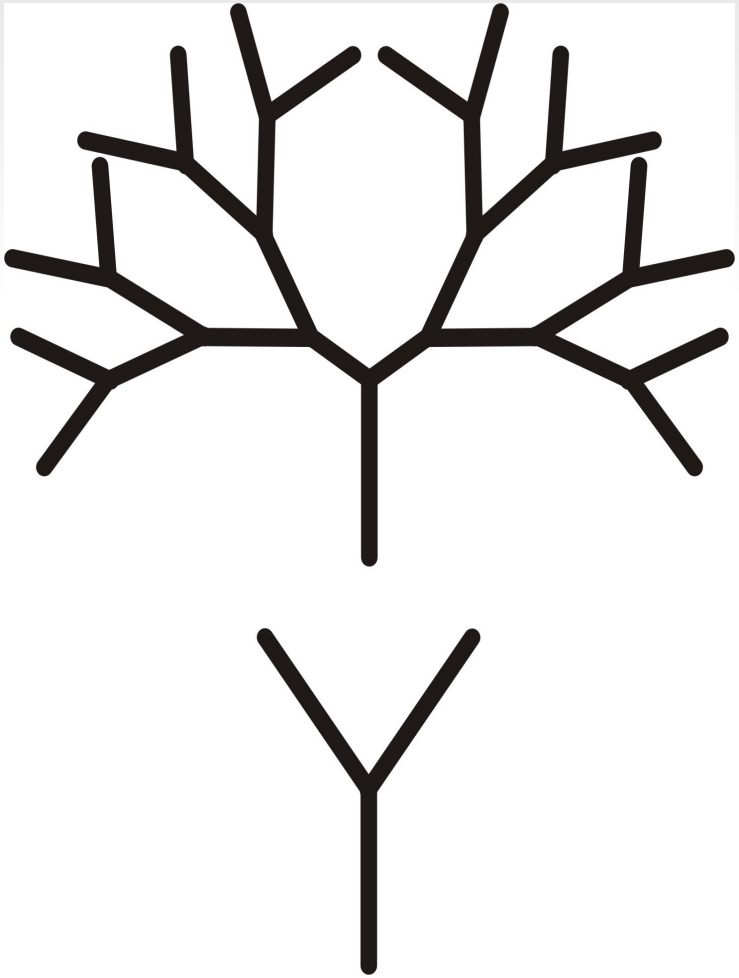
Using Shannon entropy and Kolmogorov complexity to study communicative system in ants: The *binary tree* experiments

In red-wood ants small teams search for a certain leaf with an aphid colony within a tree crown.

Teams remain stable for several days and even weeks

Experimental paradigm

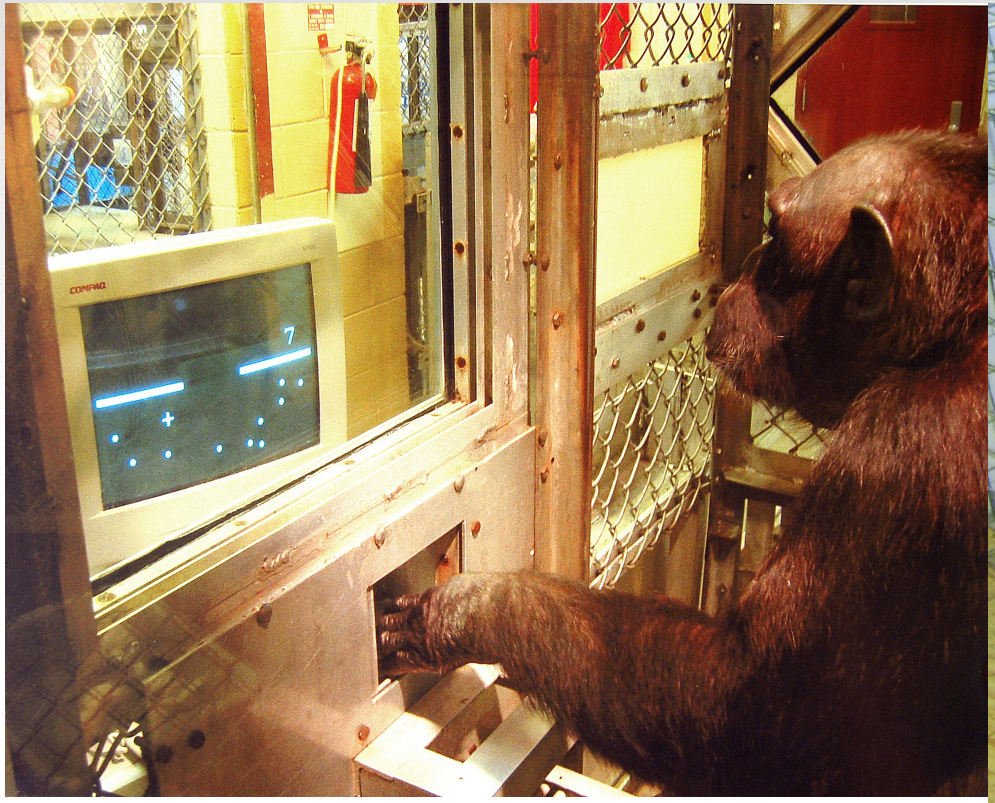
All you need is to ask ants to transmit several bits of information



