

# Knowledge transfer using termites as an educational model

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## Knowledge transfer

**“The focused, *unidirectional* communication of knowledge between individuals, groups, or organizations such that the recipient of knowledge:**

- (a) has a cognitive understanding;**
- (b) has the ability to apply the knowledge; or**
- (c) applies the knowledge.” (Schwartz 2006)**

Knowledge barriers:

**“The perceptual system in a specific human or group of humans does not contain enough contact points, or does not fit incoming information to utilize it and convert the information to knowledge.” (Paulin & Suneson 2012)**

## Awareness – lacking the bases

Many people think of this when we talk about termites in Portugal:



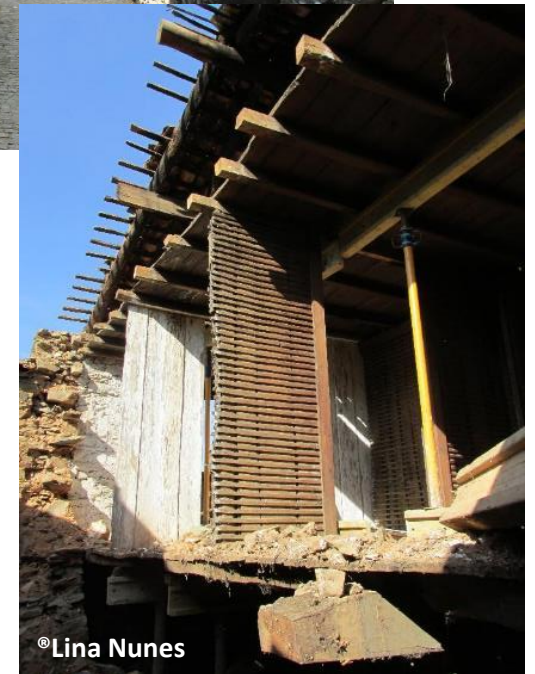
<https://www.mangoafricansafaris.com/blog/three-cheers-termites>



But they are closer than they think!

# Awareness – lacking the bases

Wooden rot is the “diagnostic” for several wood degradation agents, termites included



## Knowledge transfer - examples:

### Situational interest

**“...transient interest that is generated by aspects of a particular situation” (Hidi 1990)**

### Civic science

**“...considers science practice and knowledge as resources for civic engagement, democratic action, and political change” (Boyte 2011)**

### Formal mode of learning (STI)

**“Science, Technology and Innovation mode – dominated by scientific and technical knowledge” (Jensen et al. 2007)**

### Informal mode of learning (DUI)

**“Doing, Using and Interacting mode – dominated by informal processes of learning and experience-based know-how” (Jensen et al. 2007)**

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*Boyte, HC. 2011. Constructive politics as public work: organizing the literature. Polit Theory, 39, 630-660.*

*Jensen, MB, Johnson, B, Lorenz, E, Lundvall, B. 2007. Forms of knowledge and modes of innovation. Res. Policy, 36, 680-693.*

*Hidi, S. 1990. Interest and its contribution as a mental resource for learning. Rev Educ Research, 60, 549-571.*

# Termite services

I. Nutrient and organic matter turnover

II. Soil erosion and hydraulic properties

III. Increase biodiversity

IV. Litter decomposition

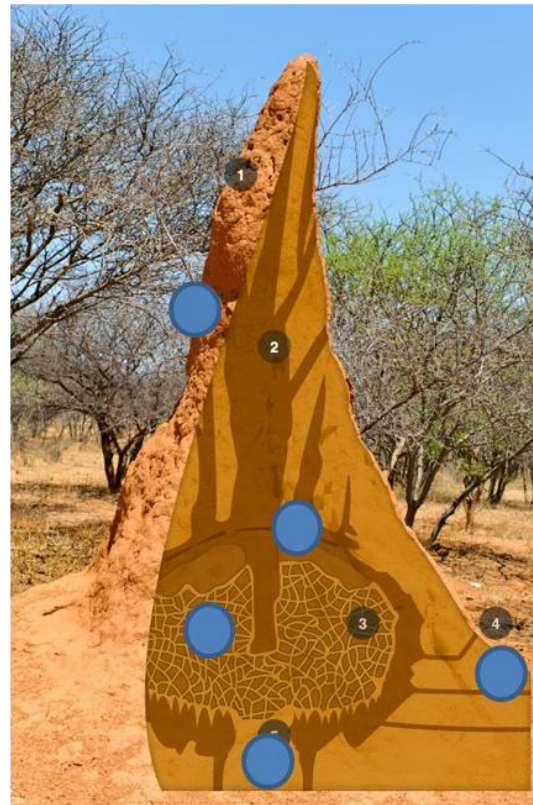
I. Structures built by termites: erosion/decomposition



