

# Restoring the joy of learning: Curiosity fueled by photography

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Virtual Prof of Passionate Curiosity

# Observations of learning and forgetting

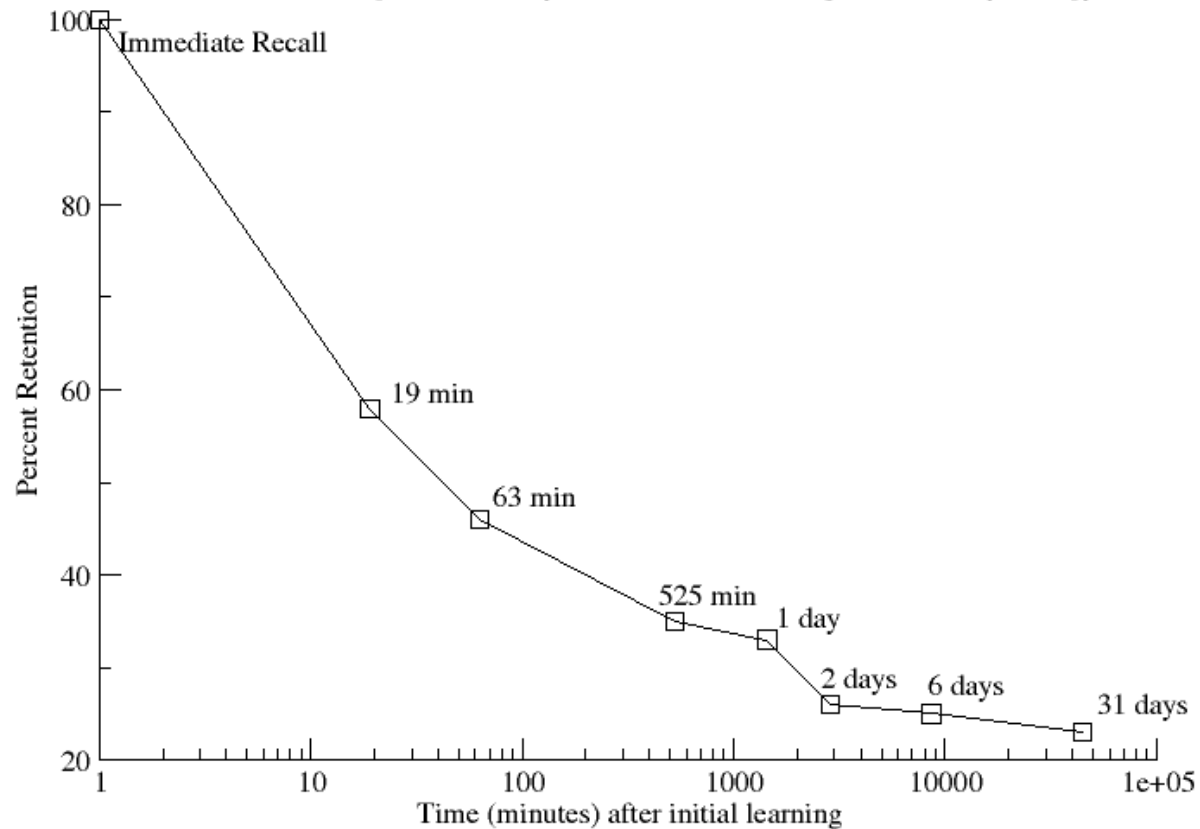
- **Learning** often arises from **whys** driven by observations
- Outside the classroom, **curiosity** is a major source of whys
- **Focused curiosity** improves identifying whys (by reducing distractions)
- **Repeating observations** reveals *expected* patterns.
- **Deviations** from expected patterns = a why: a learning opportunity
- **Repetition** improves retention of learned stuff (transfer from short term to long term memory).
- Unused learned stuff is likely **forgotten** over time



# The nature of forgetting

## The time course of forgetting

Source: Hermann Ebbinghaus, Memory: A Contribution to Experimental Psychology, 1885