Ants were individually marked with colour paint. In order to avoid the use of odour tracking, the whole maze were changed by a fresh one when a scout contacted with its team

Numerical competence: an insight from ants

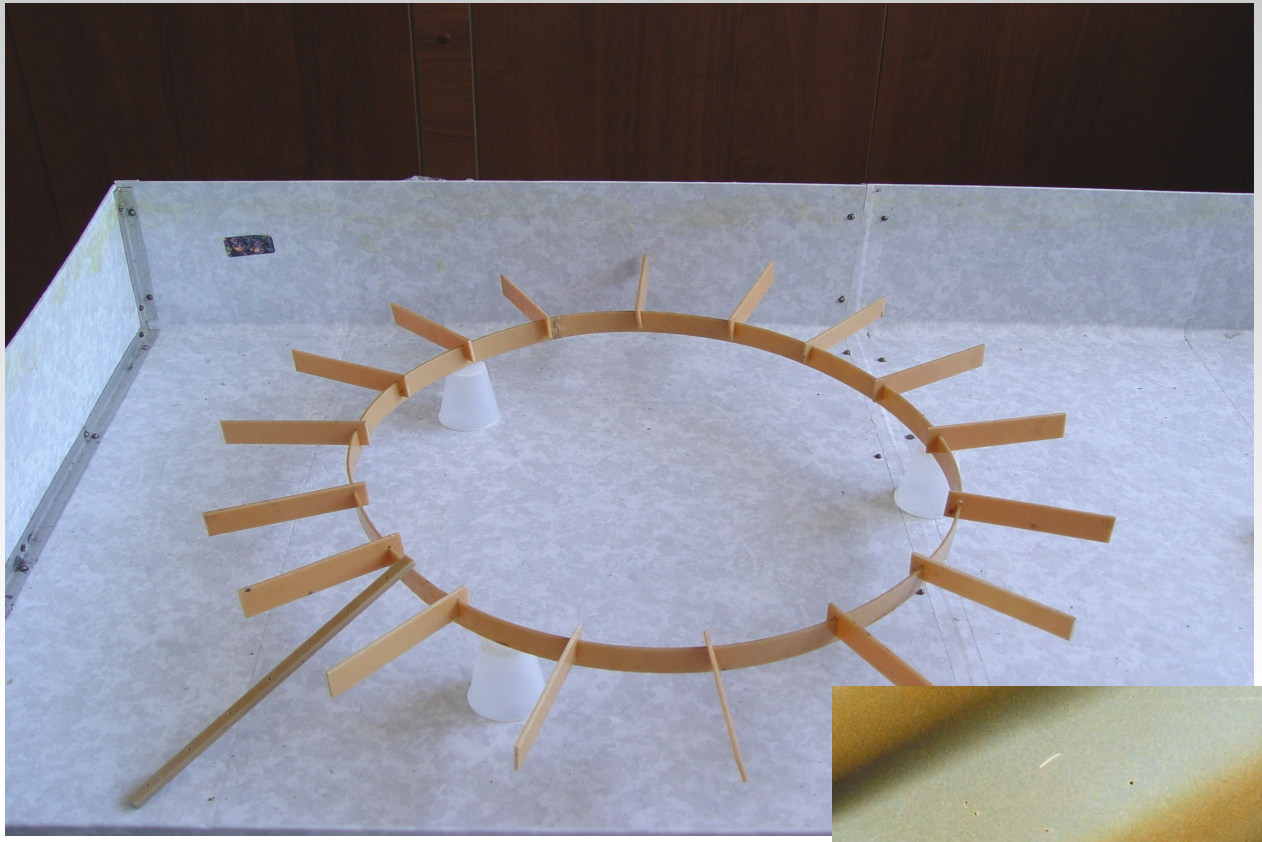
From Beran's lab



From Zorina's lab

Numerical competence is one of the main intriguing domains of animal intelligence.

Counting mazes:



a horizontal trunk (an ant team has just arrived to an empty brunch)

In some human languages numbers are represented in a similar way with ants.

1=finger

2 = finger,finger....

See: Reznikova, Ryabko, 2011; Behaviour

Mundurucus Indians (2005)

ARE ANTS SMARTER THAN FIFTH-GRADERS AT MATH?

Analysis by Jennifer Viegas
Mon Apr 11, 2011 02:24 PM ET
(9) Comments | Leave a Comment

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Ants May Be Math Wizards of the Animal Kingdom

04/12/2011

Ants can solve simple arithmetic problems and communicate numbers to their colony brethren, according to a new study in the journal *Behaviour*. While birds like pigeons ace math and non-primate humans like chimpanzees do OK, ants may have the most precise mathematical skills.