III. Provision of refuge and food resources and/or nutritional supplements for a wide range of animals

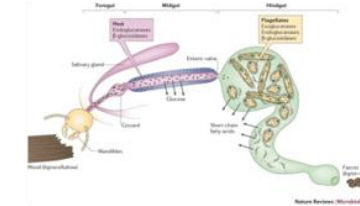


II. Soil aeration, descompactation, rehandling – modification of soil structure



In entomofilos.blogspot.pt

III. Symbiosis – fungiculture; protists and/or bacteria inside termite guts



II. Water infiltration and runoff



I/IV. Plant material processing



I/III. Nutrient hotspot triggering plant communities growth

## Termite attacks

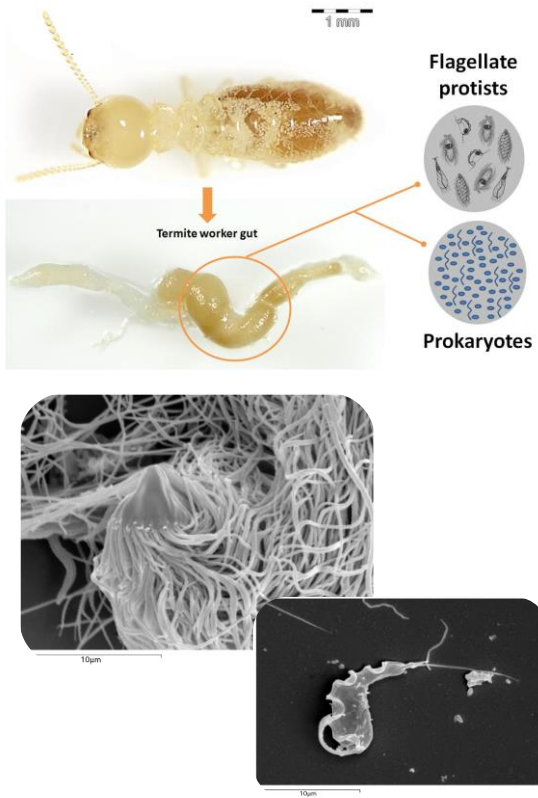


In 2010, the global economic impact of invasive termites was estimated at 35.6 billion euros (Rust & Su 2012)

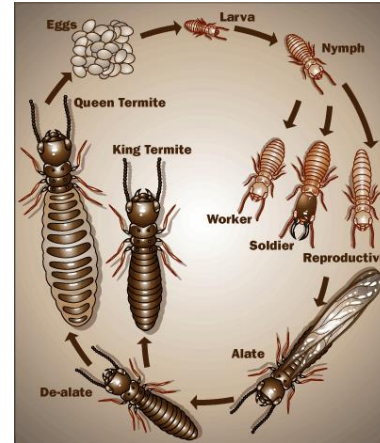


# Termites – ecological/theoretical educational models

## Symbiosis



## Pest management



## Social insects



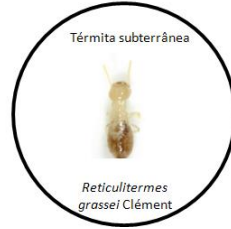
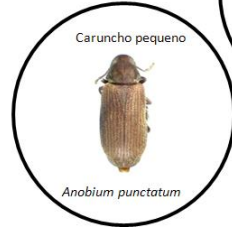
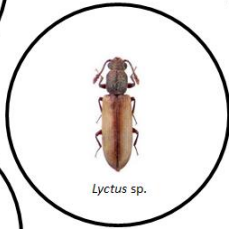
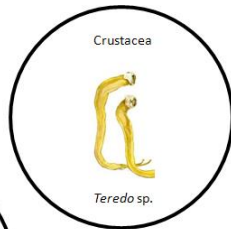
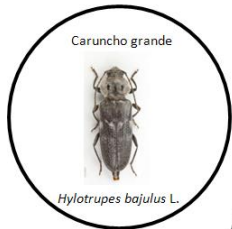
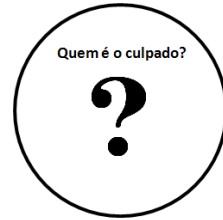
## Carbon cycle



## NEI 2014 – European Researchers' Night

“One night, several hundred cities all over Europe and beyond - exploring science through fun learning.”