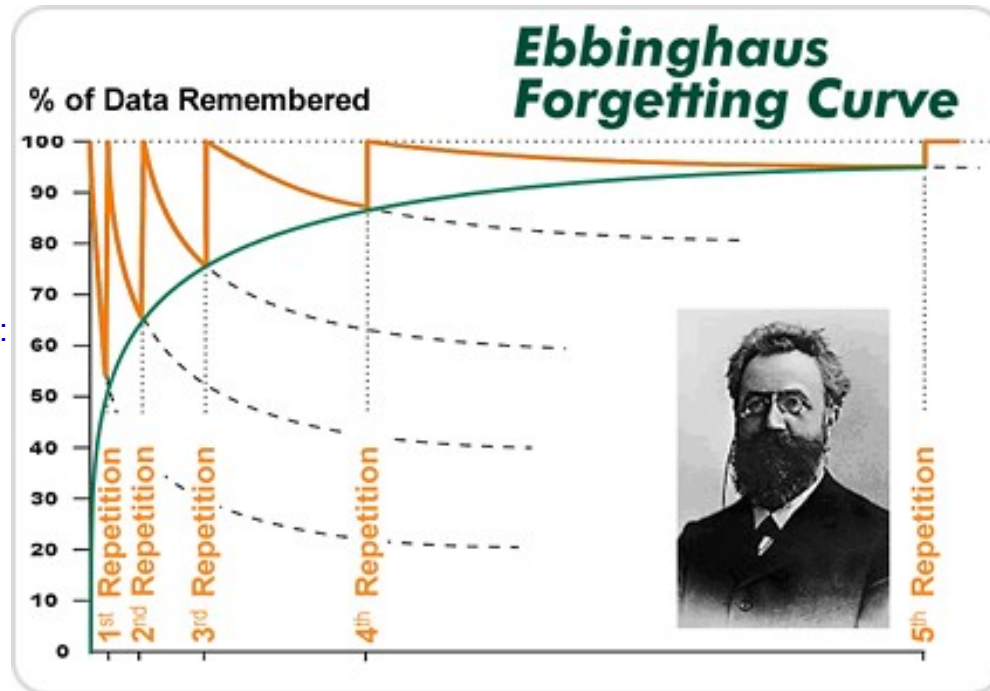
# Studies of Learning and Forgetting

Ebbinghaus, *Über das Gedächtnis (About memory)*, 1885

Repetition: reinforcing accurate recall of learned material

Retention, is exponentially related to time, t, and strength, S:

