

جامعة ديالى / كلية الهندسة
قسم الهندسة الالكترونية

حلقة نقاشية بعنوان

**Nature Inspired Technologies
(Idea and Application)**

العلوم المستوحاة من الطبيعة
(فكرة وتطبيق)

إعداد :

م.م. عصام صلاح حميد

Nature Inspired Technology ORIGINS

Intellectual
Structure
In
JAPAN

Bio-mimetics
In
GREEK

SMART
MATERIAL
In
USA

ORIGINS



Definition

Originates from the Greek word
“bios” (life)
and “mimesis” (to imitate)

Bio_Mimetics

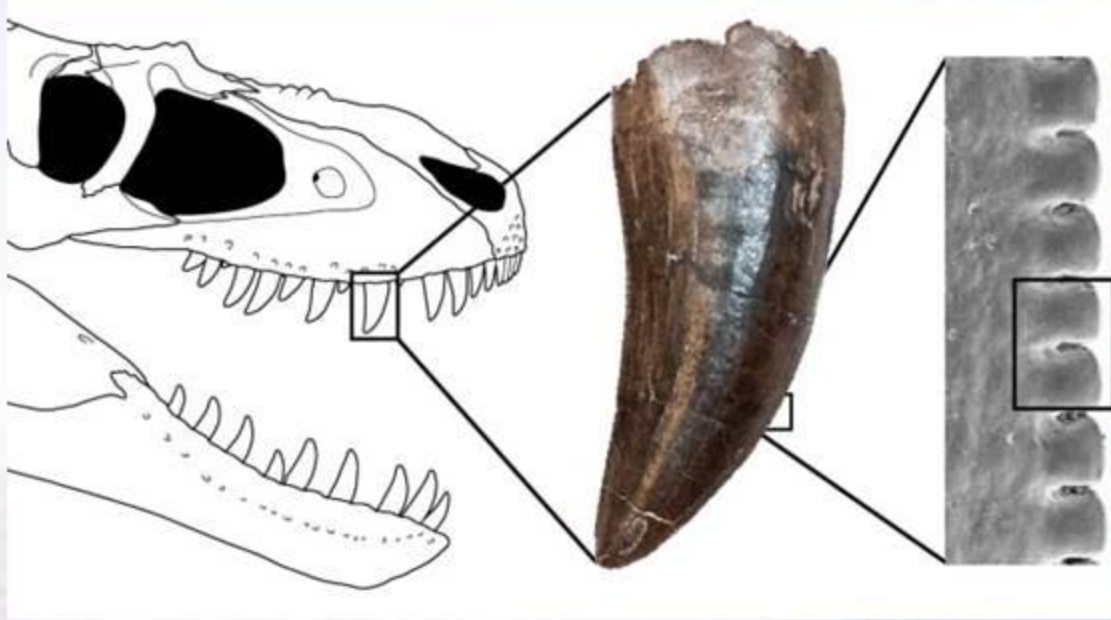
Life-Like

Copy

A globe of the Earth is centered in the image, showing the Americas. The word "History" is written in a large, bold, black sans-serif font across the middle of the globe. The globe is set against a background of a bright, hazy sky and a light-colored ground surface. The globe is reflected on the ground below it. At the top of the image, there are several curved, overlapping bands of light blue and teal color.

History

Historical information



يقول الله تعالى :

(فَبَعَثَ اللَّهُ غُرَابًا يَبْحَثُ فِي الْأَرْضِ لِيُرِيَهُ
كَيْفَ يُؤَارِي سَوْءَةَ أَخِيهِ قَالَ يَا وَيْلَتَا
أَعْجَزْتُ أَنْ أَكُونَ مِثْلَ هَذَا الْغُرَابِ فَأُوَارِيَ
سَوْءَةَ أَخِي فَأَصْبَحَ مِنَ النَّادِمِينَ)
المائدة (31)