Who's who in wood degradation?



Civic Science  
Situational Interest

Supported by the European Commission as part of the Marie Skłodowska-Curie Actions

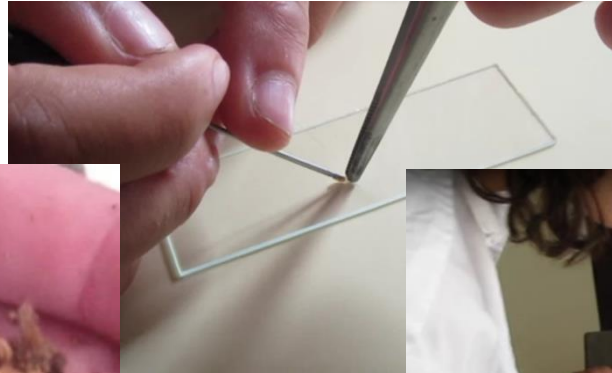
# Schools and kindergartens visits



**Situational Interest  
DUI**



The Faculty of Science and Technology of the New University of Lisbon (FCT NOVA) promotes the FCT NOVA Challenge competition to promote the interest in scientific knowledge in the young science students, provide interaction among young people and researchers, as well as stimulate the emergence of talents in the area of Sciences, Technologies and Engineering.



**Aim:** explore a complementary approach to the neo-Darwinian theory of evolution, namely through symbiogenesis, which explains "the origin and evolution of organisms through the combination or association of two or more living beings that enter into symbiosis (Merezhkowsky, 1909)

<https://www.youtube.com/watch?v=V7DEuj1O5ZU&feature=youtu.be> (in portuguese)

### Follow-up

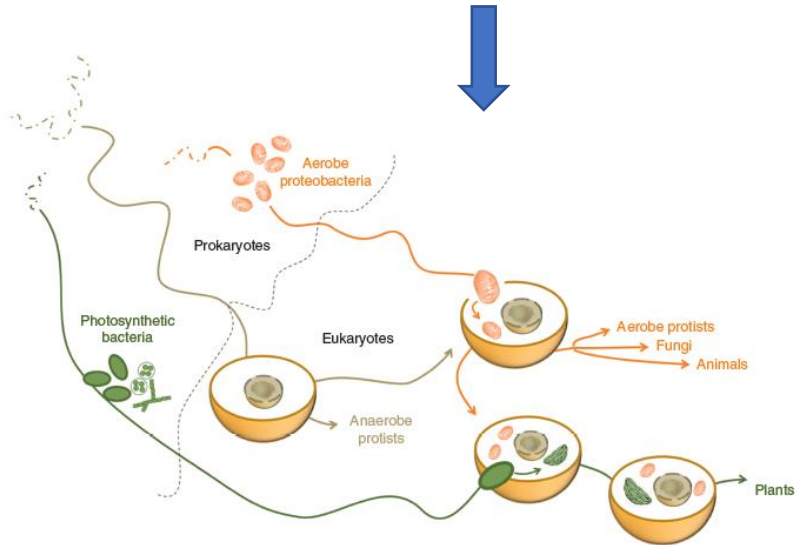
- developed activities of scientific dissemination of this theme in the school, as well as didactic materials

DUI/STI

“symbiotic relations are not exceptions, but rule in the natural world!”



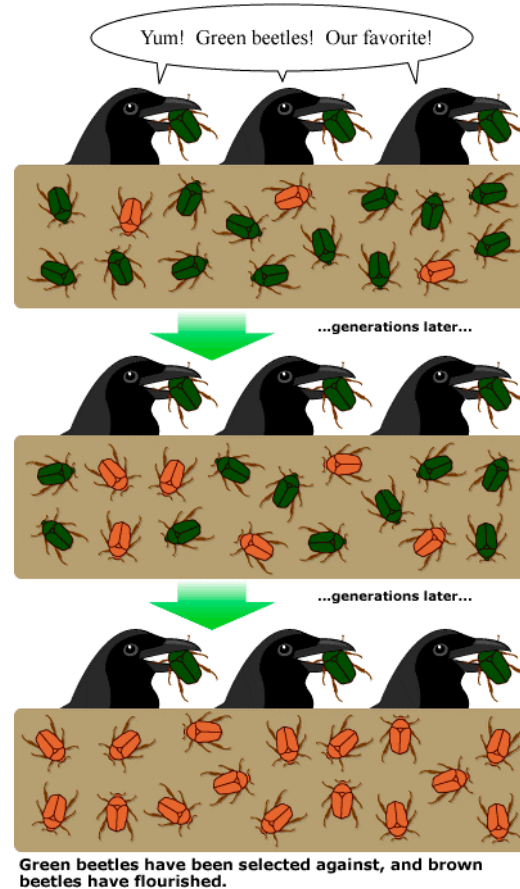
*Symbiogenesis*, or endosymbiotic theory  
 evolutionary theory of the origin of  
 eukaryotic cells from prokaryotic organisms