$$R = e^{-\frac{t}{S}}$$



# Focusing Curiosity: Eyes (objects)



From Marc Levoy's Stanford Digital Photography Class

# Compound Eyes



## Fish Eyes



**Clownfish**



**Gobi**





**Huntsman**

**More than two eyes:  
Wide Visual Field**

**Jumping Spider**





## Rear Vision



Lynx

Lynx



## Wang Yang's Eyes

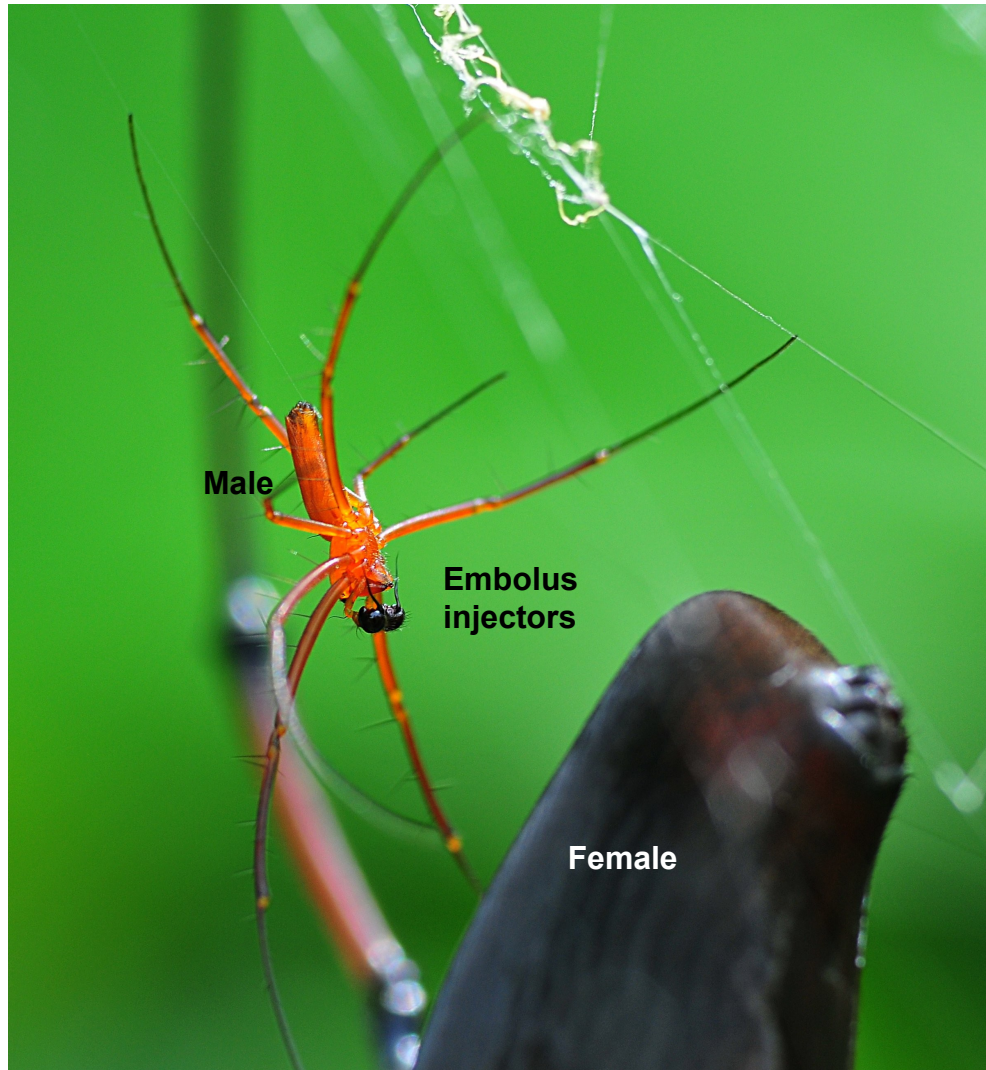


# Focusing Curiosity: Spider Mating (behavior)



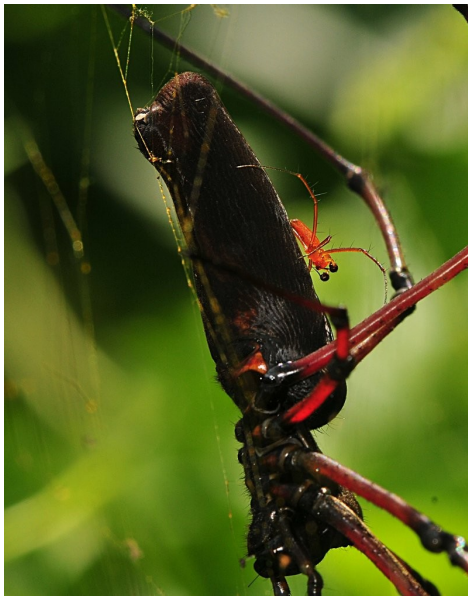
*Miagrammopes*

Repeat visits to the same place: an opportunity to observe behavior over time



*Nephila philipes*:  
Mating tools

## Phases of mating

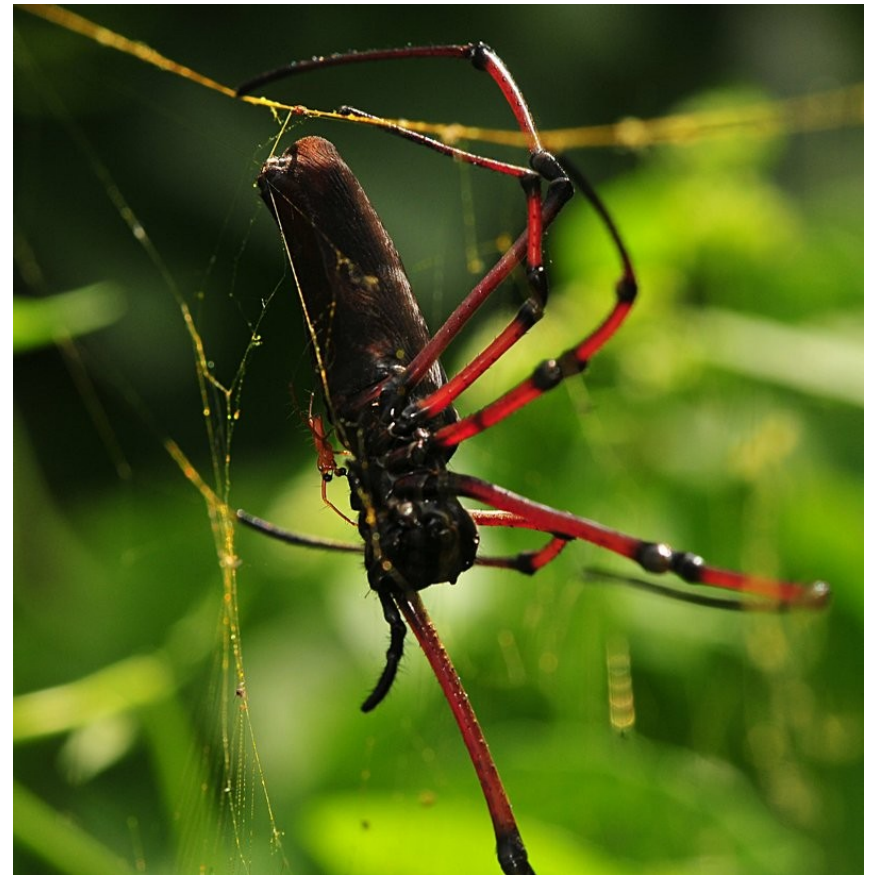