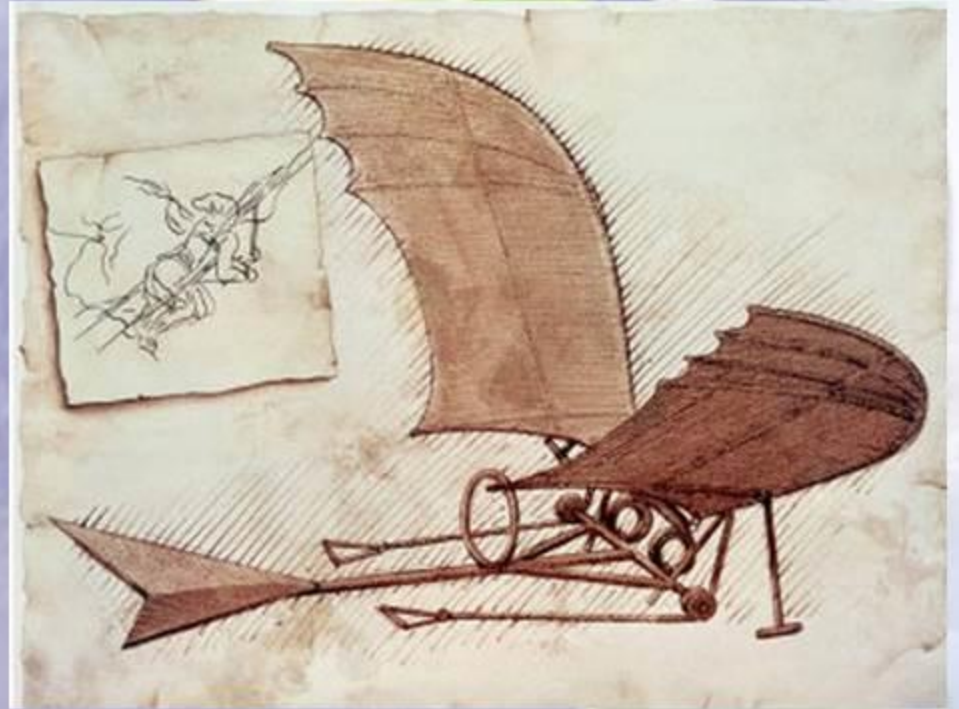
قَابِيلُ
قَتْلُ

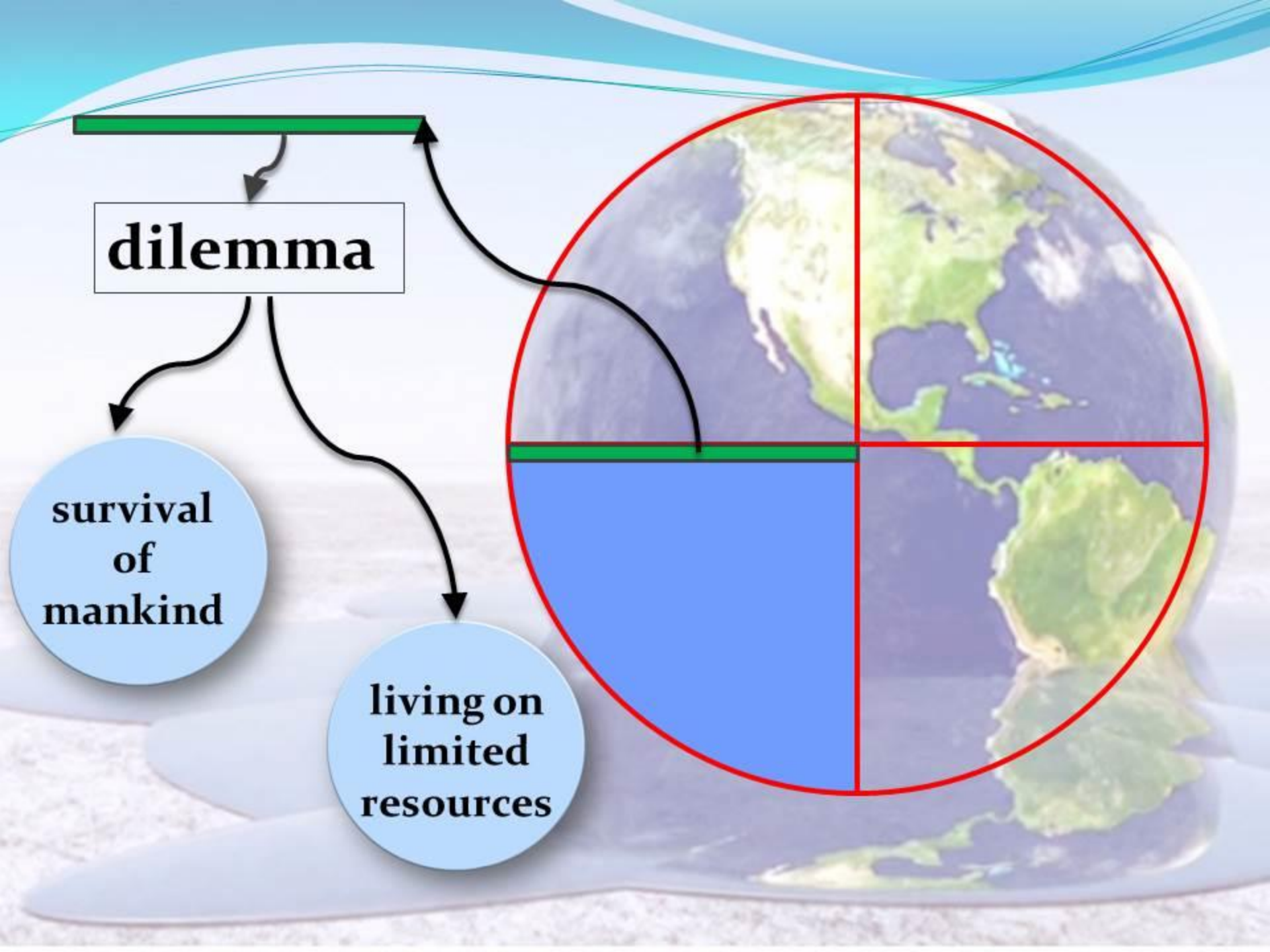
هَابِيلُ

فَطَخِلَ فِي

حَيْرَةٍ مِنْ أَمْرِهِ

Historical information





dilemma

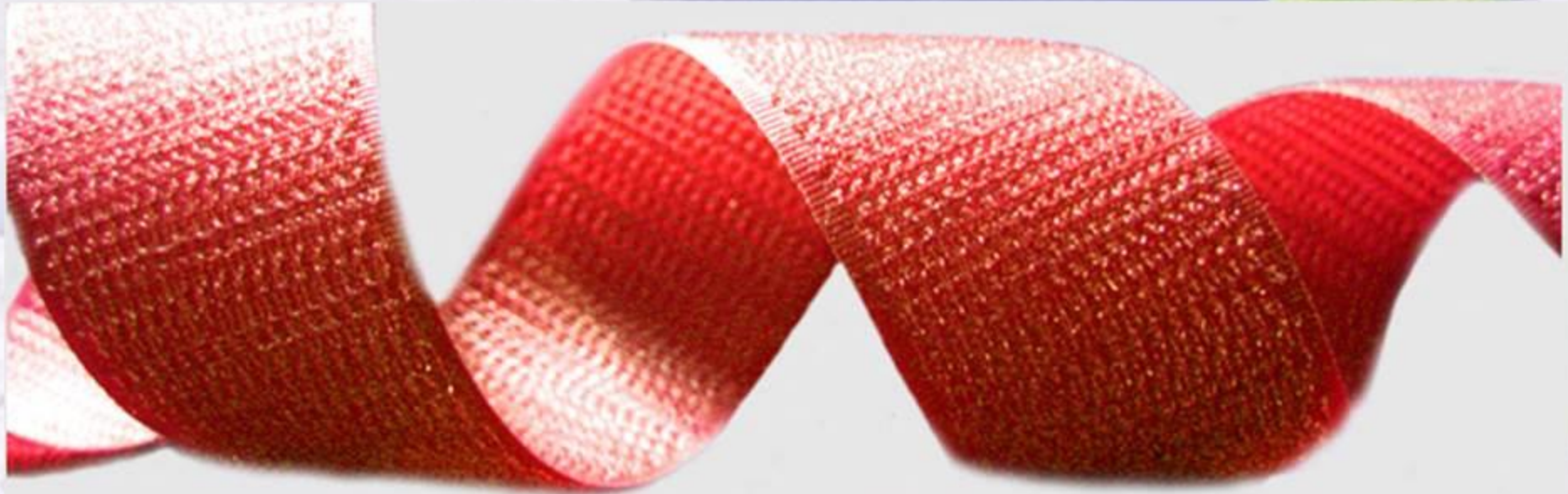
**survival
of
mankind**

**living on
limited
resources**



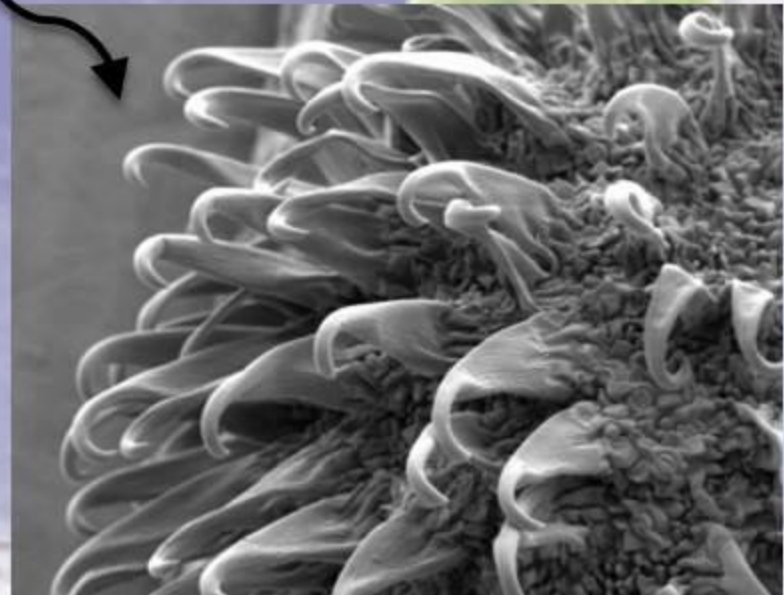
Applications

**What
is this ?!**



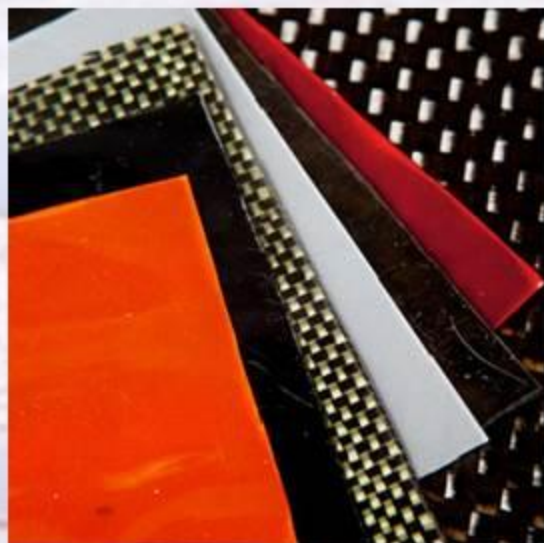
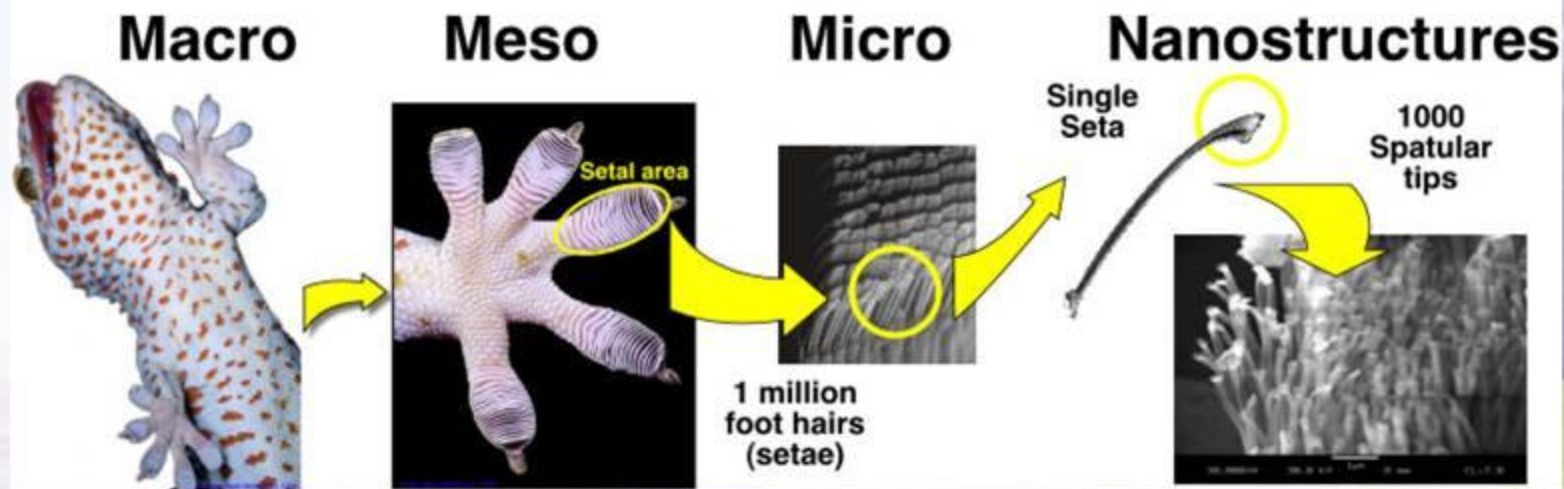
Velcro Tape

Swiss engineer
George de Mestral
in 1941 → removed Burrs
from his dog → He took
closer view to the seeds →
He found hooks →
He designed what we know
and use as
Velcro tape



Gecko Tape

Gecko adhesive system



Ornilux Birdsafe glass

Up to a **billion** birds die in collisions with glass each **year** in the United States



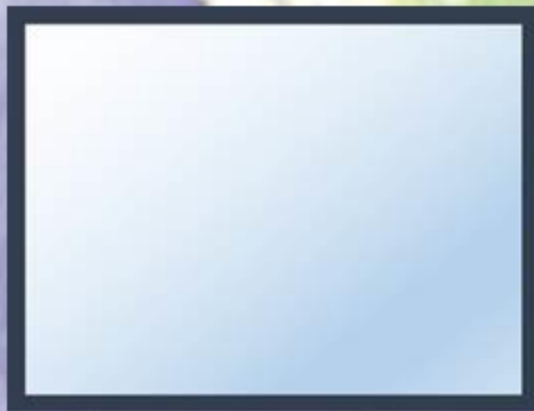
**HOW TO
SAVE ?!!**



ORNILUX

Bird Protection Glass

**What
people
see**



**What
Birds
see**



Traveling Salesman Problem (TSP)