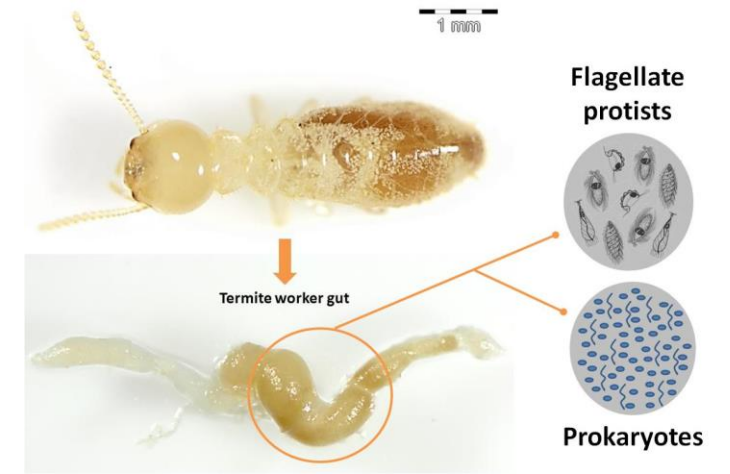
**Figure 3** The origin of mitochondria and chloroplasts by symbiogenesis. Mitochondria evolved from aerobic proteobacteria, and chloroplasts from photosynthesizing cyanobacteria.

In *Encyclopedia of Evolutionary biology*, RM Kliman, 2016

**Natural selection, in a nutshell:**



Knowledge transfer using termites



← *Neo-darwinism*

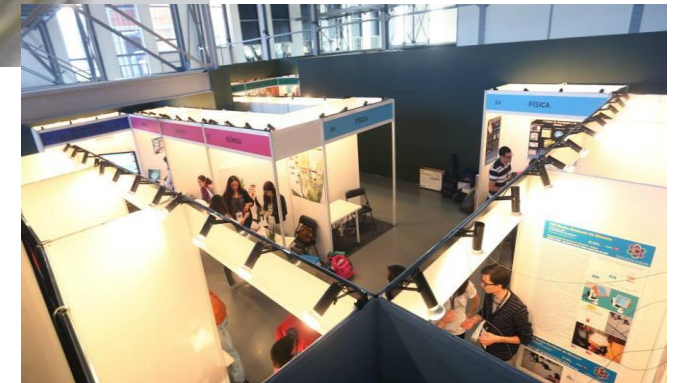
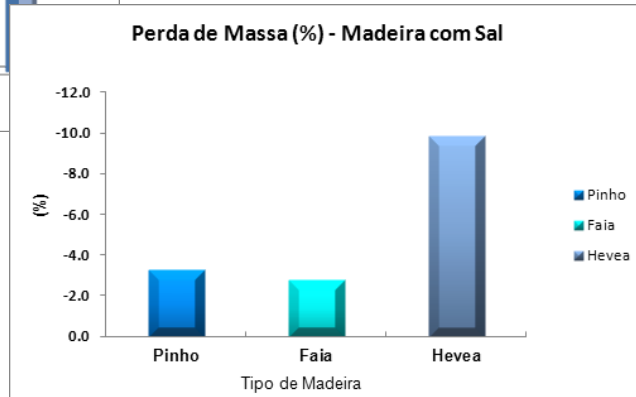
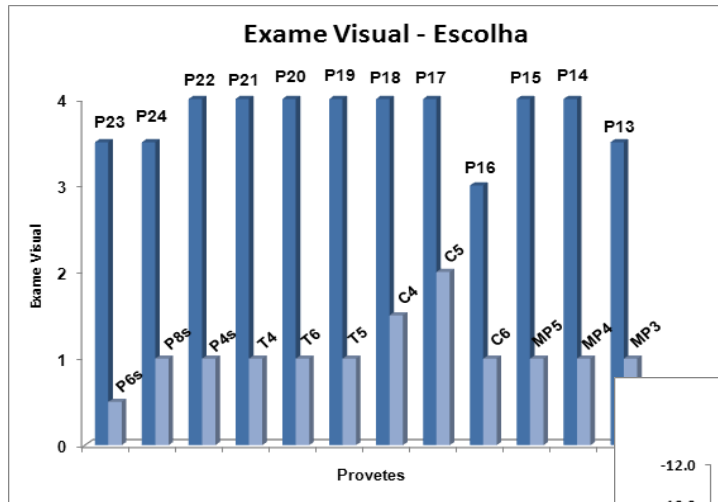
synthetic evolutionary theory  
 adjusting Darwin's natural selection  
 theory with modern population  
 genetics

