



# National University of Singapore

## LSM1303 Animal Behaviour

### Lecture II: Communication II



*N. Sivasothi aka Otterman*

# Animal Communication II

## Introduction & Chemical Communication

2. Communication by Sound

2.1 Characteristics

2.2 When lions roar

2.3 Diversity of calls

2.4 How far can calls travel?

2.5 Calls of a pika

3. Visual communication

3.1 Diversity of signals

3.2 Displays

4. Tactile Communication

4.1. Characteristics

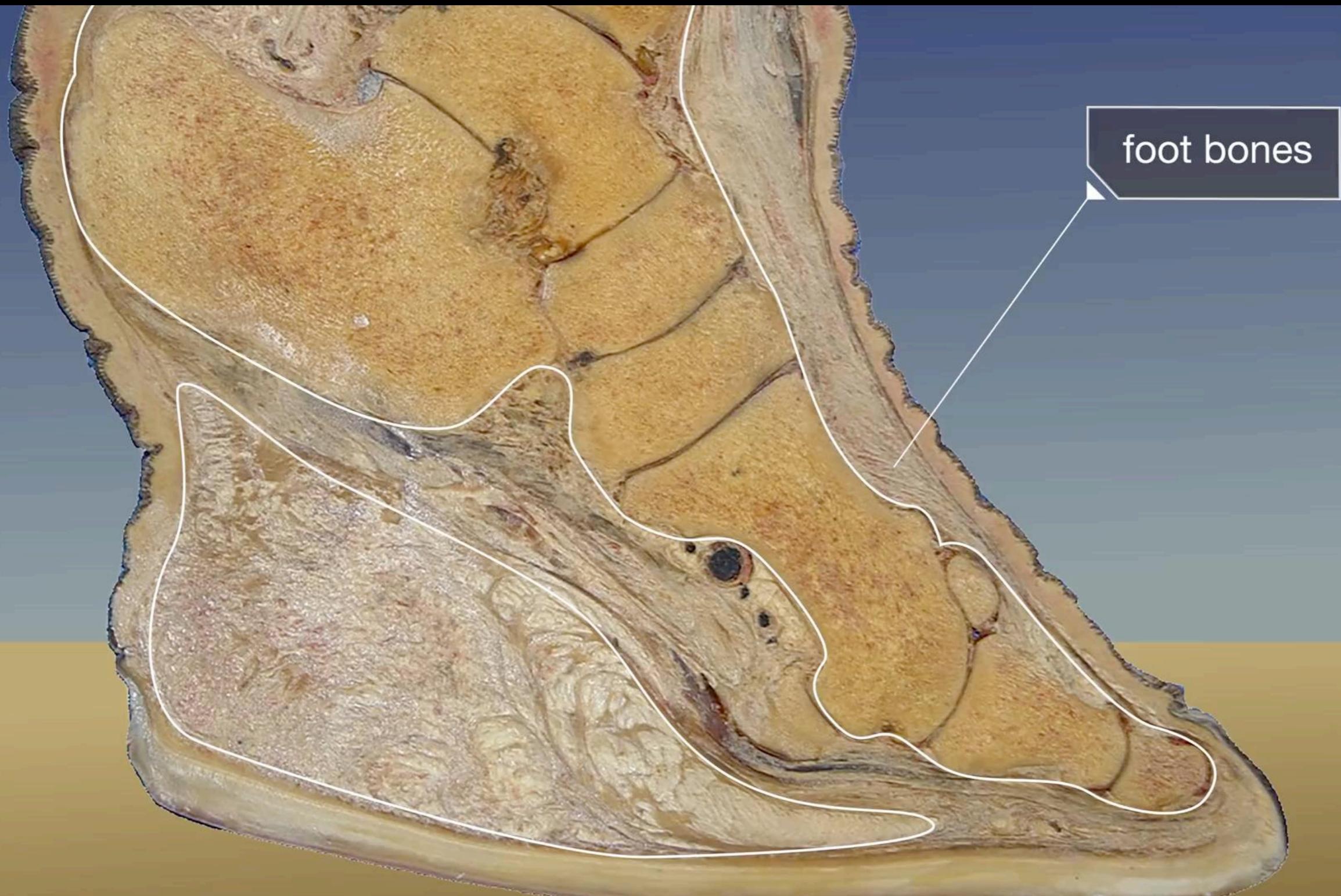
4.2 Honeybee waggle dance

## **2. Communication by Sound**

## 2. Communication by sound

- Has been well studied in bats, songbirds, whales and dolphins...
- ...and increasingly, in elephants.

# PBS: Seismic communication in Elephants



Elephants detect subsonic vibrations, “hear with their feet”; the research of Caitlin O'Connell-Rodwell

[HHMI BioInteractive Video]



## 2. Communication by sound

- Is also known in mice and rats (in addition to chemical communication), e.g.:
  - Adult rats emit ultrasonic vocalisations during aggression, mating, play and some stress
  - Separated rat and mice pups emit ultrasonic vocalisations to have parents rescue them

# Alston's singing mouse (*Scotinomys teguina*) calling in the cloud forest (Bret Pasch, U Florida)



## 2.1 Characteristics

- a) Long-distance information transfer.
- b) Transmitted in habitats where visibility is limited  
(useful in the dark, in forest understorey –  
remember the gibbons?)
- c) Can be modified quickly
- d) High energetic cost

## 2.2 When Lions roar

### Example of how vocalisations are used

- Lions usually roar between dusk and dawn
- Stay in touch with companions
- Advertise ownership of territory:  
strength to rivals  
and attract mates
- Non-territory owners risk inviting contests from  
territory owners if they are detected nearby

Grinnell, J., & McComb, K. (2001). Roaring and social communication in African lions: the limitations imposed by listeners. *Animal Behaviour*, 62(1), 93-98.

## 2.2 When Lions roar

- Lions are able to discriminate the roars of larger and smaller groups, companions and strangers
- Note the low frequency roars

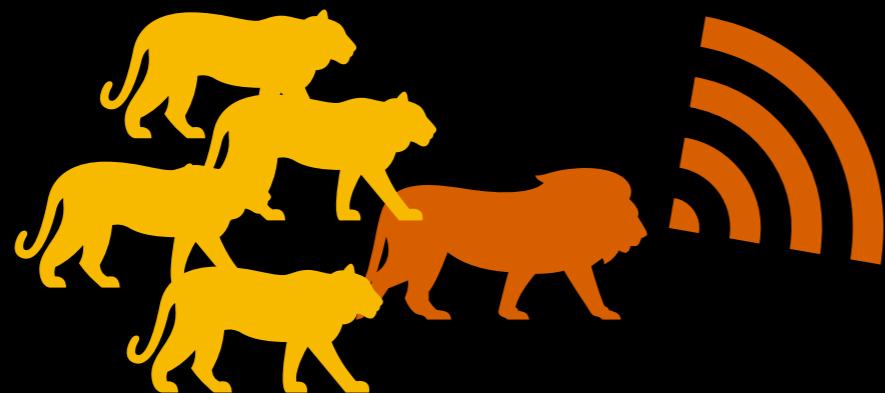


Grinnell, J., & McComb, K. (2001). Roaring and social communication in African lions: the limitations imposed by listeners. *Animal Behaviour*, 62(1), 93-98.

## 2.2 When Lions roar

### With males

- Roaring is confined to males resident in prides and will escalate in a contest
- Nomadic male lions do not roar, despite the need to maintain social ties



Grinnell, J., & McComb, K. (2001). Roaring and social communication in African lions: the limitations imposed by listeners. *Animal Behaviour*, 62(1), 93-98.