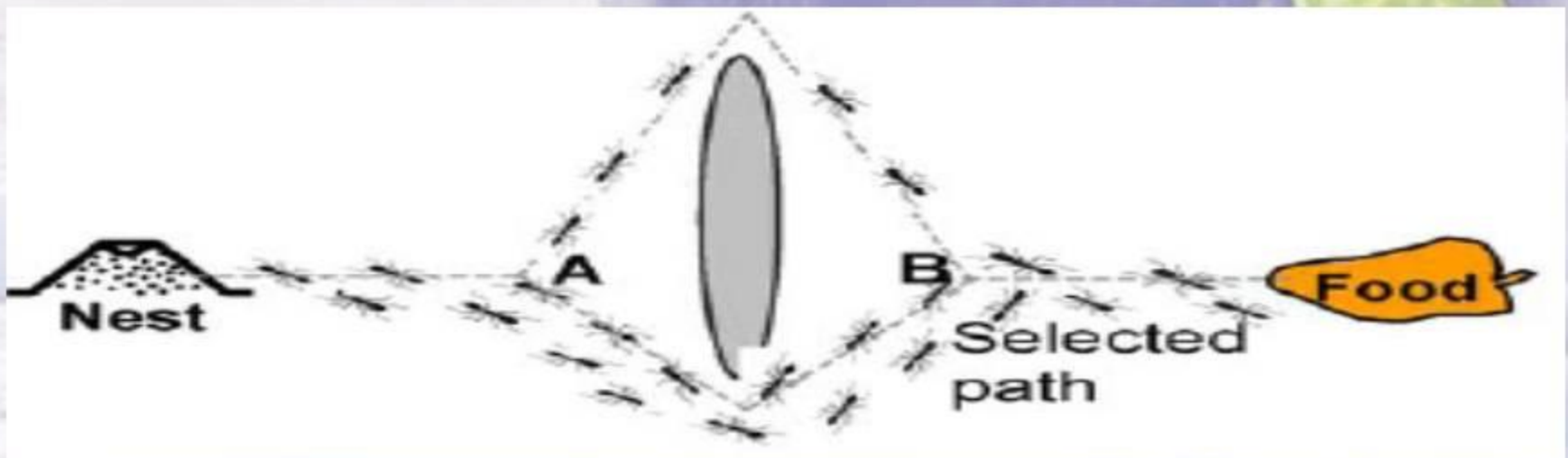
ANT Colony

When two points (say, two nests, or a nest and a food source) need to be connected, ants may start out tracing several winding pheromone paths among them. As ants zig back and forth down trails, pheromone levels build up

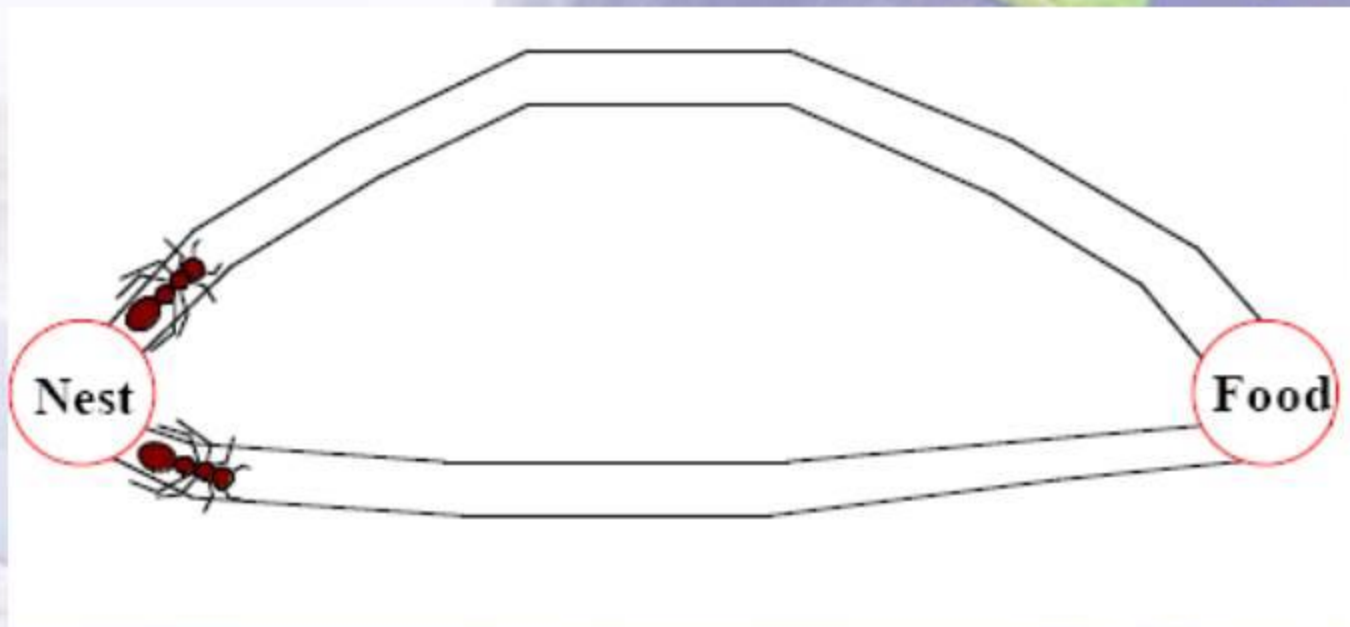


Shortest Route

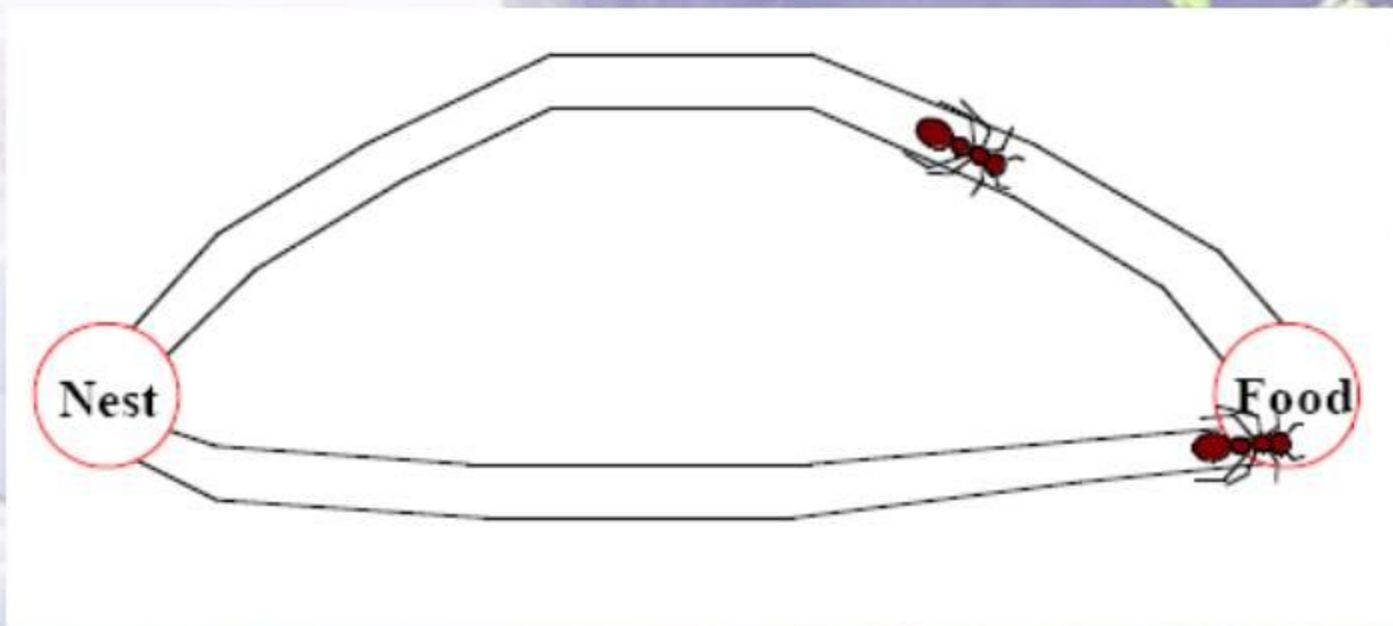
Shortest route is found using pheromone trails which ants deposit whenever they travel, as a form of indirect communication