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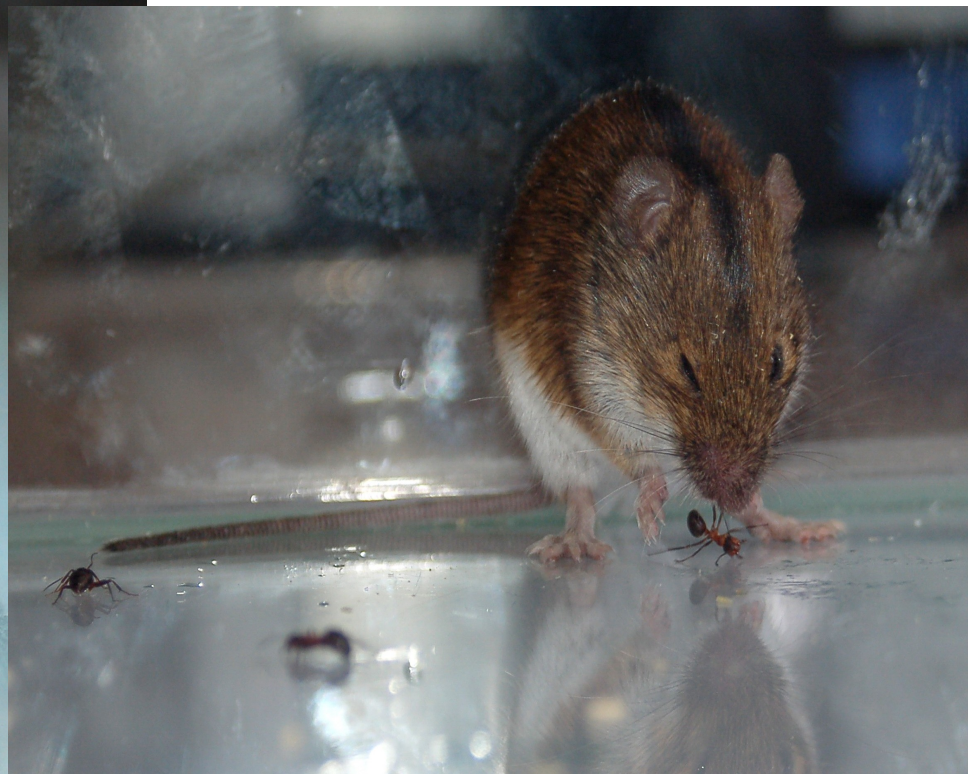