## 2.2 When Lions roar

### With males

- Resident males remain silent outside of their territories even when presented with playbacks of unfamiliar males roaring
- Nomadic males start roaring only when they are taking over a pride.
- Cost - benefit calculation



Grinnell, J., & McComb, K. (2001). Roaring and social communication in African lions: the limitations imposed by listeners. *Animal Behaviour*, 62(1), 93-98.

## 2.2 When Lions roar

### Defending adult females

- **Decision (approach of weaker group)** – are less likely to approach a playback of 3 intruders (versus a single intruder)
- **Decision** – when they did approach 3 intruders they were more cautious

Grinnell, J., & McComb, K. (2001). Roaring and social communication in African lions: the limitations imposed by listeners. *Animal Behaviour*, 62(1), 93-98.

## 2.2 When Lions roar

### Defending adult females

- **Decision** – defenders decision to approach was adjusted according to the size and composition of their own group.
- **Decision** – In contests between social groups, opponents assess resource-holding potential on the basis of relative group size.

Grinnell, J., & McComb, K. (2001). Roaring and social communication in African lions: the limitations imposed by listeners. *Animal Behaviour*, 62(1), 93-98.

## 2.3 Diversity of calls: the example of cat vocalisations

- There are at least 21 types of vocalisations in cats,
- with variations of pitch, rhythm, volume and tone.
- “The environment has an important impact on the vocal behaviour and thus feral cats and pet cats vocalise differently.”

Tavernier, C., Ahmed, S., Houpt, K. A., & Yeon, S. C. (2019). Feline vocal communication. *Journal of Veterinary Science*, 21.

### Contact call (affiliative)

-Chirps (mother-kitten), gurgle, mew, murmur, purr, trill

### Reproduction call

-Caterwaul (mowl), copulatory cry (female), mew, yowl

### Solicitation call (excitation, desire)

-Chatter, chirp, mew (human-cat), purr (human-cat interaction), tweedle/tweet, squeak

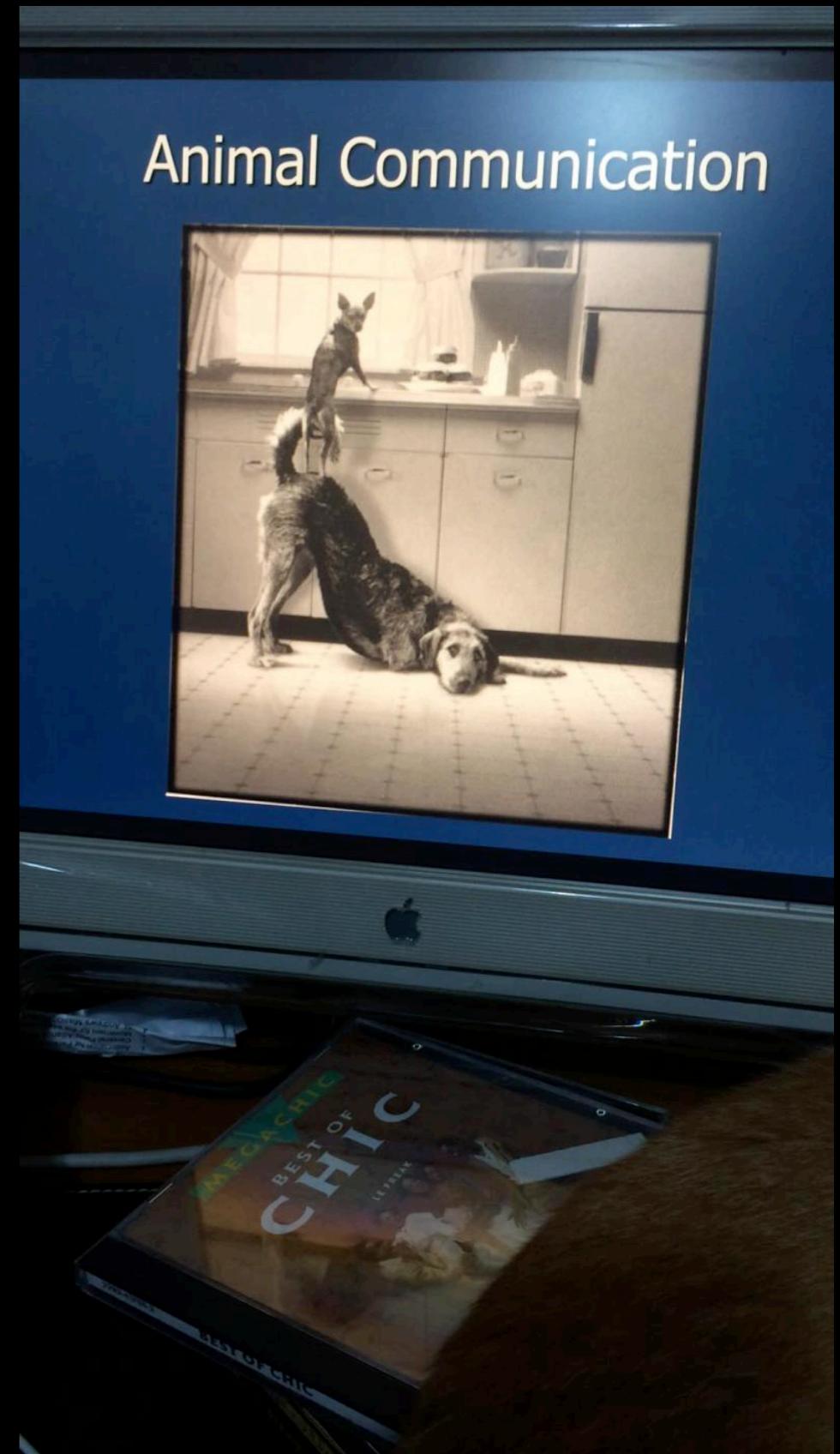
### Antagonist call

-Growl, hiss, howl, moan, pain shriek, snarl, spit, yowl

## 2.3 Diversity of calls:

### i) the purring of cats has many roles

- Cats seem to purr when they're content, invite contact
- But also when hungry or in pain, so maybe self-soothing
- Purring frequencies have shown to stimulate bone regeneration!



Mr Bats, my purring cat

## 2.3 Diversity of calls:

- ii) unsterilised male cats yowl for mates, but also at each other



## 2.3 Diversity of calls:

ii) unsterilised male cats yowl for mates, but also at each other

- The yowling of male cats is reduced when sterilised
- Of relevance to Trap-Neuter-Release-Manage programmes – island-wide in Singapore by SPCA, Cat Welfare Society and AVS

Yeon et al., 2011. Differences between vocalization evoked by social stimuli in feral cats and house cats, Behavioural Processes, 87(2): 183– 189.