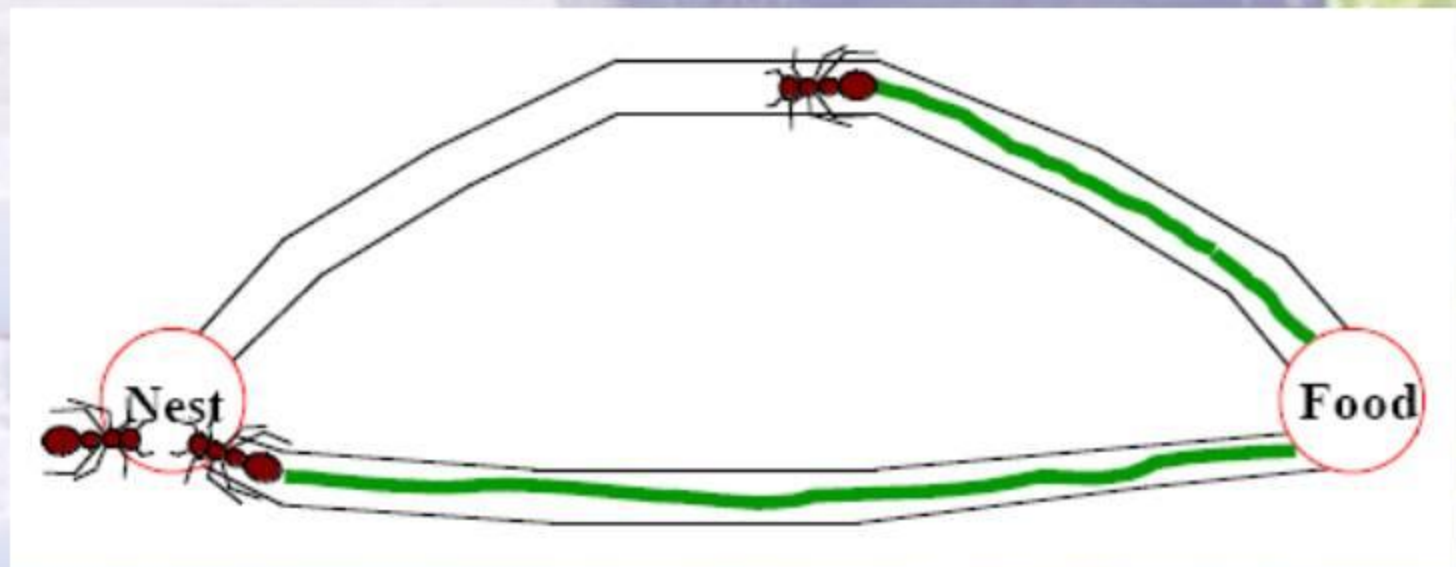
When ants leave their nest to search for a food source, they randomly rotate around an obstacle



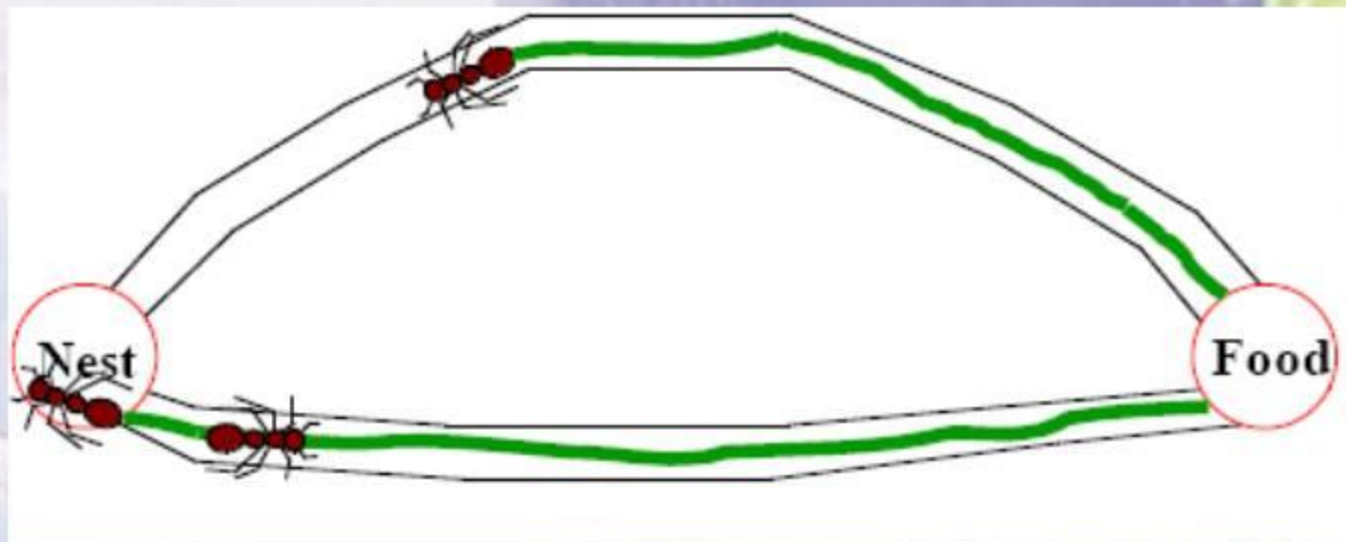
**initially the pheromone deposits
will be the same for the right and left
directions**



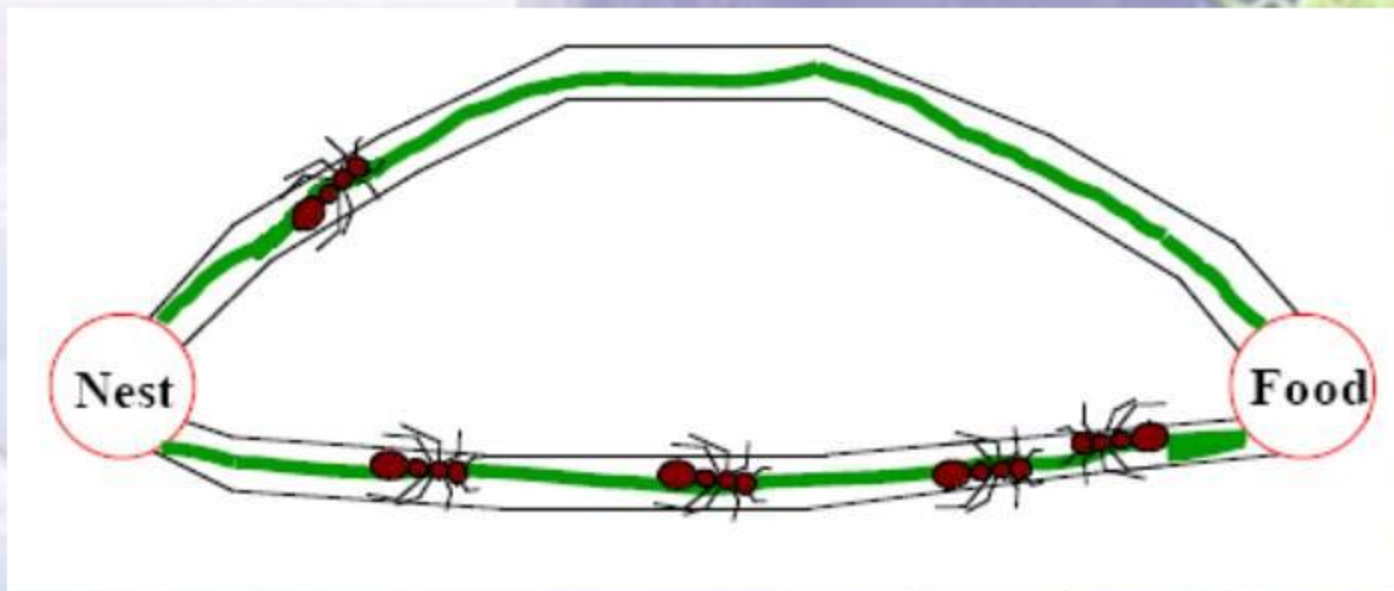
When the ants in the shorter direction find a food source, they carry the food and start returning back, following their pheromone trails, and still depositing more pheromone.



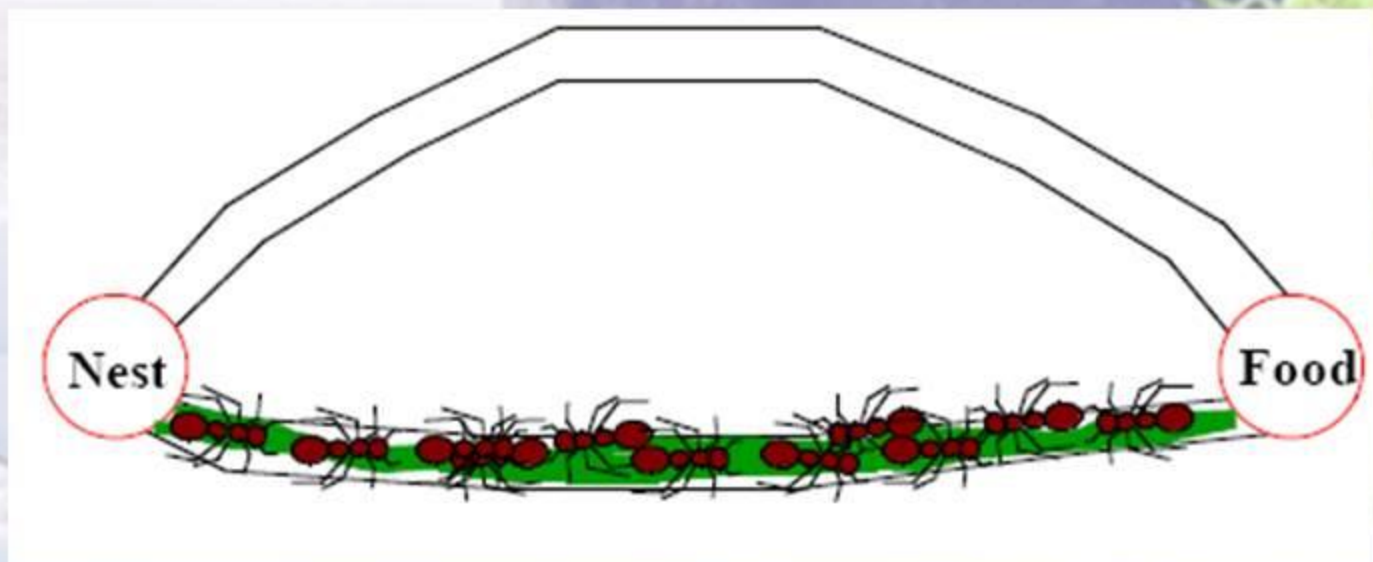
An ant will most likely choose the shortest path when returning back to the nest with food as this path will have the most deposited pheromone



For the same reason, new ants that later starts out from the nest to find food will also choose the shortest path.