The Approach

Weaving



Probing



# Weaving





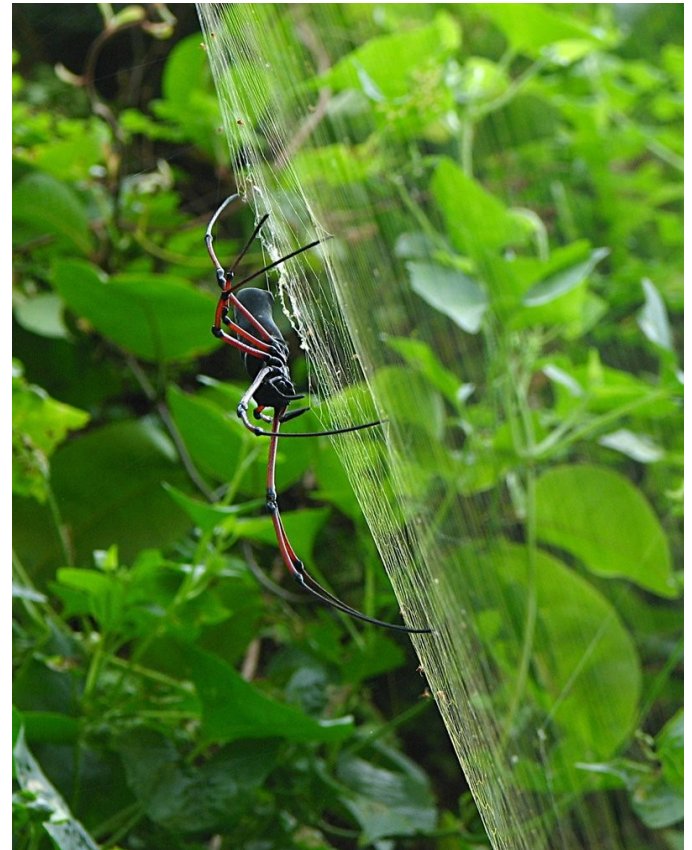
## Embolus Injector Insertion

*Argyrodes flavescens*: a kleptoparasite



**Sky Reflections**

**Size scale**





## The Approach



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Engaged



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## Coupled



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## Post Mating Results

Lynx egg sac and babies



# Focusing Curiosity:

Water: Liquid and Vapor Phases (physical process)



Observing falling water:  
droplet formation





Observing the atmosphere:

A disruption of the expected pattern  
Vortex Condensation



## Clouds

Glory: interference of  
Incident and reflected light



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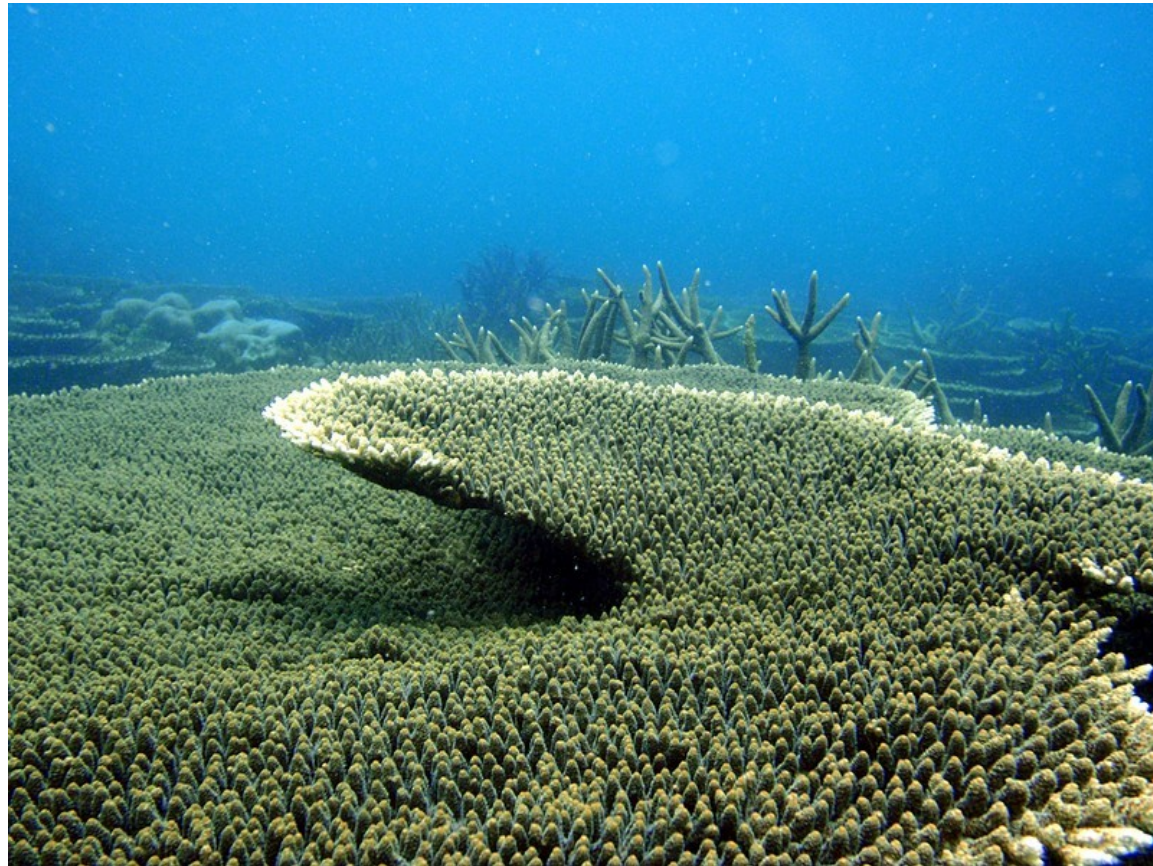




Water vapor condensation: morning dew

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# Focusing Curiosity: Underwater



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# Giant Clams

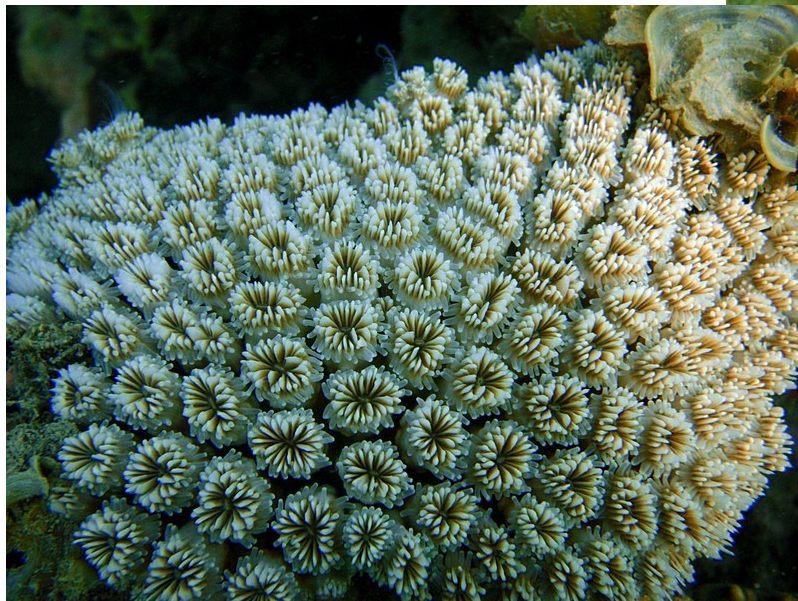
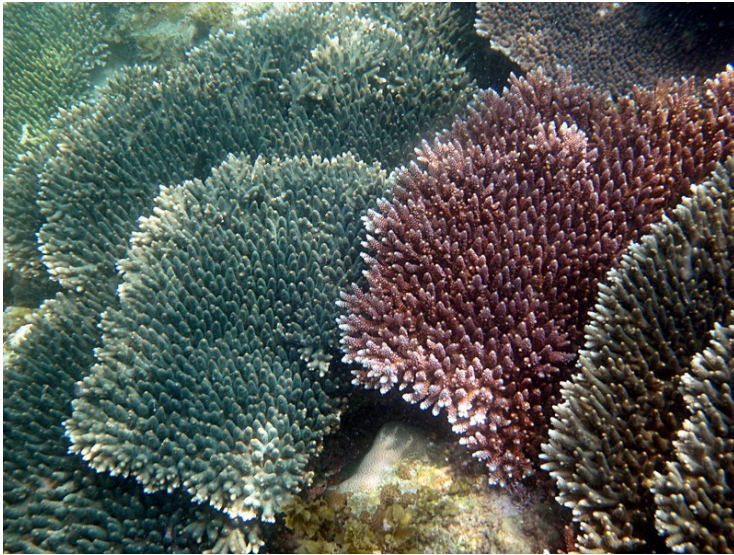
Repetition and looking for patterns