## 2.3 Diversity of calls: iii) cats “chitter” at distant prey



## 2.3 Diversity of calls:

### iv) adults mews communicate or manipulate humans

- Meows - directed almost exclusively at humans (otherwise between mother and kitten)
- Between cats, there is a greater reliance on body language and scent
- Cat-human interactions are more vocal than Cat-Cat interactions

# Retaining the juvenile mew for vocalising humans (BBC Earth; 2:15)



## 2.3 Diversity of calls: Why do dogs bark?

BBC



## 2.4 How far can sound carry: Communication in Humpback Whales

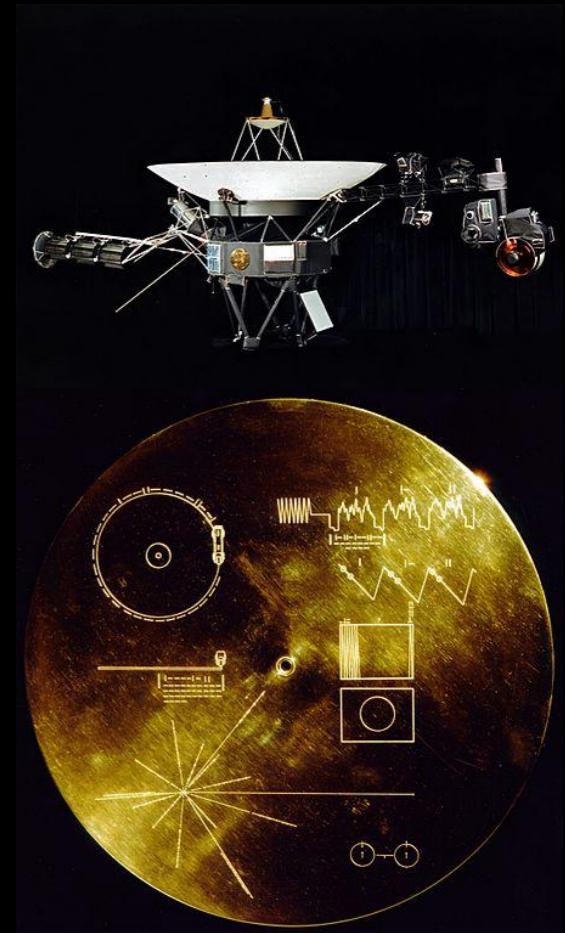


## 2.4 How far can sound carry: Communication in Humpback Whales

- Whales are social, travel in pods
- At least **34 different sound types**;
  - main sounds types = clicks, whistles, and pulsed calls,
  - also rumble, grunt, and gurgle.
- There are vocal signatures for individuals and group
- E.g. the North Pacific group dialect differs from the South Pacific dialect

# 2.4 How far can sound carry: Communication in Humpback Whales

- Sing when breeding
- Usually solitary males
- Song may last 6 - 35 min
- Sing continuously up to 22 hours
- Can be heard up to 100 miles away!



Voyager Golden Record, 1977

On August 25, 2012, Voyager 1 became the first spacecraft in interstellar space ... along with some whale songs!

# Communication in Humpback Whales (2:20)



60  
MINUTES



2.5 A pika vocalises to maintain a territory,  
which contains a diversity of plants  
– this is necessary for survival  
BBC/Attenborough - Pika (2:37)



### **3. Visual Communication**

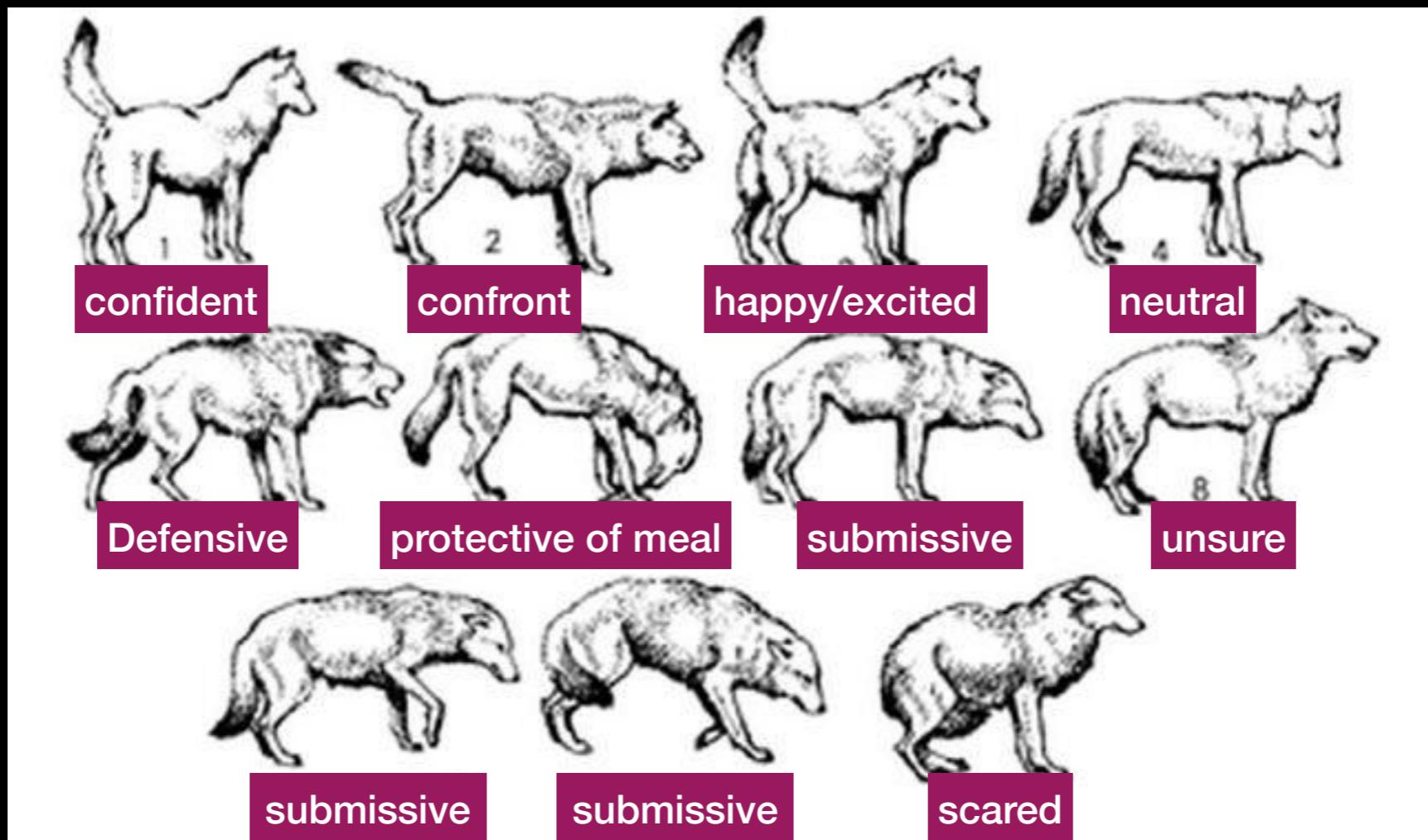
# 3.I Visual communication – characteristics

Characteristics:

- a) Location of receiver is known
- b) Rapid transmission
- c) Rapid fade-out time
- d) Diversity of signals can be generated
- e) Cannot be used in some habitats