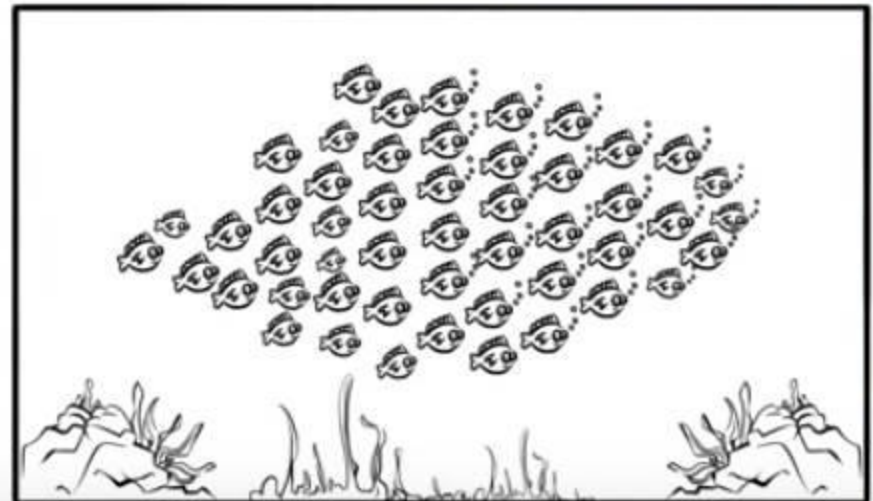
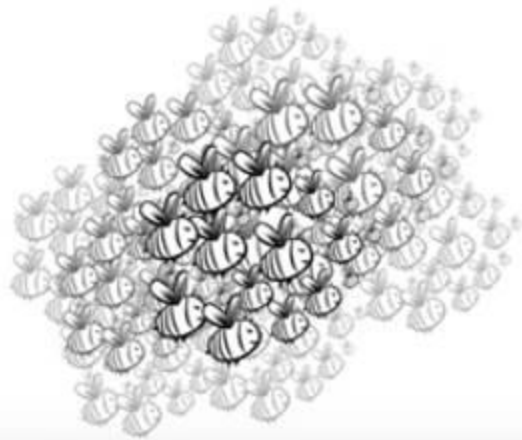
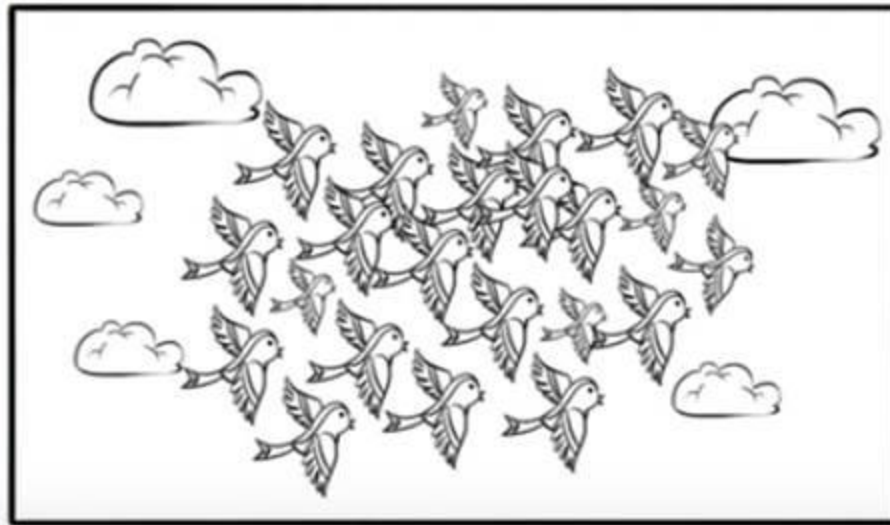


Over time, this positive feedback (autocatalytic) process prompts all ants to choose the shorter path

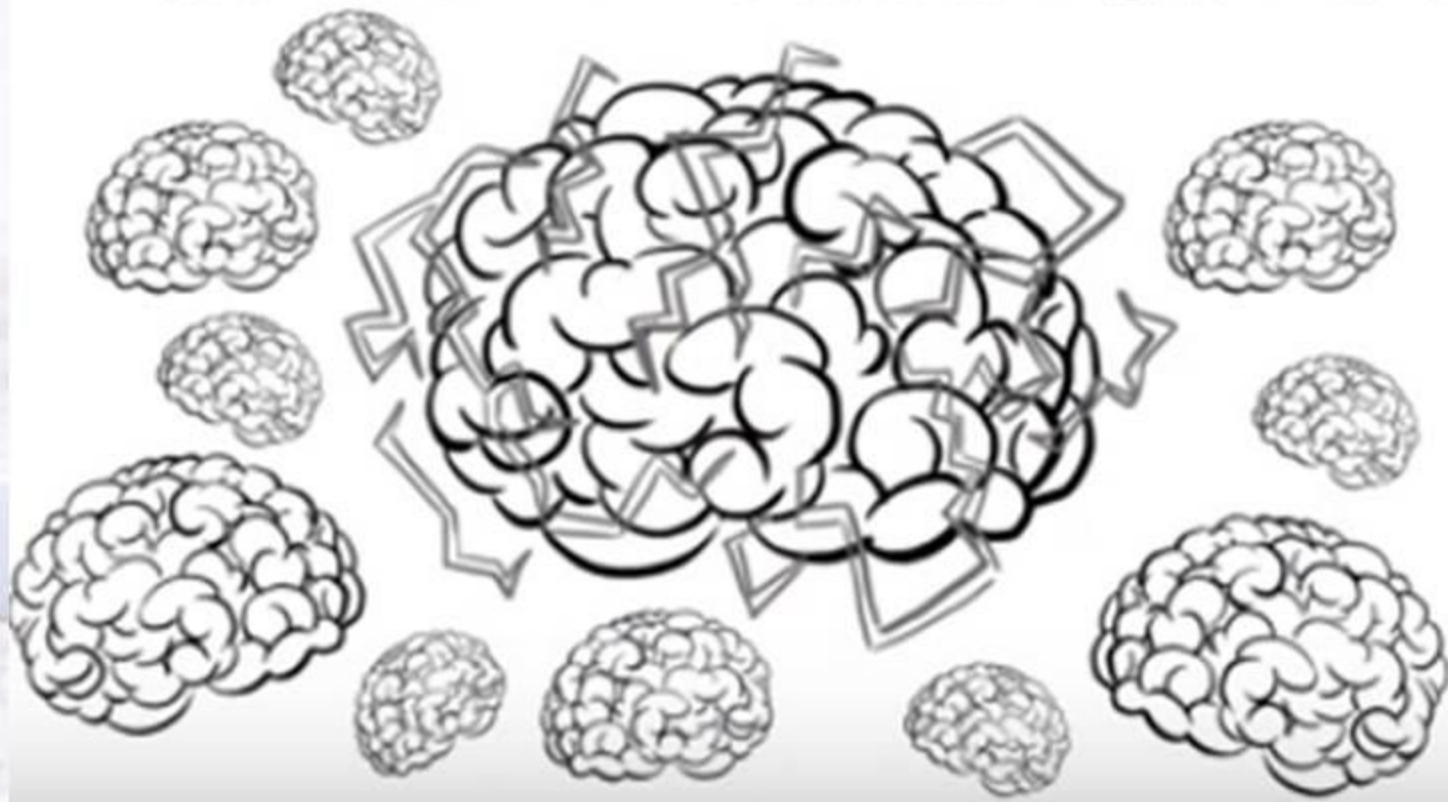


Swarm intelligence

(SI) is the collective behavior of decentralized, self-organized systems, natural or artificial.