DUI/STI

# National Demonstration of Science 2013

## Project: Termites – new materials durability and efficacy of salt treatments

Cork , plastic wood and thermally modified wood



- Engineering Prize
- Special ACJ Prize

DUI/STI



<http://sostermitas.angra.uac.pt/>

...pela presença de um pó tipo farinha, o granulado dos dejectos das térmitas assemelha-se mais a grãos de açúcar.



Ver imagem  
Avermelhados pretos



Ver imagem  
Avermelhados pretos



Ver imagem  
Brancos



Ver imagem  
Amarelados



Ver imagem  
Granulado de térmitas avermelhado ou preto

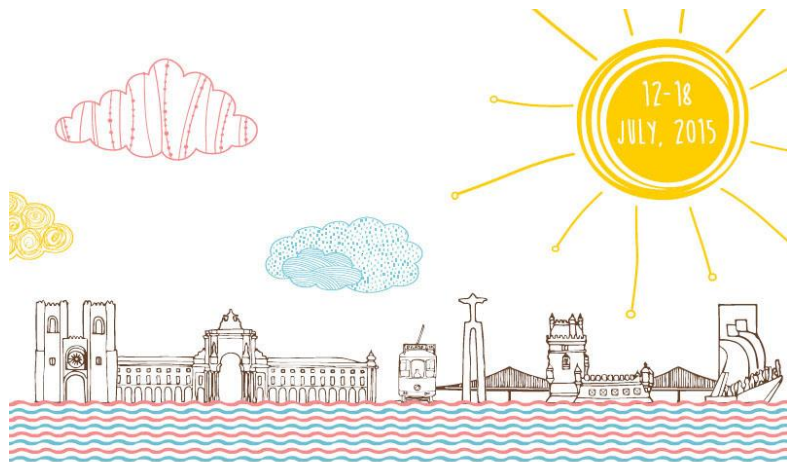
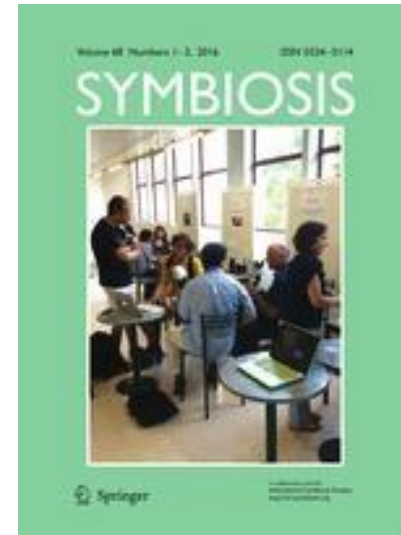


Ver imagem  
Pó de caruncho

# 8th International Symbiosis Society congress 2015

## – Teaching symbiosis session

“Display the symbiosis model, using for example, living material (by naked eye or dissecting microscope), film, slides , their book(s) or images, or even a specific teaching method. A kind of **'living poster' session.**”



## Course: integrated control of termites in buildings



29 participants from 3 countries

STI





## Other examples

### Raising the public awareness - the correct use of wood



Tercena Temporary  
Accommodation Center –  
for children >4 years



## Future directions

- Define a *knowledge management* (KM) strategy for termites
- Develop tools/programmes for knowledge transfer according with some criteria (target group age, objective of the action, adequate mode of learning...)
- Disseminate information on correct practices for preventing/control termite attack to wooden (and wood-based products) infrastructures and products
- Include the correct use of wood in the targeted theme for KM strategy
- Establish a network (national/european/international) to tackle these objectives and apply the designed KM in different countries and communities



### Knowledge Management



Spread and make knowledge accessible and usable within or between chosen organizations (Paulin and Suneson 2012)



Thank you for  
your  
attention!