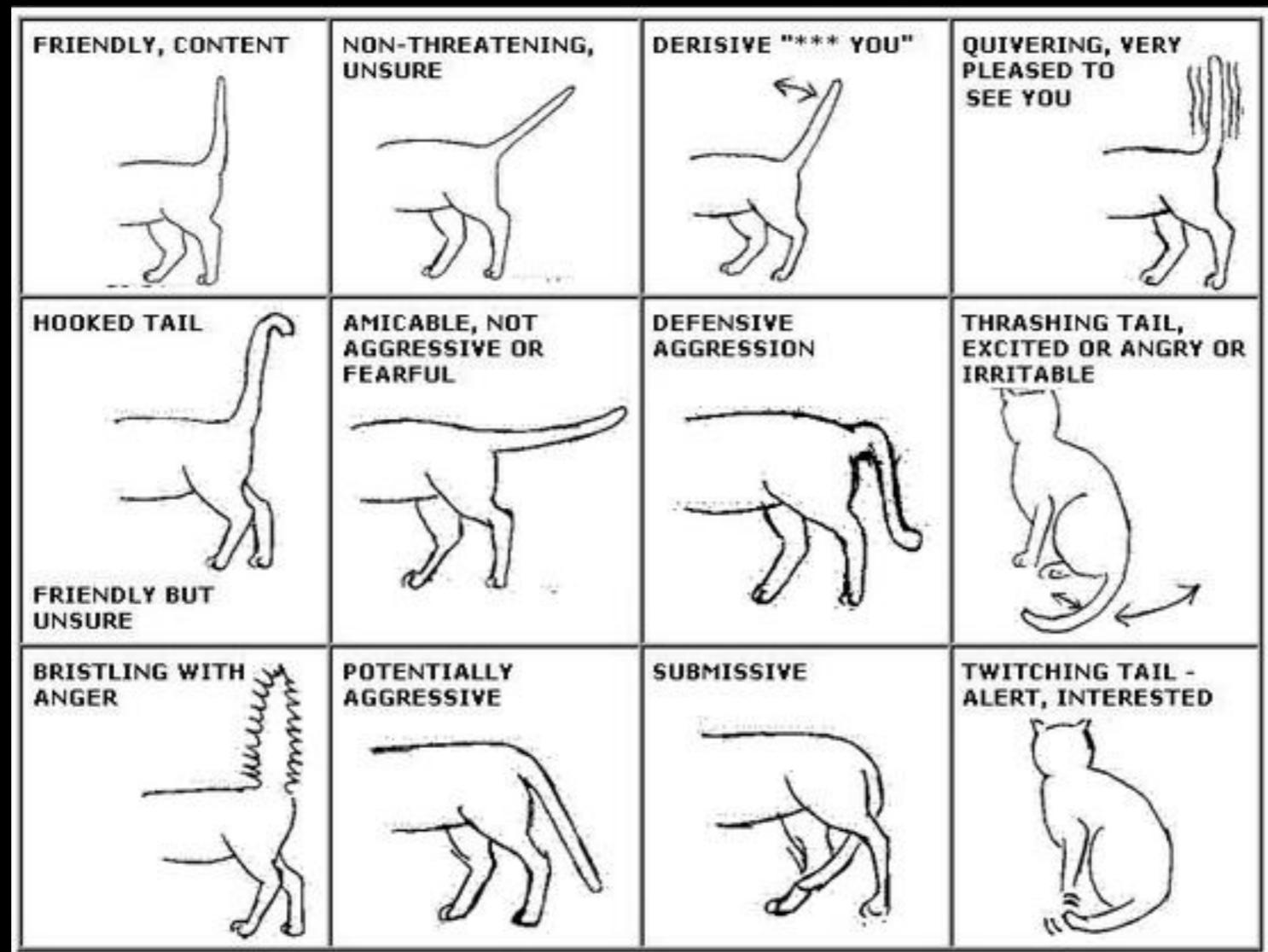
# 3.I Visual communication – diversity of signals

Tail and body posture in dogs communicate meaning



# 3.I Visual communication – diversity of signals

Tail and body posture in cats communicate meaning



**catchannel.com**  
presents

# **Reading Cat Body Language**

**powered by CAT FANCY magazine**

## 3.2 Visual communication – DISPLAYS

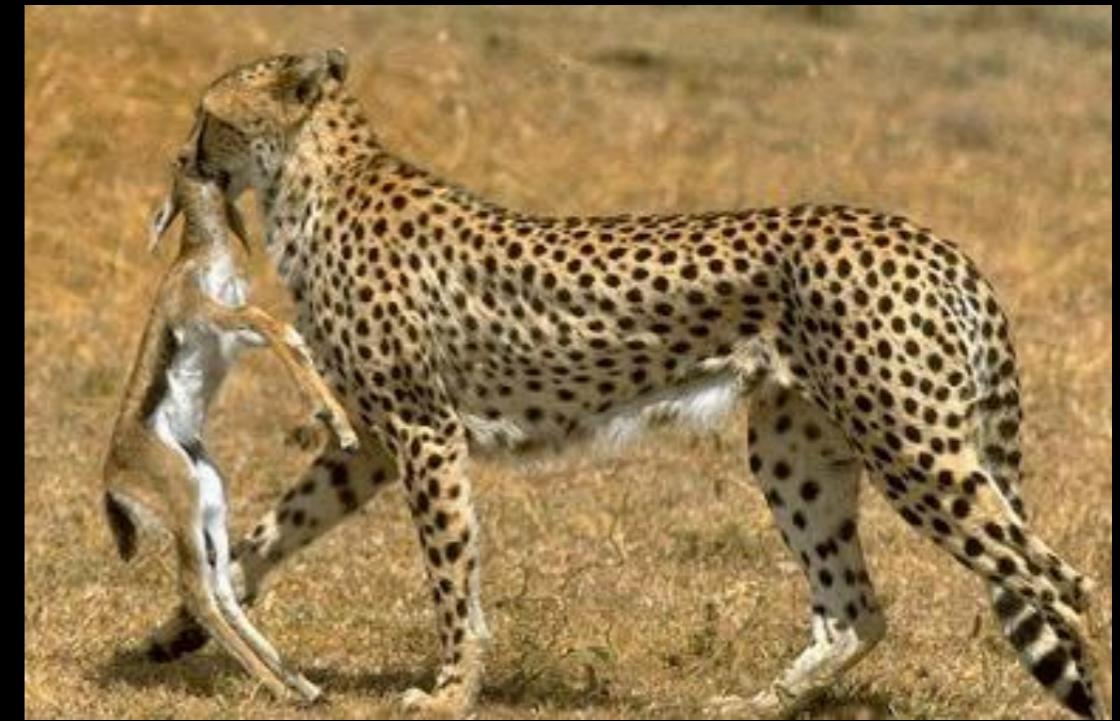
Displays are ritualised behaviours that evolved specifically as signals.

E.g. alarm, threat, courtship

## 3.2.1 ALARM display



Signalling group members



Tail swishing in ungulates signals danger to conspecifics (amongst other things)



## 3.2.2 THREAT display: enlarge; armament



Enlargement to threaten



Armament



Enlarge

# Lion Tailed Macaque Threat Display



BBC: Praying mantis threat display versus jumping spider (2:41)

BBC



### 3.2.3 COURTSHIP displays: Fiddler crabs



[WildSingapore.com](http://WildSingapore.com)

# Mangrove fiddler crabs in Singapore

[mangrove.nus.edu.sg](http://mangrove.nus.edu.sg)



## Orange fiddler

*Uca vocans*

Size: 3-4 cm

The Orange fiddler is very common on sandy-muddy substrates, often at the edge of mangroves.



## Rosy fiddler

*Uca rosea*

Size: 2 cm

The Rosy fiddler is found mainly in back mangroves, on firmer mud.



This beautiful species was described in 1940 from Singapore. Today, it is highly endangered locally because most of Singapore's back mangroves have been lost.



*Uca annulipes* displaying

## Porcelain fiddler

*Uca annulipes*

Size: 2-2.5 cm

The Porcelain fiddler prefers slightly sandier substrates and can be found on sandbanks.



## Purple fiddler

*Uca paradussumieri*

Size: up to 5 cm

The most striking species is the Purple fiddler.