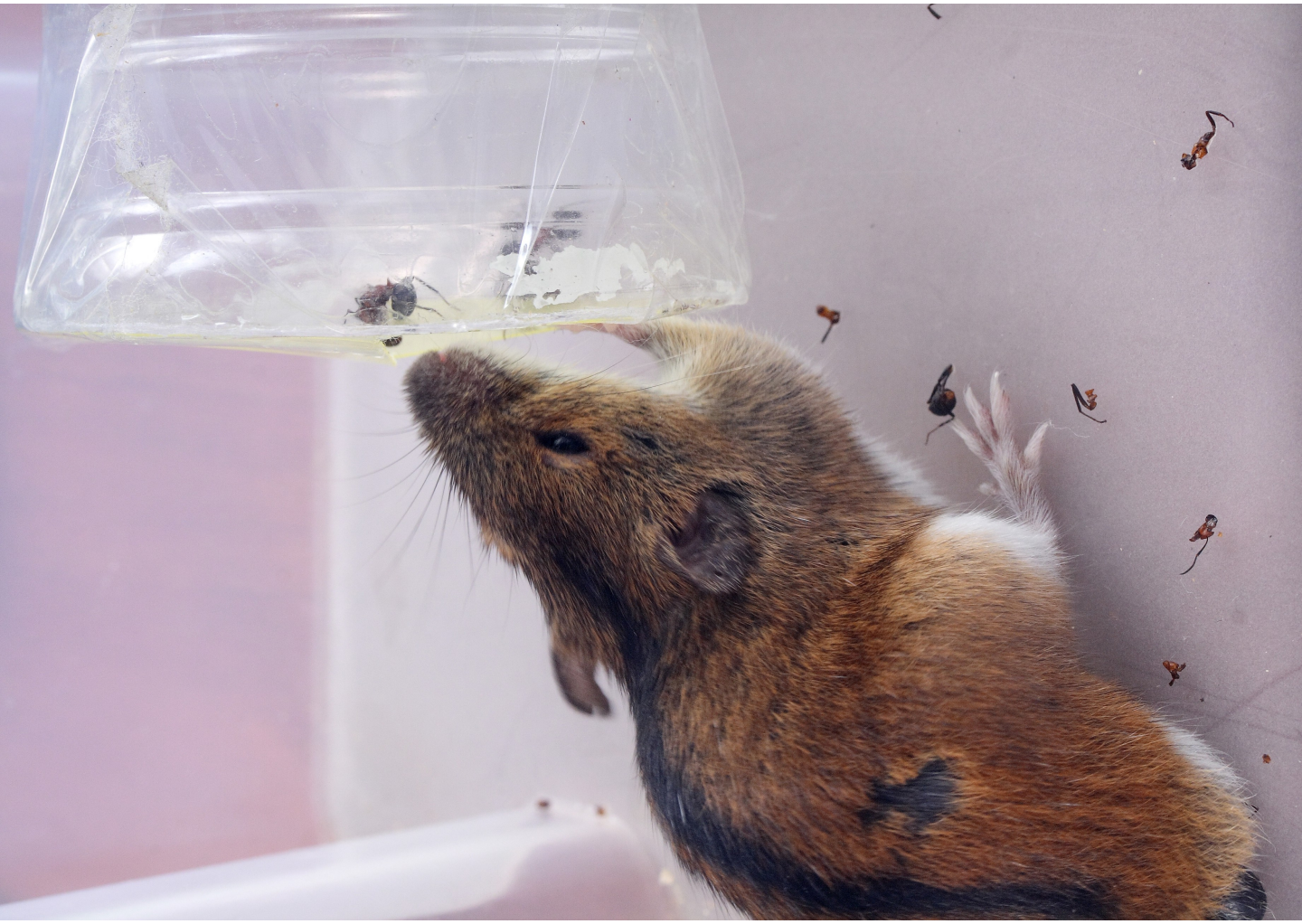
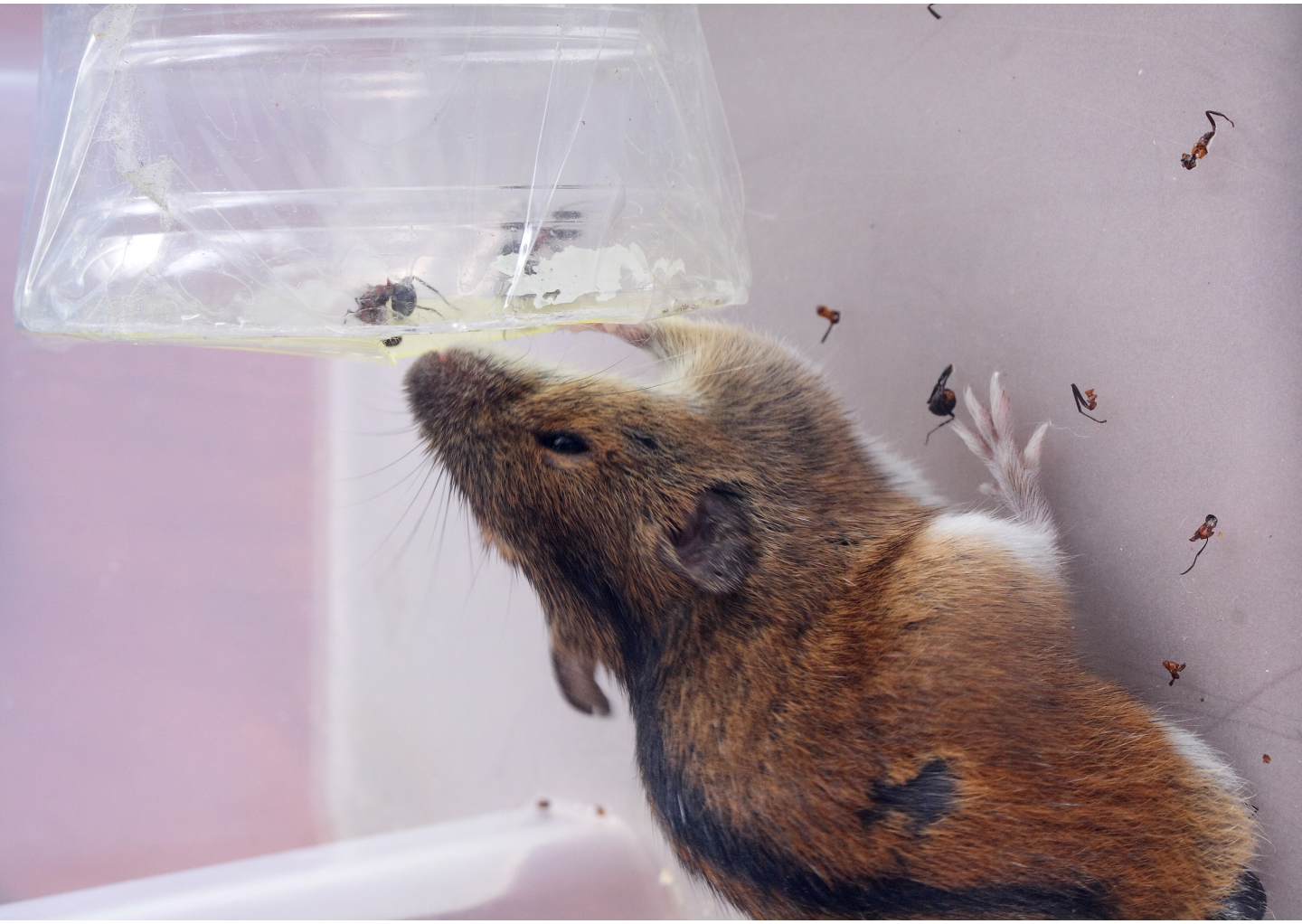
Natural living problems in animal life: ants “count” sticks, mice “count” ants