What is this?



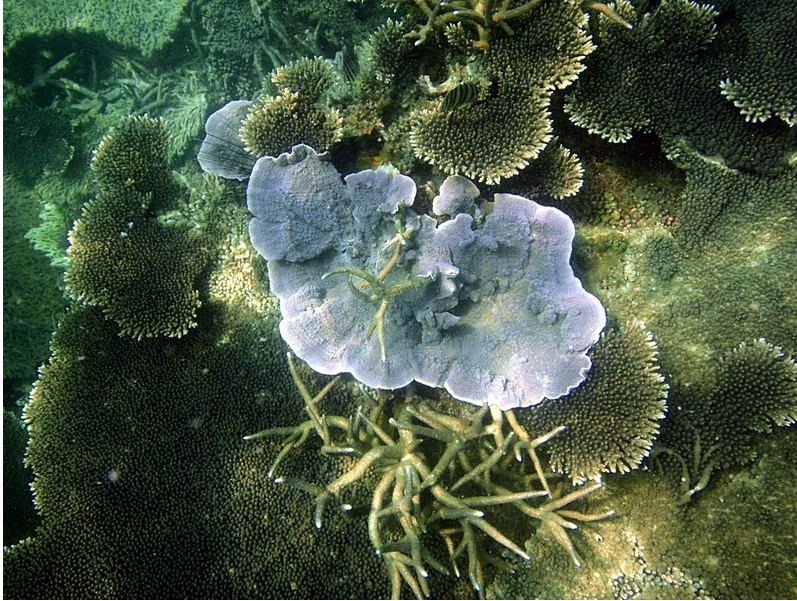
# Observing Colorful Coral



A variety of spatial  
patterns



# Health and Disease



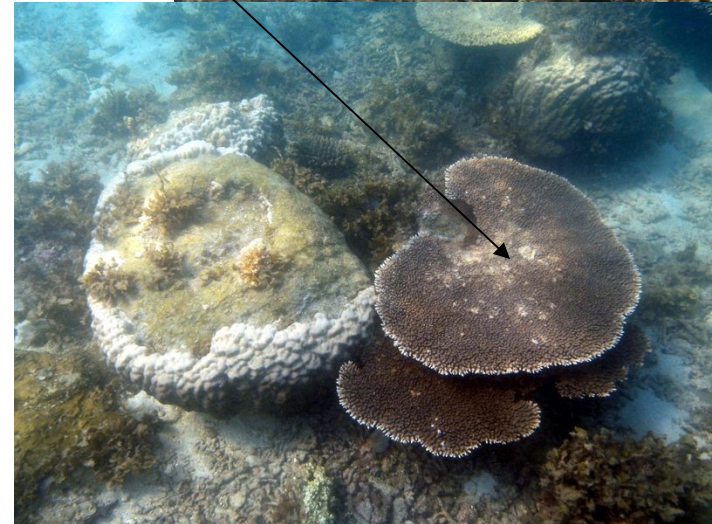
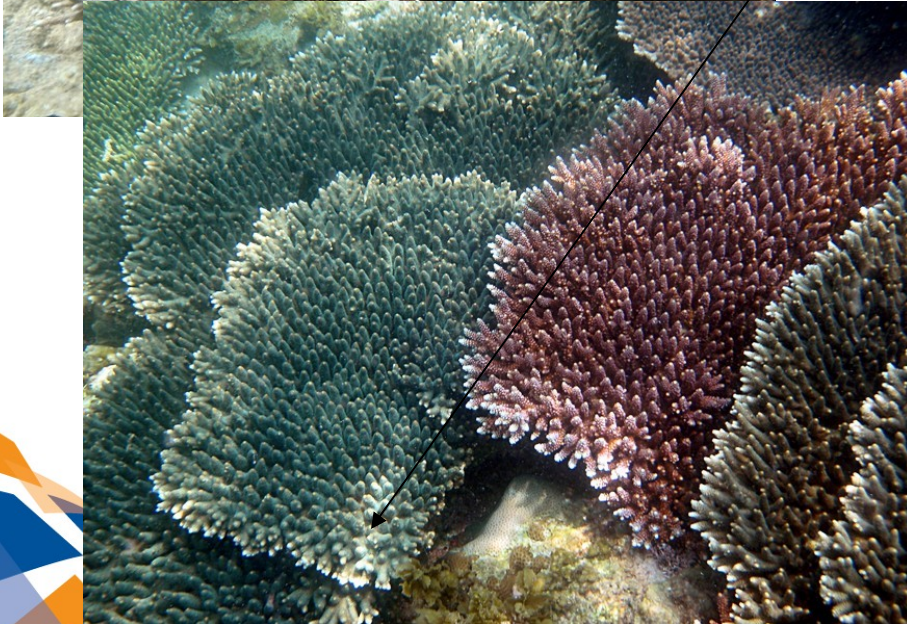
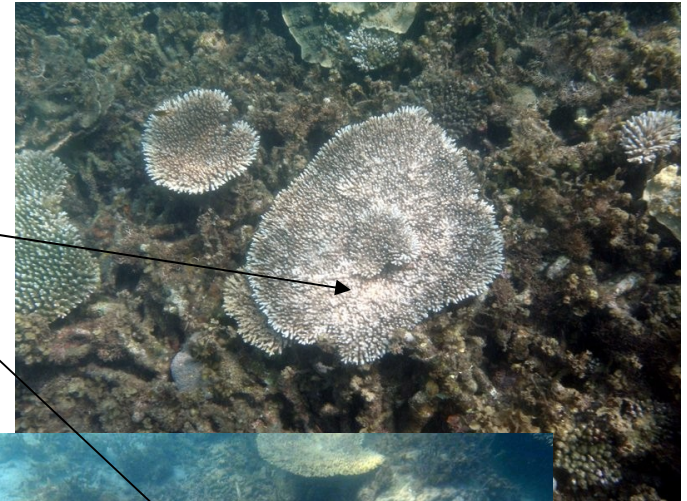
Spatial uniformity pattern broken  
What is this?



Coral bleaching: Temp > 30C

# Coral health and disease

Bleaching



# Some thoughts about learning

- Repetition is the first law of learning