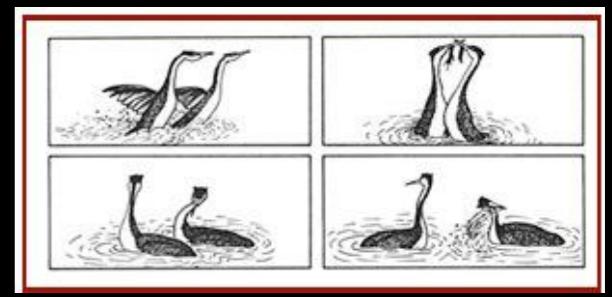


It is an obligate mangrove crab, and often occurs in soft mud. Juveniles build chimney-like burrows.



Fiddler crabs waving on Ao Nam Bor Bay  
YouTube: Kingfisher Tanee

# The courtship dance of the Grebes, BBC Life (1:44)



# **4. Tactile Communication**

# 4. I a Tactile communication in animals: Characteristics

Characteristics:

- a) Effective only over short-distance
- b) Can be performed if visibility is limited
- c) Fast response to change
- d) Easily located

# 4.1b Tactile communication in animals: What, Why?

- How do animals use tactile functions to communicate with each other?
  - head rubbing, nuzzling, biting, licking, body contact, pawing, boxing
- What do animals use tactile communication for?
  - Affection, anger, warning or dominance

Forms and meanings vary with species and the same gesture can communicate different signals for each species

With pets, mimicry of gestures can help put an animal at ease.

Failure to recognise signals may be tolerated by benign individuals

# 4. Ic Tactile Communication in Animals: When?

Most commonly seen in adult herding or pack animals, e.g. rodents, felines (cats), and canids (dogs), and in use in various situations

1. Parenting
2. Social bonding
3. Greetings
4. Play
5. Dominance (aggression)

# 4.1c Tactile Communication in Animals: Parenting

- Parenting birds and their young
  - Gulls: chicks peck a coloured spot on their parent's beak to encourage the parent to regurgitate food (*FAP from the instinct lecture*)
  - Adult birds nuzzle chicks to preen downy feathers until first moult
- Mammalian mothers raising young
  - Mothers lick newborns to stimulate breathing and blood flow and clean the babies of afterbirth, maintain their temperature, stimulate defaecation, and transfer her scent.
  - Newborns move towards their mother's nuzzling and licking. Nuzzling of young to their mother's teats **will stimulate milk flow**.
  - They maintain body contact to share body heat and protection from predators.

Important specific knowledge for animal husbandry, wildlife care and rehabilitation

# 4.1c Tactile Communication in Animals: Social bonding

- Social bonding in rodents (tactile & chemical communication – remember the lab mice?)
  - Most rodent species are social animals, living in family groups. Physical contact helps to develop and maintain bonds between related animals and familiars
  - Huddling together offers protection, but also helps maintain close bonds between individuals.
  - Nuzzling, licking and grooming swaps pheromones; this tactile communication works hand in hand with chemical communication