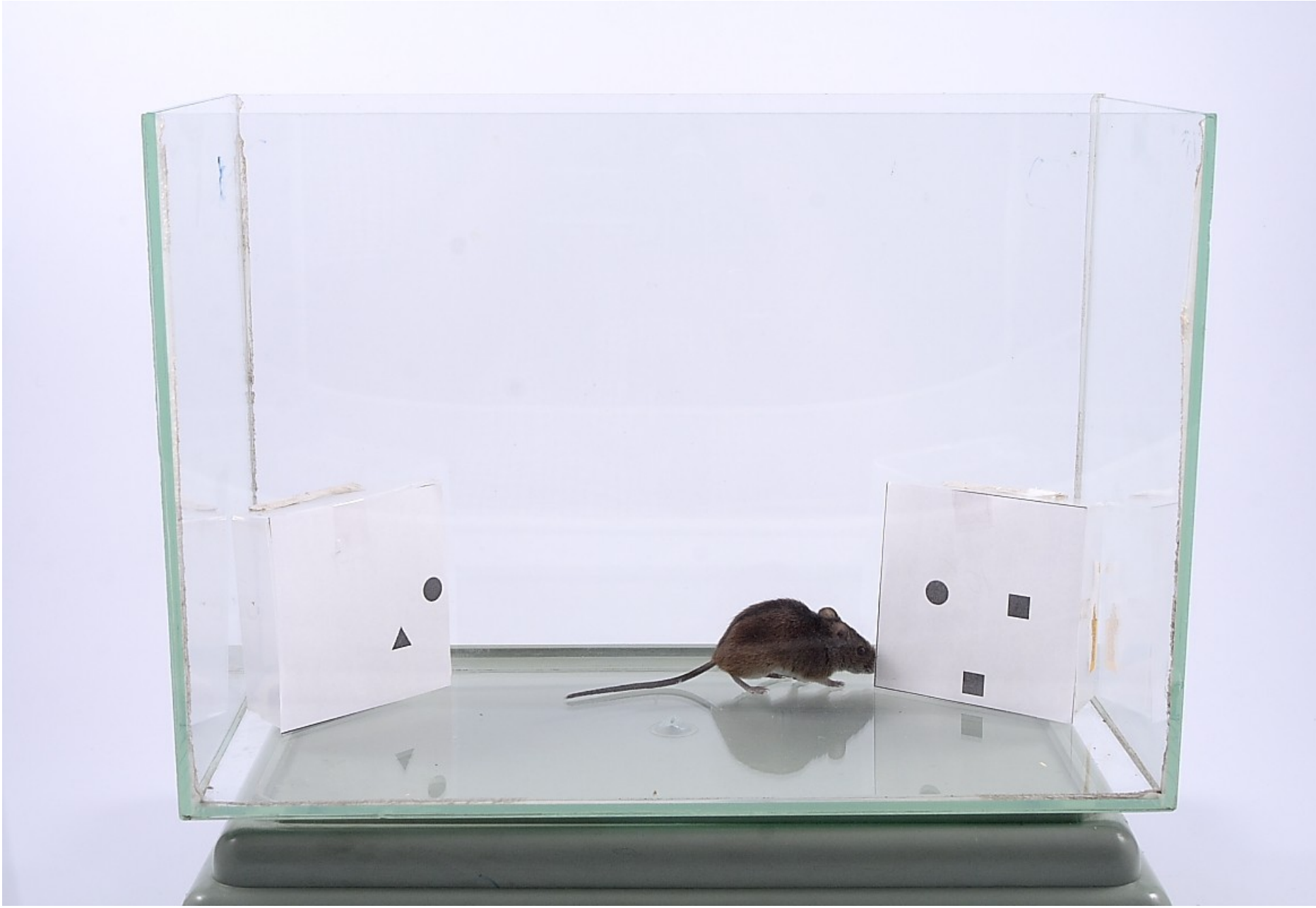


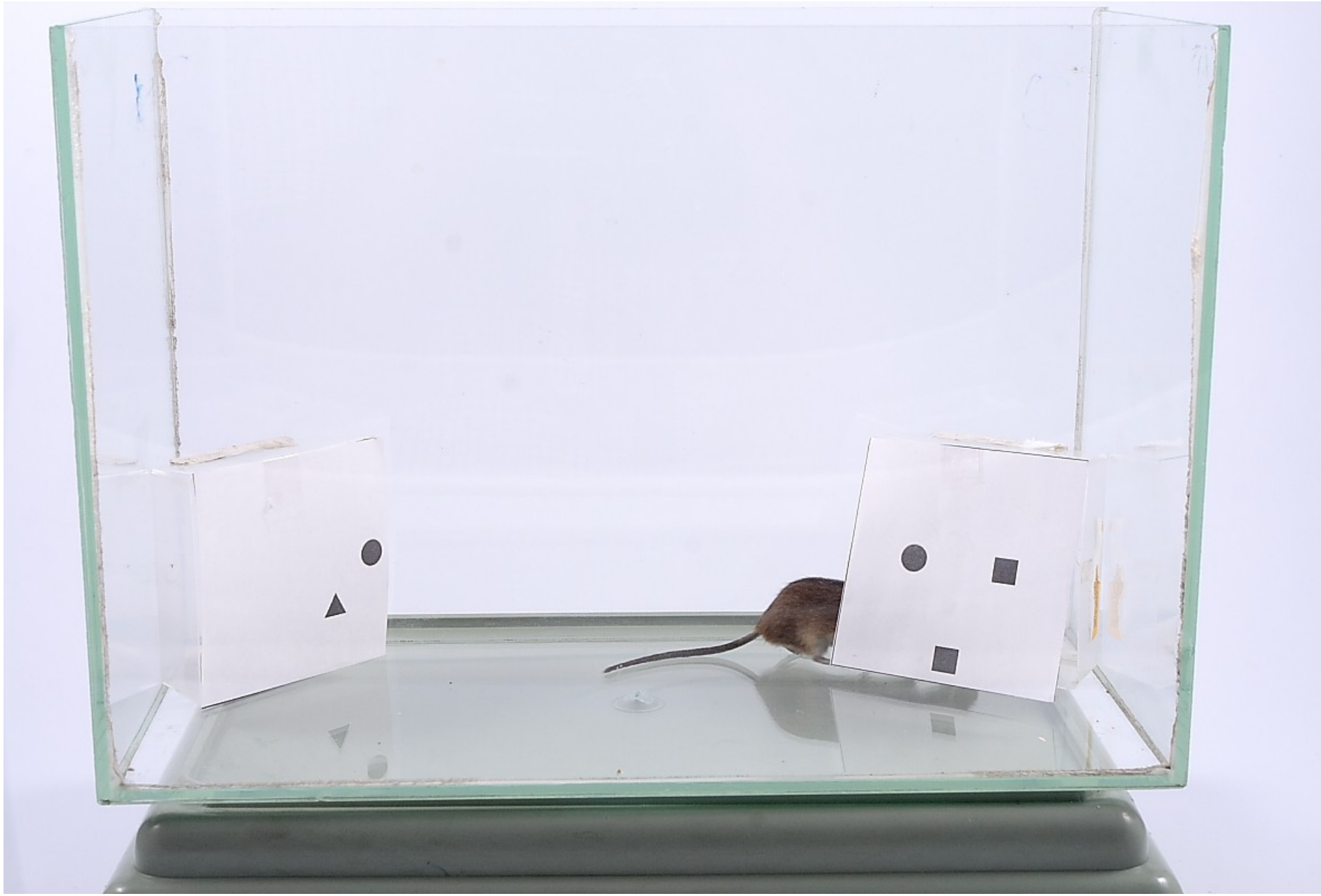
this is the first experimental paradigm in which animals “count” items basing on a balance between nutritiousness and danger