- We can't learn everything: we forget what we infrequently use
- Curiosity fuels my learning and passion (because its fun)
- Learning from chronically unfocused curiosity is inefficient
- Repeated observations facilitate recognizing patterns
- Why do patterns vary? (curiosity)
- Learning without review and reflection is probably pointless

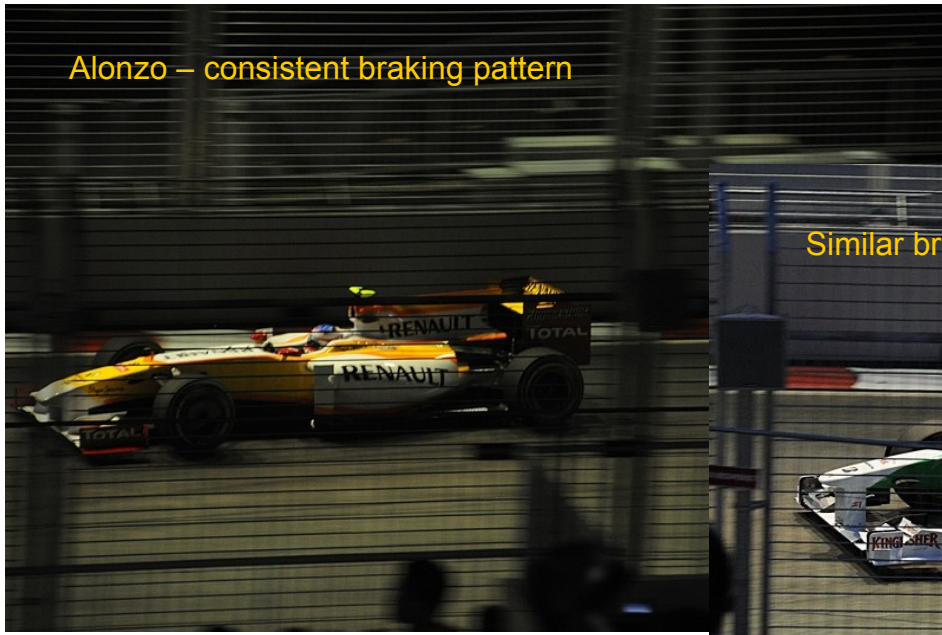
A learning example with focusing curiosity: Singapore F1  
1: Characterize the area of interest