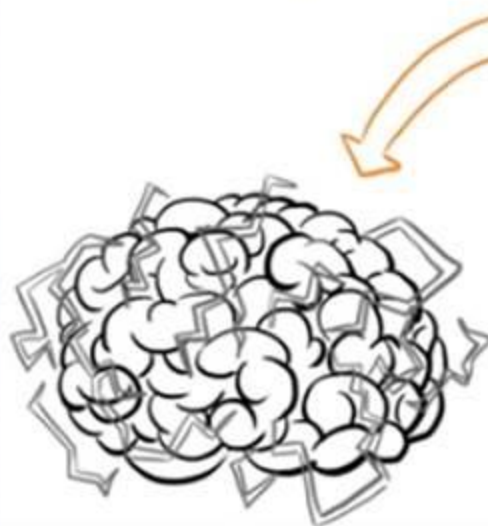


SWARM INTELLIGENCE





**Groups are
smarter when
work
together**



ARTIFICIAL
SWARM INTELLIGENCE



Termites Mound

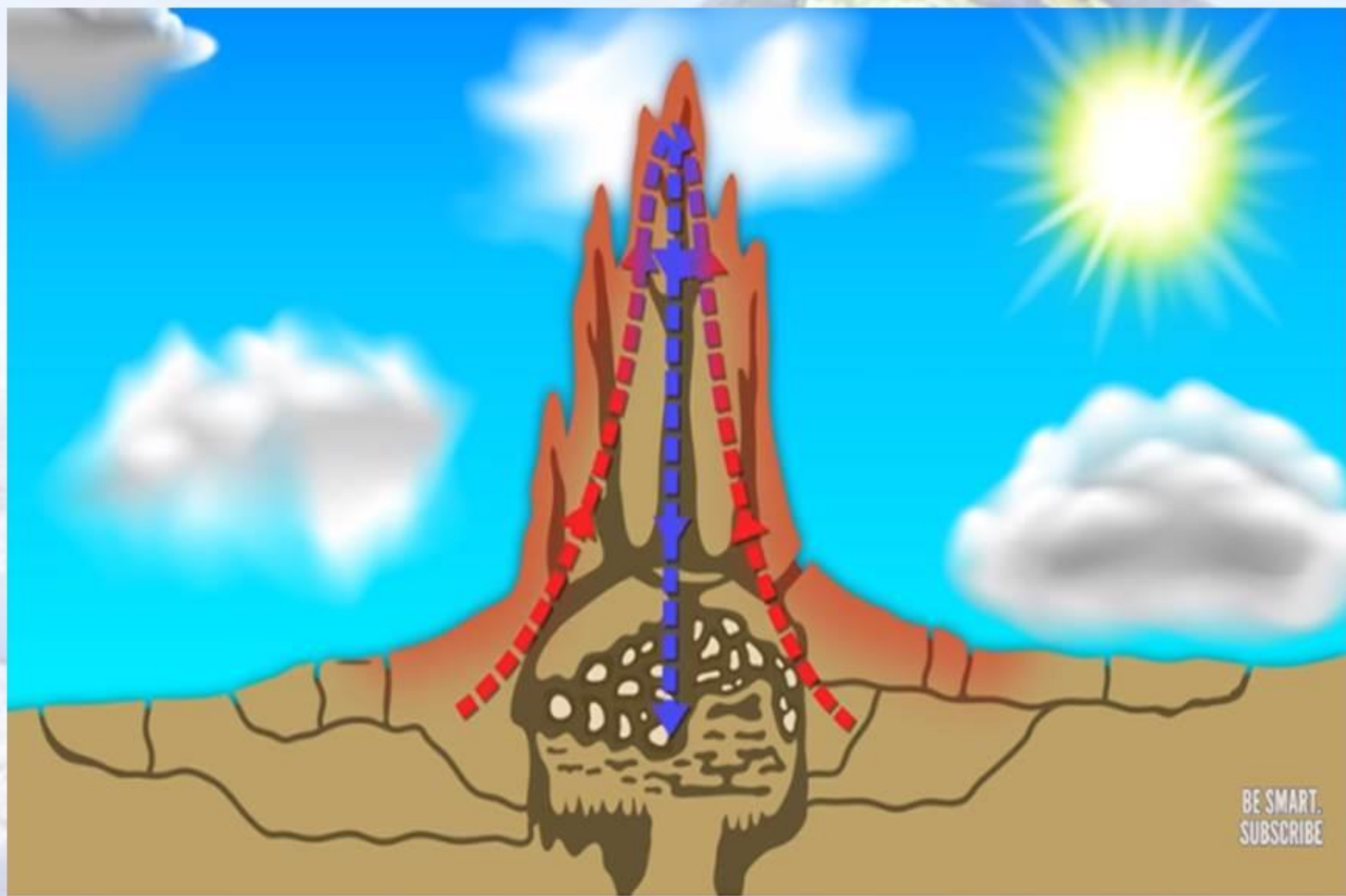


**30,000
eggs/ day
x 365 days/year =
10,950,000 / year**

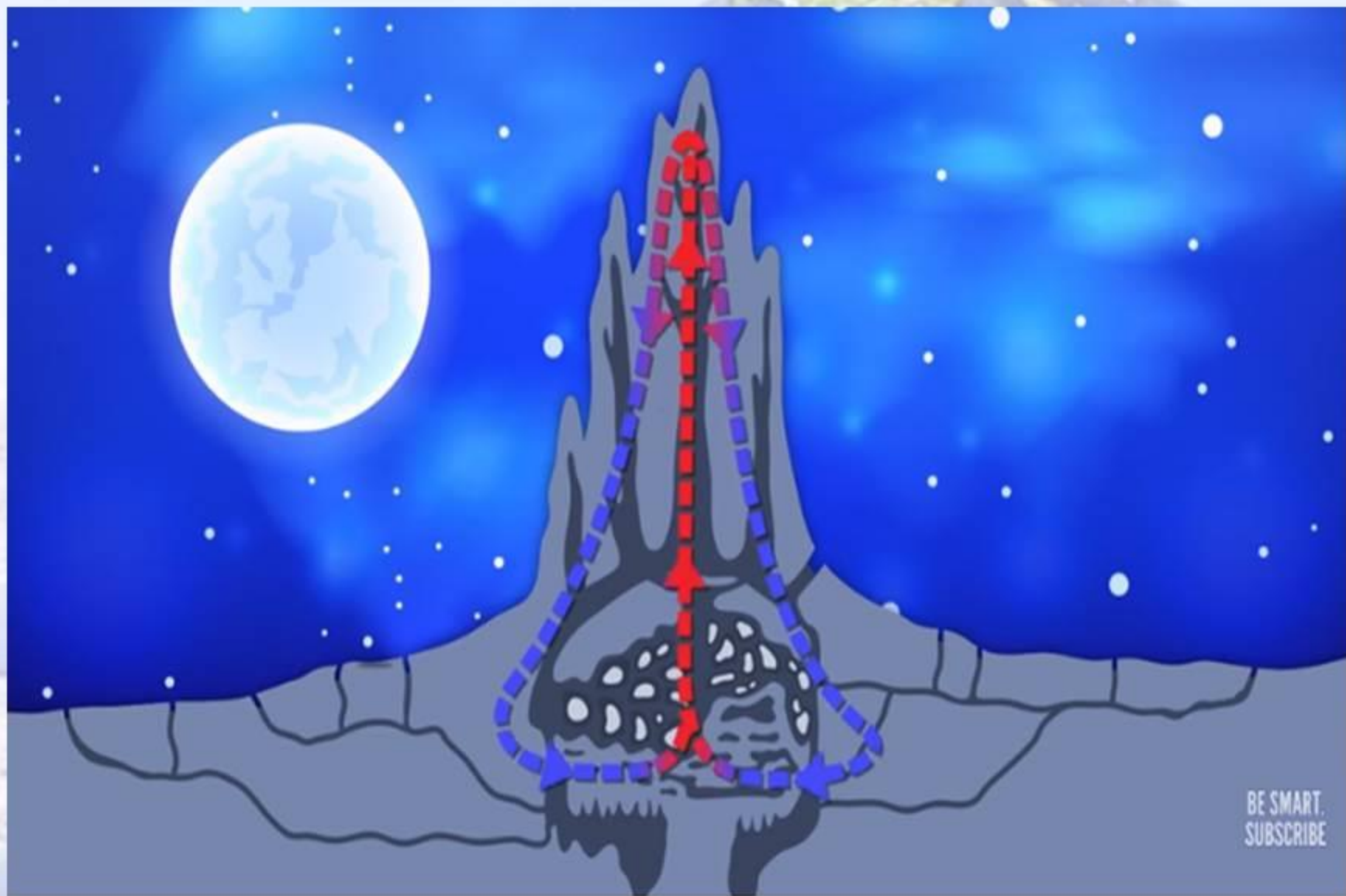
**In
15
years**

164,250,000





BE SMART.
SUBSCRIBE



BE SMART.
SUBSCRIBE



Air on the top pulls air along with it



This pulls air up from the top of the hill to replace the air being moved



Now, Fresh Air is pushed to the inside through the tiny entrances





Eastgate Zimbabwe Building
whose architect is , Mick Pearce ,
Designed to be ventilated and cooled
By **entirely** natural means

FIBONACCI SEREIS

$$\text{Fib}(n) = \text{Fib}(n-1) + \text{Fib}(n-2)$$

1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144....

What is its
relationship with

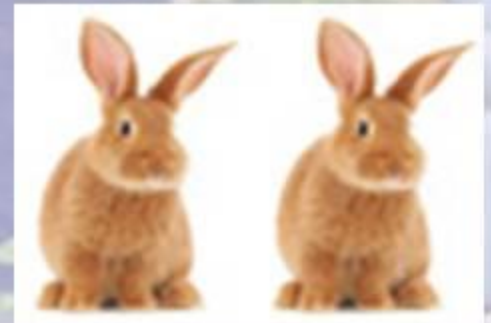
nature ?!!