Animal Communication I:  
Chemical Communication

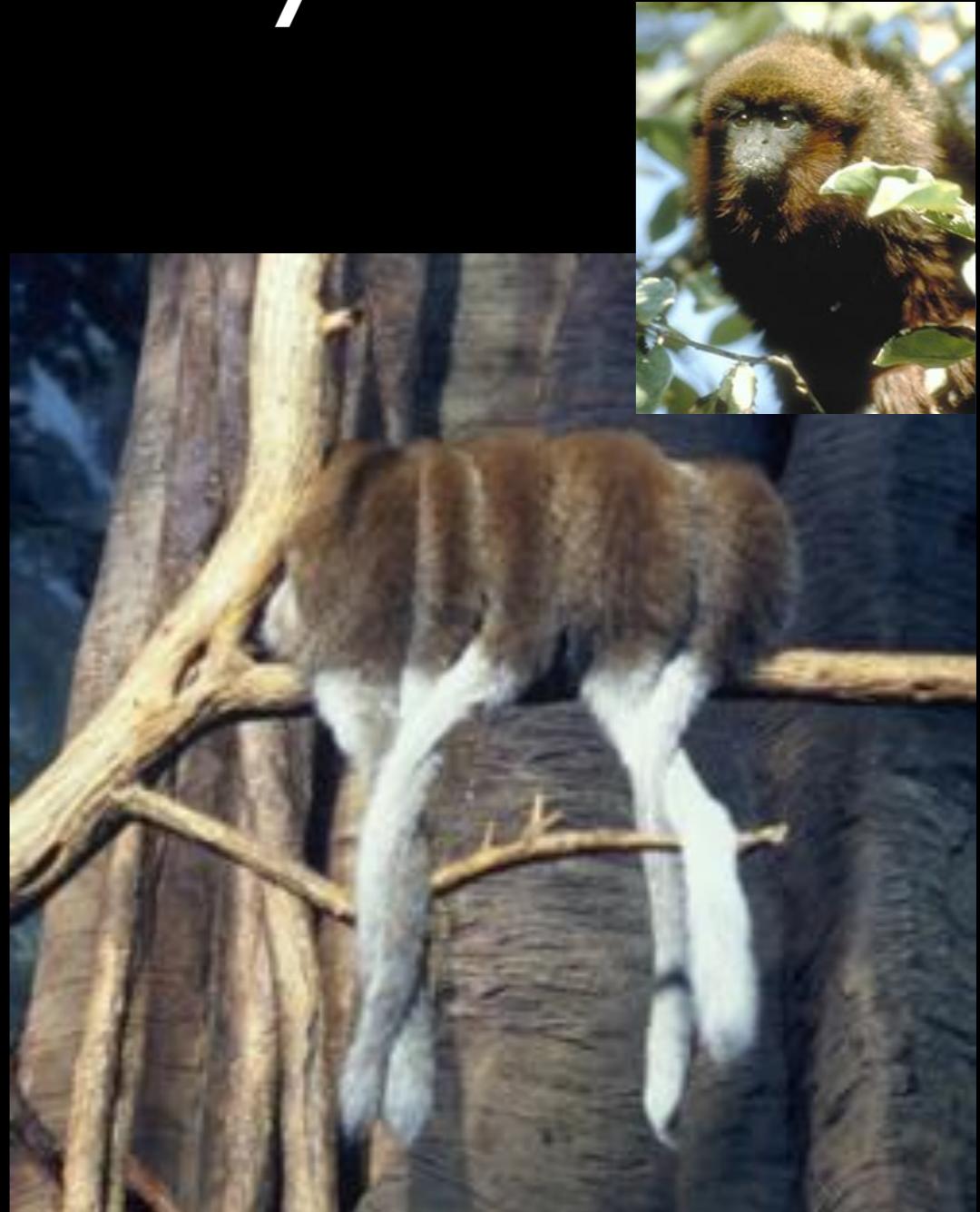
## 6.2 Of mice and pheromones



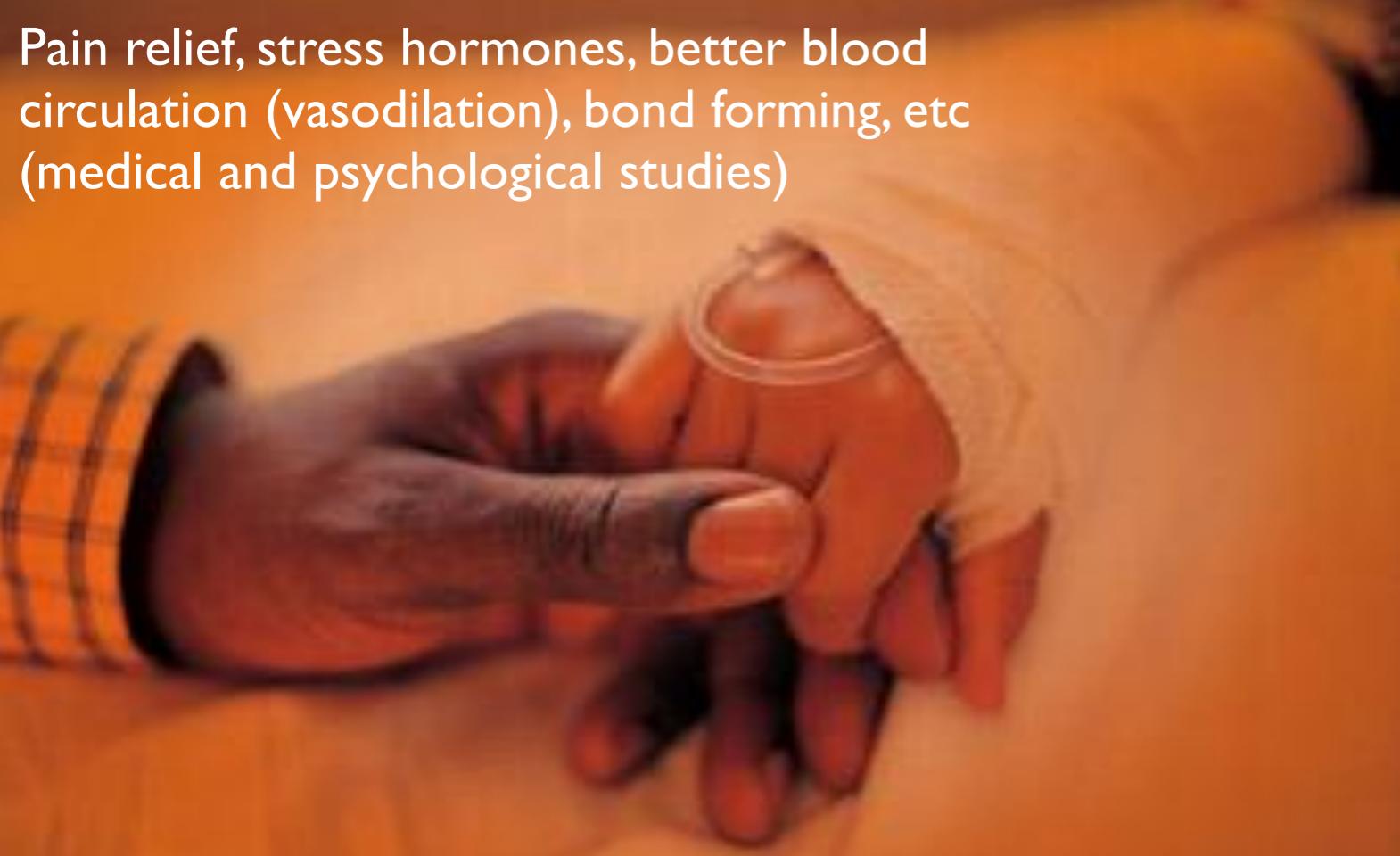
The Secret Chemical  
World of the Lab  
Mouse

# Tail twining in the Dusky Titi Monkey

- Adult monogamous pairs are very close emotionally to one another, coordinating their activities to a high degree and remaining within close proximity
- The pair will frequently huddle, intertwine tails, groom and hold hands.
- Also, they will foot grasp, lip-smack, nuzzle, gently grasp one another and sit pressed together

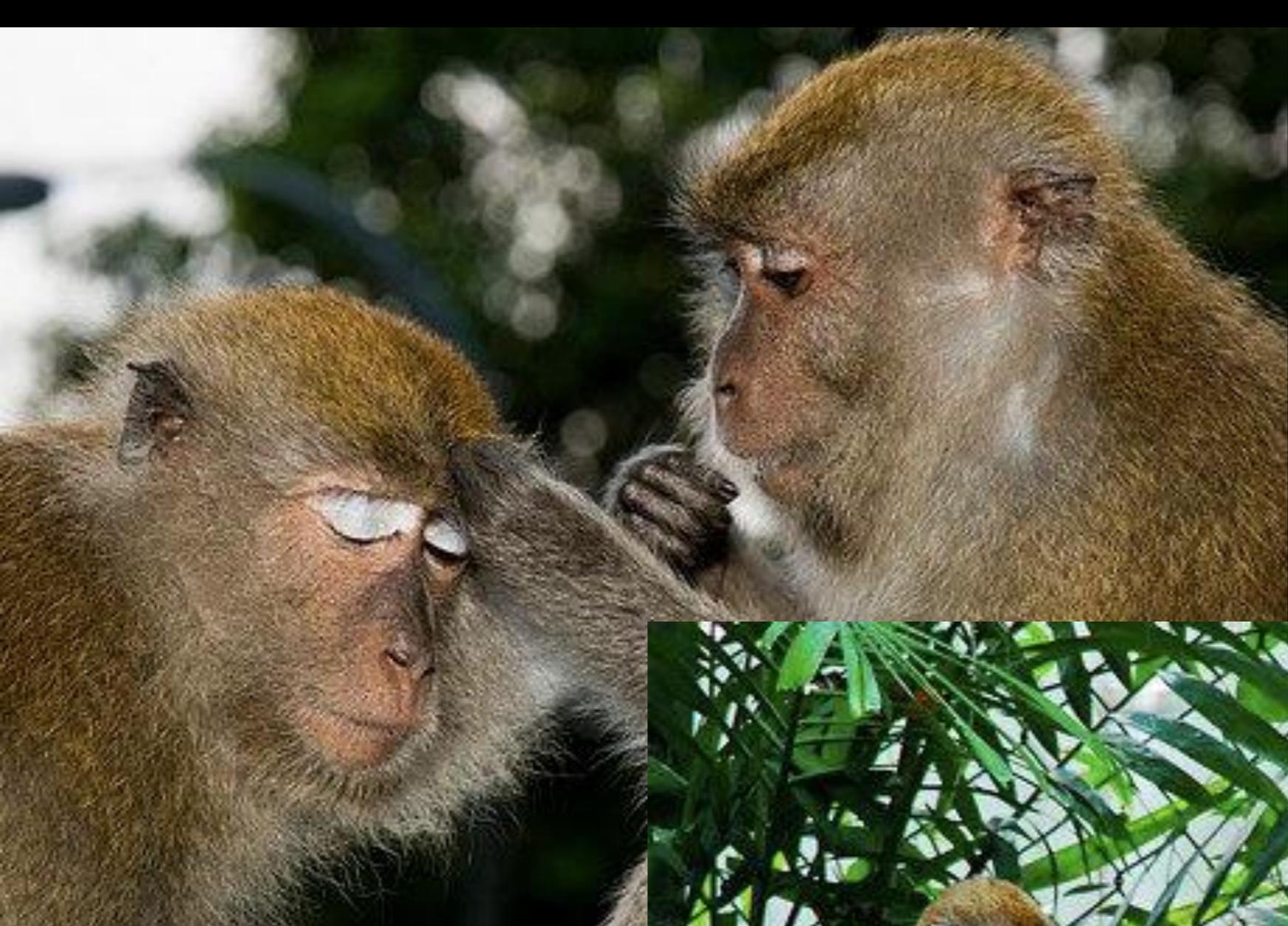


Pain relief, stress hormones, better blood circulation (vasodilation), bond forming, etc (medical and psychological studies)



Xylo the cat





**Long-tailed macaque,  
Singapore**



# Long-tailed macaque grooming (Leong Tzi Ming)



# 4.1c Tactile Communication in Animals: Greetings

- Tactile Greetings
  - Familiar animals greet one another through physical contact and vocalisation.
  - Cats rub heads with other familial cats and groom each other.
  - Dogs greet with a gentle paw or lick of the face.
  - In wild animals, greetings between familiar animals usually involve physical contact such as walking with bodies touching or nuzzling the head.