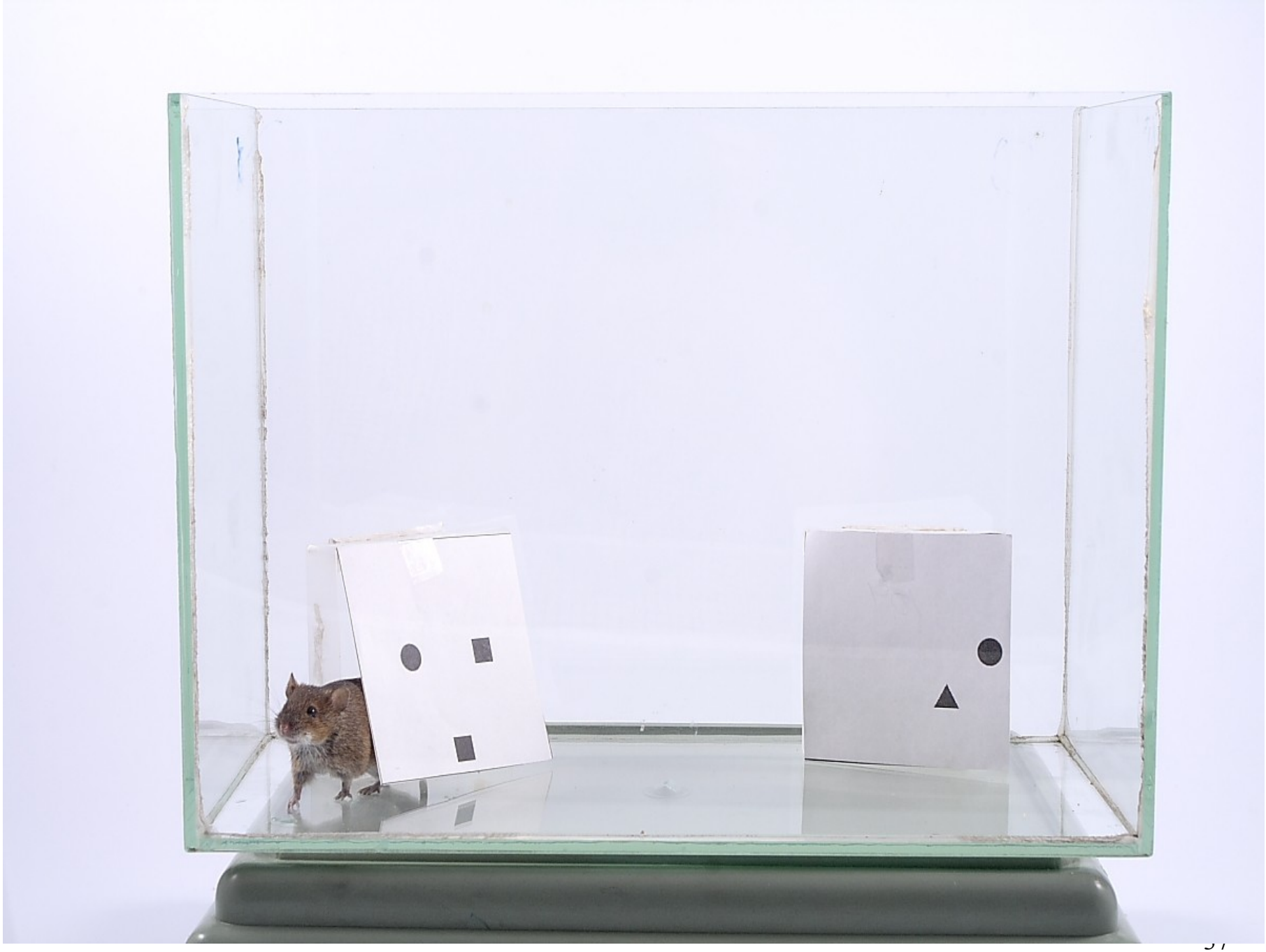




Mice “count” arbitrary stimuli







Mice not only discriminate between clearly distinctive quantities such as 5 versus 10, but also demonstrate high accuracy in distinguishing between small (2 versus 3) and large (5 versus 6, and 8 versus 9) quantities of elements differed by one item only. The last two series show that small rodents can judge about numbers precisely, beyond the limits of subitising.

This is the first evidence of proto-counting in small rodents

CONCLUSION

In sum, we can suggest that cognitive capacities of many non-human species exceed the bounds of specific cognitive adaptations. This should change the way we think about distribution of intelligence in biosphere. Many discoveries are in store for cognitive ethologists in this field.
One of the topical problems of cognitive science concerns the development of methods for comparative analysis of "biodiversity" of mental and "linguistic" skills in non-human and human species.

Please, read "The Krachka"!
http://reznikova.net/blog/