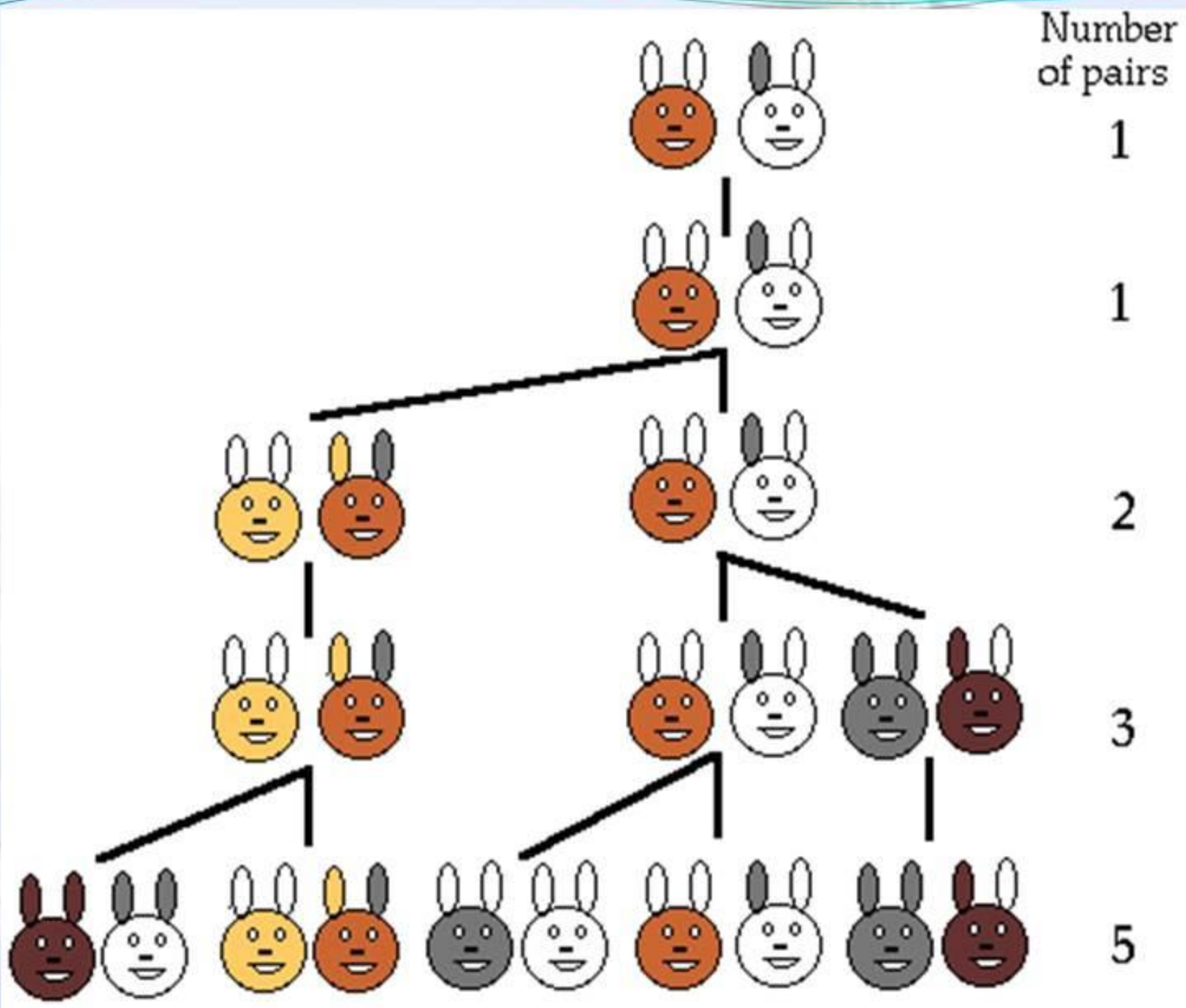
**In 1202 ,
Leonardo Fibonacci
started with a
Rabbit problem**



Leonardo Fibonacci

(rabbits never die,
every month each
adult pair produces
a mixed pair of baby
rabbits who mature
the next month)





Number of pairs

1

1

2

3

5

A globe of the Earth is centered in the image, showing the Americas. The globe is reflected on a light-colored, possibly metallic or glass, surface below it. The background is a light blue sky with a white horizon line. At the top of the image, there are decorative wavy lines in shades of blue and white. Overlaid on the globe is the text "It is still not realistic" in a bold, black, serif font.

**It is still not
realistic**

What about BEEES?!