# “How to properly greet cats,”

## Dr Christine Cao, DVM [1:32]



# 4.Ic Tactile Communication in Animals: Play

- Play
  - Youngsters will often **instinctively play together** which brings about motor development useful in adulthood, and bonding.
  - Predatory species will **learn hunting and attacking behaviors** when a few weeks old.
  - Pups chase and wrestle, learn to be stealthy and effectively catch and kill prey. They learn the limits of biting within play to avoid injury.
  - Dogs **initiate a play bow, inviting the other dog to play.** A game of chase or play-fighting re-establishes their bond'

# How Do Dogs Make Friends?

## Pets: Wild At Heart | BBC Earth

BBC

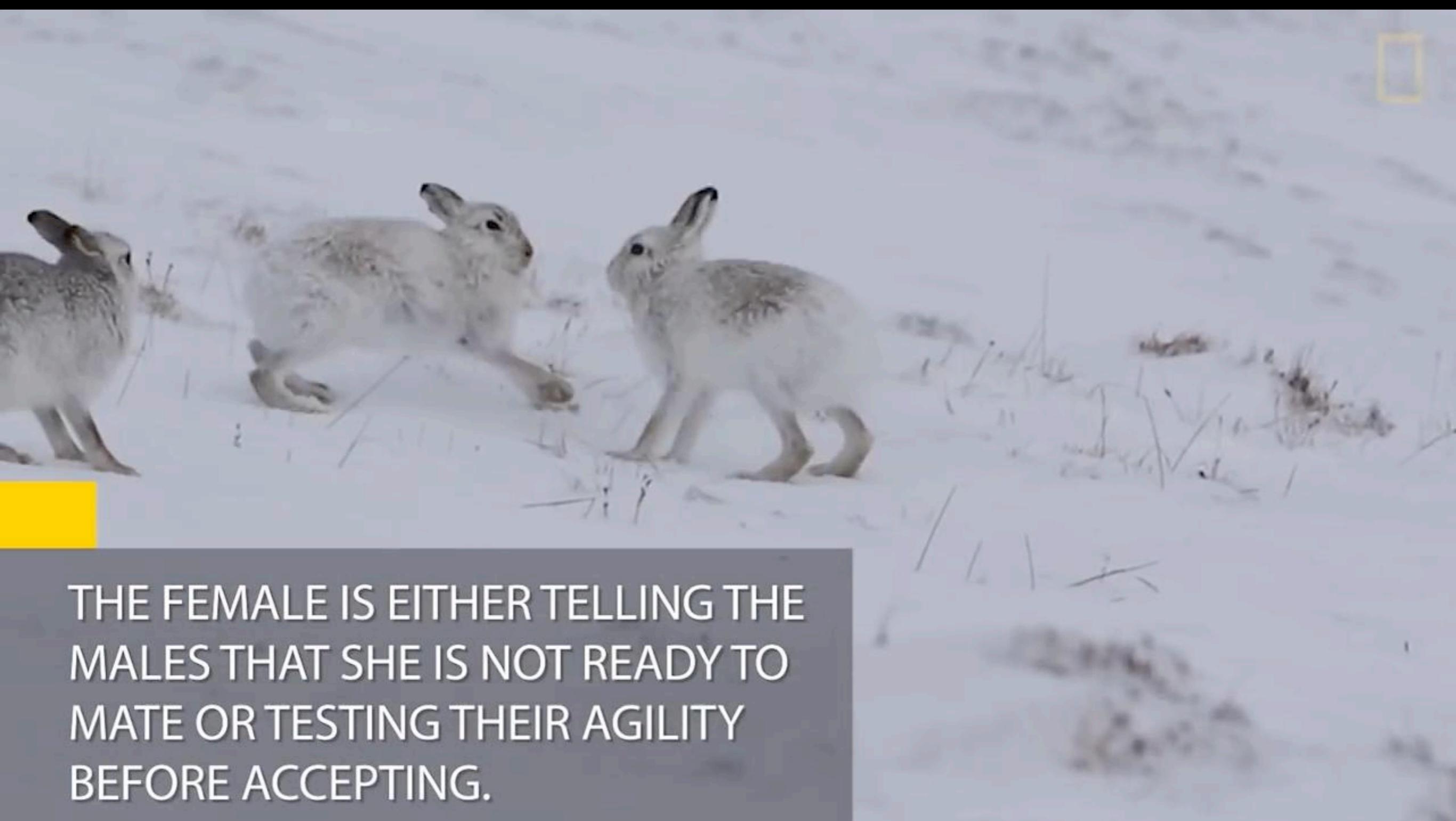


# 4. Ic Tactile Communication in Animals: Dominance

- Horses and deer
  - A head shake and nudge or butt against the neck may be followed by a nip using teeth if neither individual backs down.
  - Hooved animals will use their powerful hind legs to kick out at challenges to their hierarchy
- Rabbits and hares
  - Breeding season: males participate in boxing matches to determine dominance. Winners win the right to mate with nearby females in season.
  - Boxing matches can also involve kicks to the face or chest using the hind legs. The recipient of a strong kick will usually back down to avoid being hurt.
- Fish
  - Males circle one another and use a flurry of quick and repetitive body slams to warn off each other males.

# Female hare punches suitors

National Geographic [0:57]



THE FEMALE IS EITHER TELLING THE MALES THAT SHE IS NOT READY TO MATE OR TESTING THEIR AGILITY BEFORE ACCEPTING.

# Stallion Fight: body contact, shoving, bites, kicks (Planet Earth II | BBC Earth [4:13])

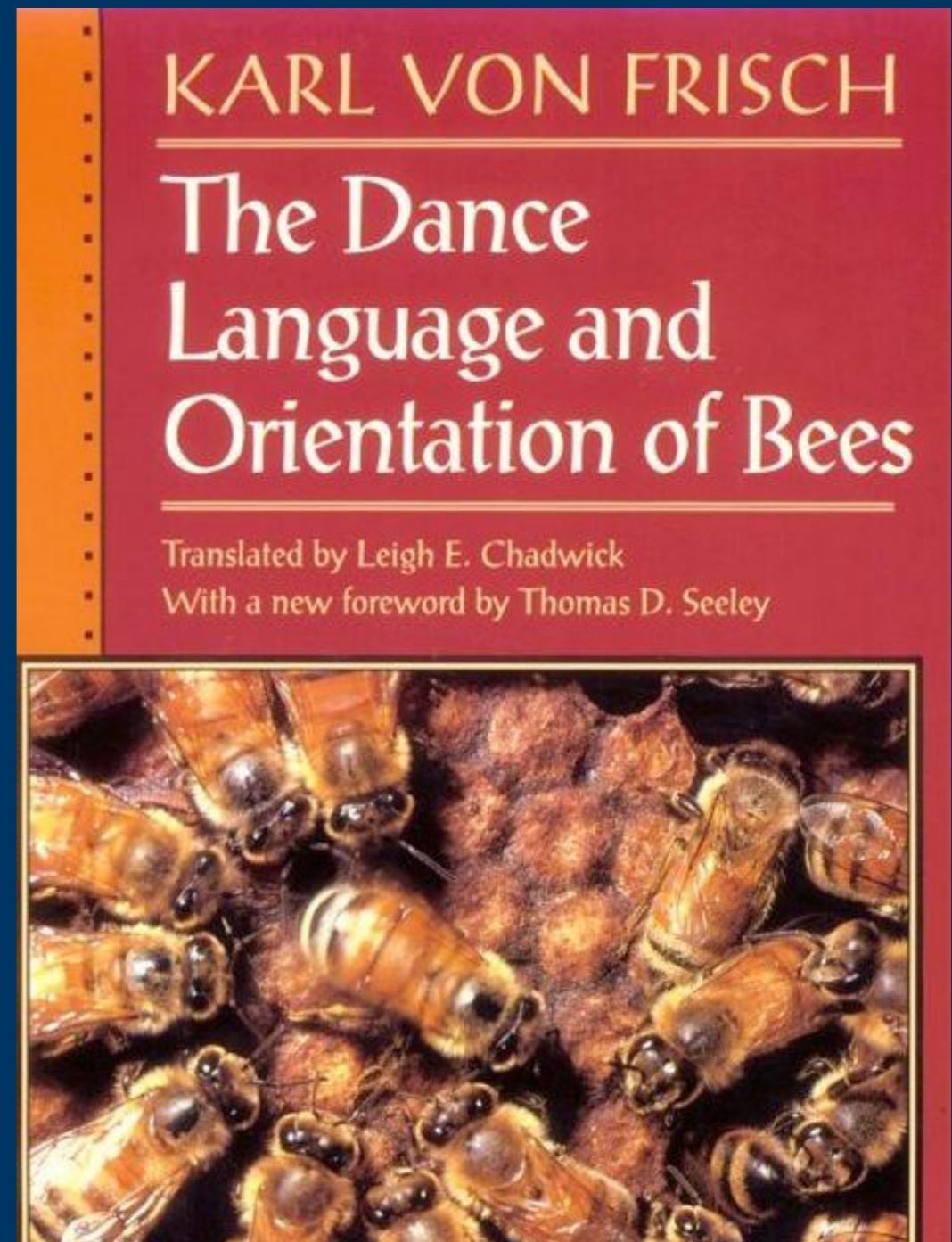
BBC

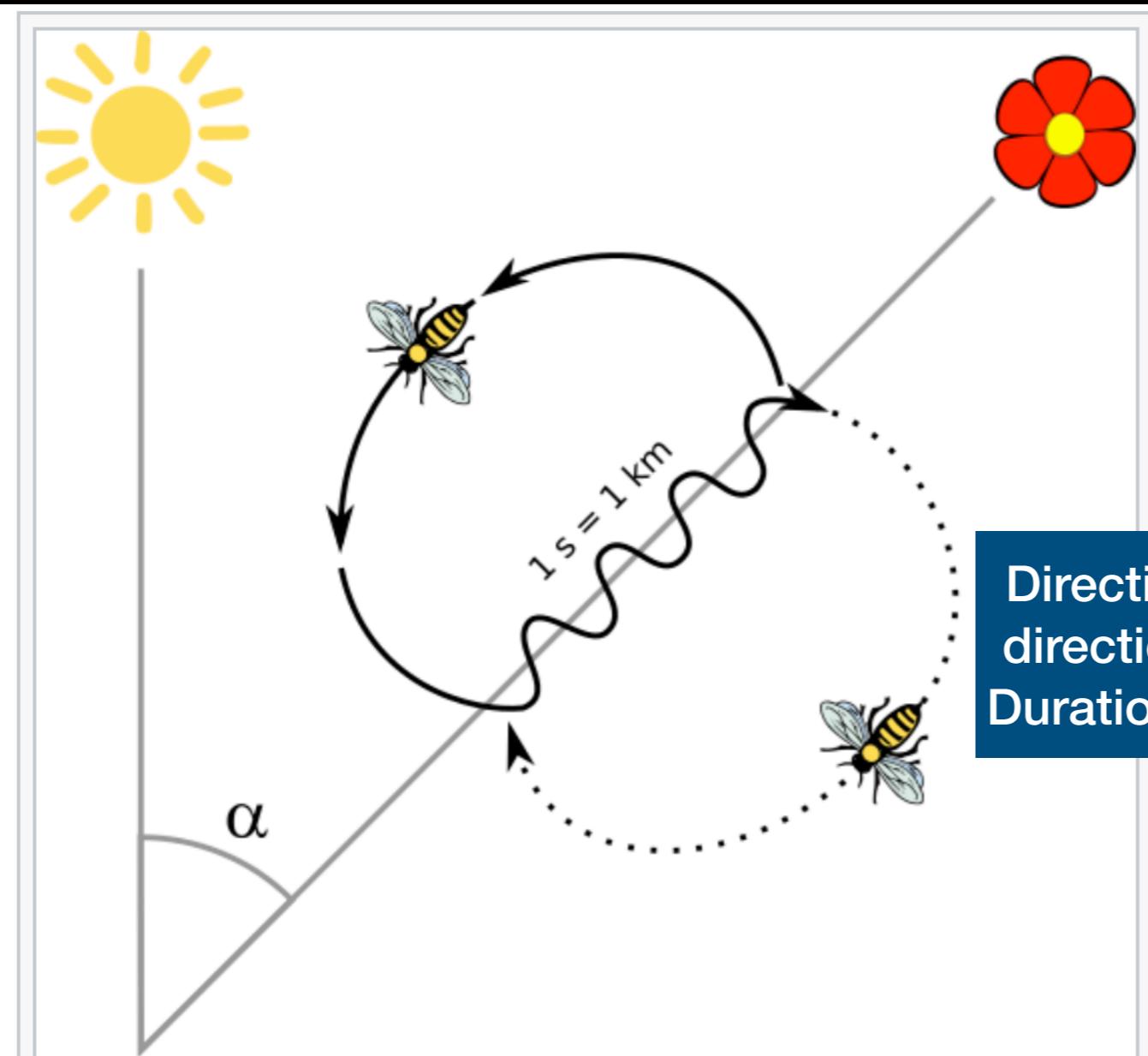


# 4.2 Tactile communication: the dance of the honey bee

Described by Aristotle, 330BC!

Explored by Karl von Frisch,  
who won the 1973 Nobel Prize  
along with Konrad Lorenz and  
Nikolaas Tinbergen





The **waggle dance** - the direction the bee moves in relation to the hive indicates direction; if it moves vertically the direction to the source is directly towards the Sun. The duration of the waggle part of the dance signifies the distance.



# The Waggle Dance

## Inside the Animal Mind | BBC (2:38)

BBC



# Honey Bee Waggle Dance (0:54)



# Honey Bee Waggle Dance (1:37)



# Type of Signals

Character	Chemical	Audio	Visual	Tactile
<b>Effective distance</b>	Long	Long	Medium	Short
<b>Abilities to go over obstacles</b>	Good	Good	Poor	Poor
<b>Exchange</b>	Slow	Fast	Fast	Fast
<b>Complexity</b>	Low	High	Medium	High

# How to approach a ...

- Dog
- Cat

## Required Reading or Viewing

- [Link] View "How to Get a Cat to Like You" | Lifehacker (2018) [5:58]
- [Link] View "How to Approach a Dog Safely" | Union Lake Veterinary Hospital (2016) [5:37]



**Understanding communication  
Understanding animals  
Understanding people**