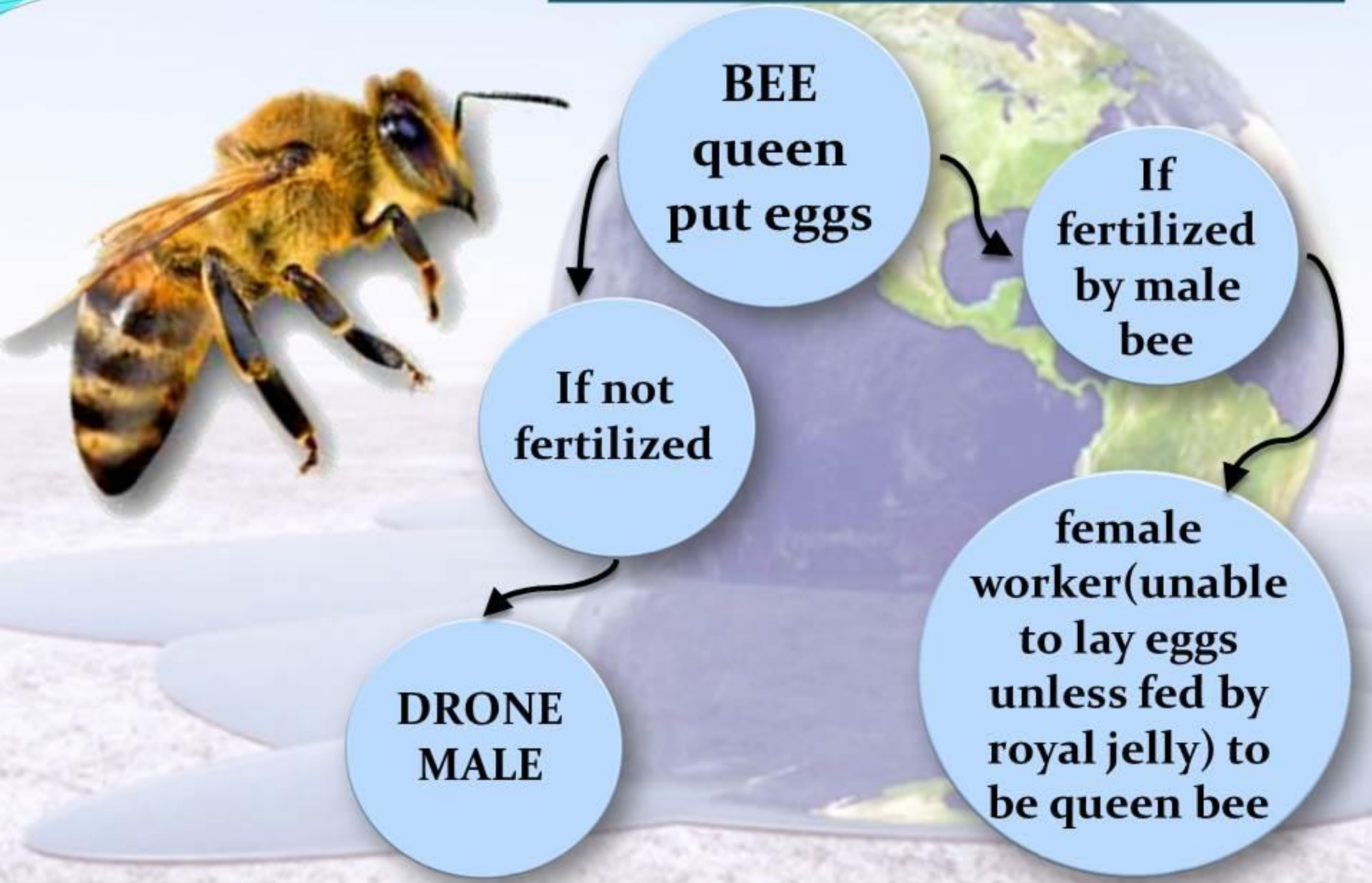
**BEE
queen
put eggs**

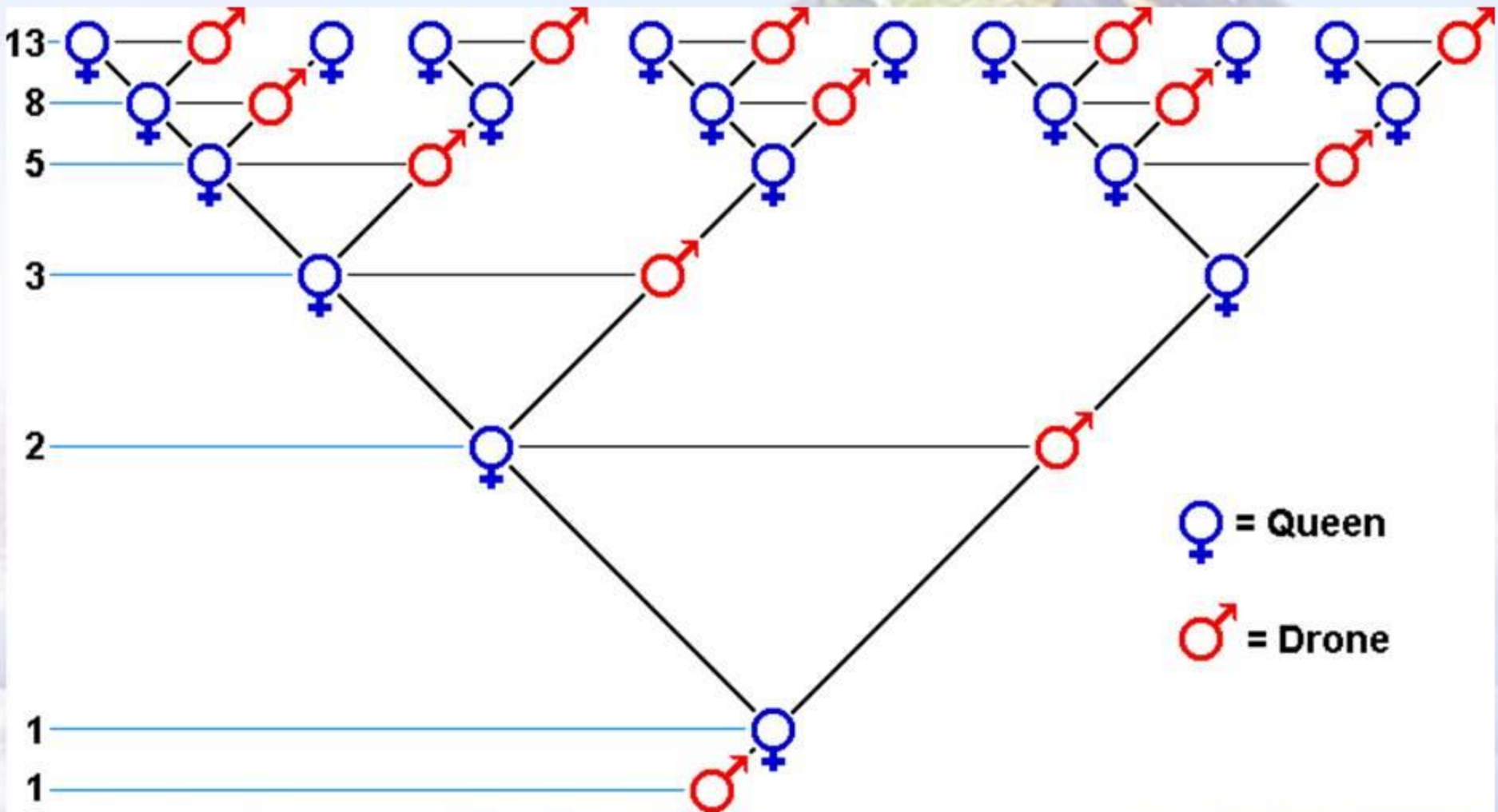
**If
fertilized
by male
bee**

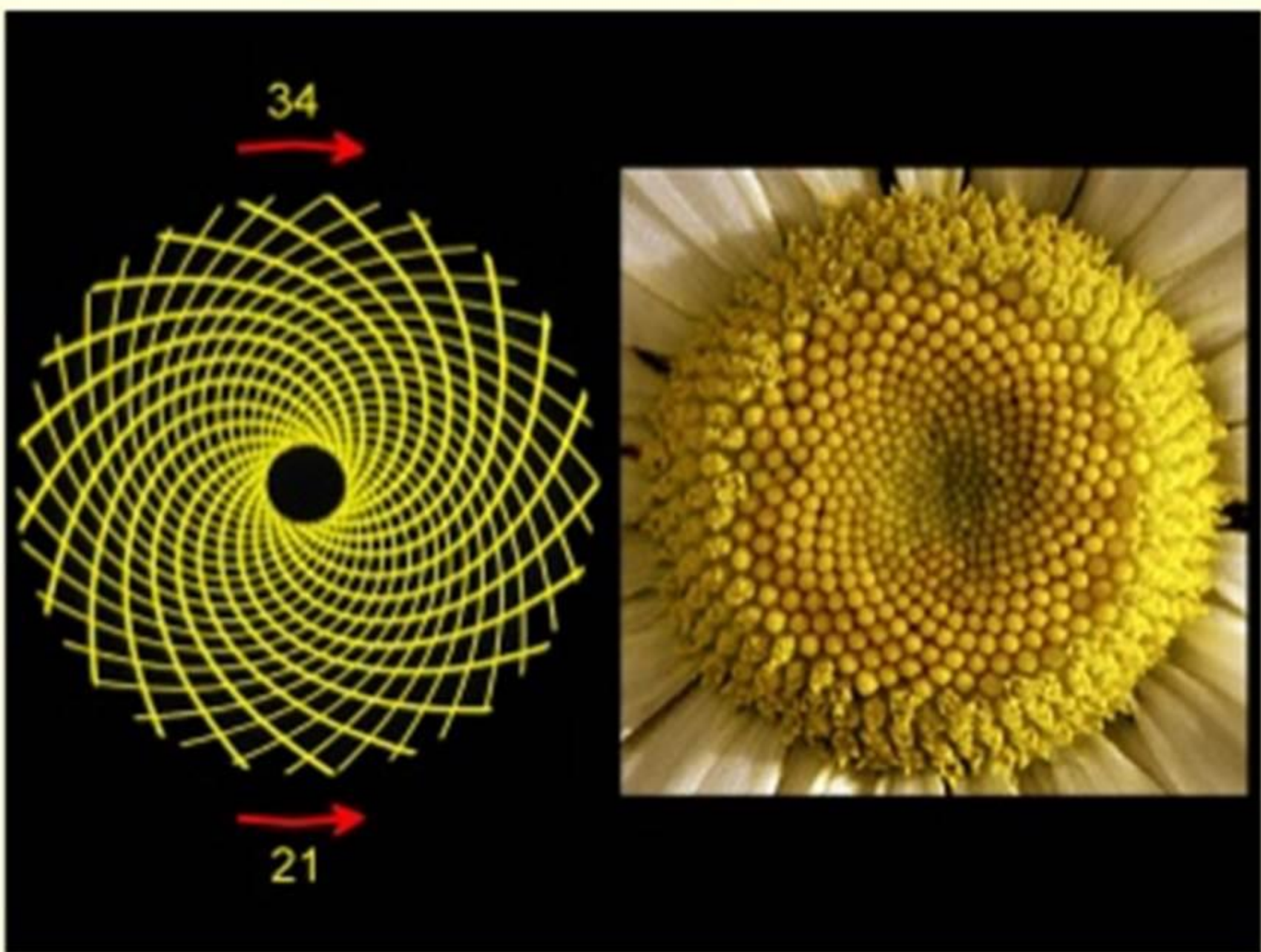
**If not
fertilized**

**DRONE
MALE**

**female
worker (unable
to lay eggs
unless fed by
royal jelly) to
be queen bee**









More Fibonacci numbers in nature

- ✦ Most of the time, the number of petals on a flower is a Fibonacci number!

1 petal-calla lily



2 petals-euphorbia



3 petals-trillium



5 petals-columbine



8 petals-bloodroot



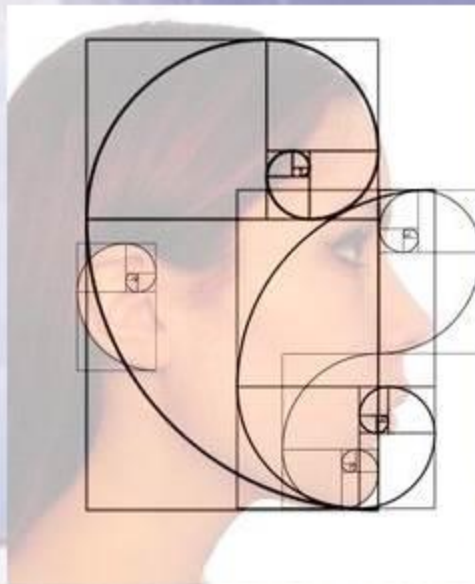
13 petals-black eyed susan



Fibonacci and Golden Ratio

$$1/1 = 1, \quad 2/1 = 2, \quad 3/2 = 1.5, \quad 5/3 = 1.666\dots,$$

$$8/5 = 1.6, \quad 13/8 = 1.625, \quad 21/13 = 1.61538\dots$$



Math is Beautiful

The Golden Ratio can be applied to the human face to determine beauty.



Kingfishers



Bullet train
In
japan

**Clean without
cleaner
LOTUS flower
EFFECT**






A 3D-rendered globe is the central focus, its surface covered with a collage of various website design templates. These templates include colorful headers, navigation menus, text blocks, images, and charts. A magnifying glass with a black handle is positioned over the globe, its lens enlarged to show the word "THANKS" in a bold, black, sans-serif font. The background features a soft, light blue sky with a faint, larger globe visible behind the main one. The overall composition is bright and modern, symbolizing digital design and gratitude.

THANKS

المصادر

- 
- [1] Benyus JM. *Biomimicry*. HarperCollins e-books; 2009.
- [2] Shimomura M. *The new trends in next generation biomimetics material technology: learning from biodiversity*. *Sci Technol Trends Q Rev*. 2010;37:53-75.
- [3] Vincent JF, Bogatyreva OA, Bogatyrev NR, Bowyer A, Pahl A-K. *Biomimetics: its practice and theory*. *J R Soc Interface*. 2006;3(9):471-482. [[PMC free article](#)][[PubMed](#)]
- [4] <https://www.wired.com/2015/11/building-skyscrapers-like-termite-mounds-could-save-energy/>
- [5] <https://www.buildinggreen.com/news-article/ornilux-bird-safe-glass>
- [6] <https://www.youtube.com/watch?v=EeSUPTAz2MM>
- [7] <https://creativecommons.org/licenses/by-sa/4.0/>
- [8] <https://plus.maths.org/content/fibonacci-sequence-brief-introduction>