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2: Capture lap to lap braking pattern at turn 18  
(Why? Something interesting more likely with change  
(turns) than with no change (straight segments).



Alonzo – consistent braking pattern



Similar braking pattern with other drivers



Alonzo – next lap, same braking pattern



### 3: Look for temporal patterns



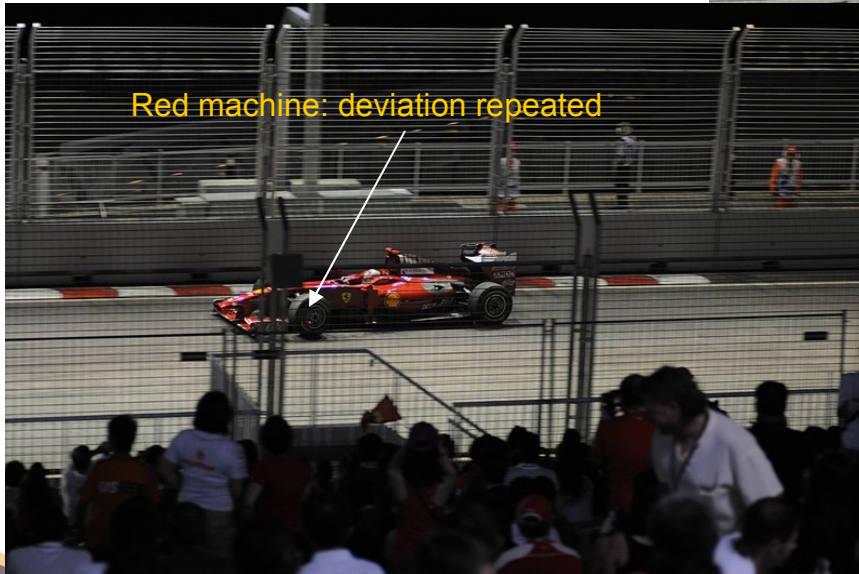
Is the braking pattern machine Independent?



Oops – pattern broken



# Brake fire limited to red machine

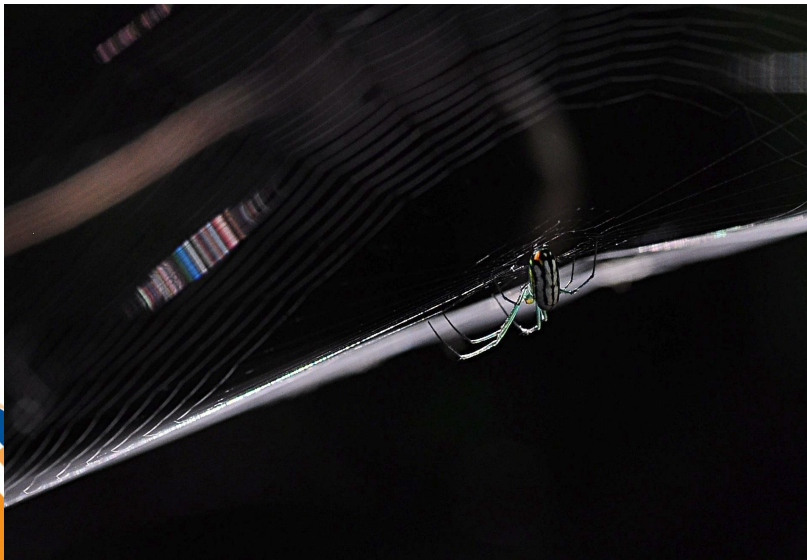
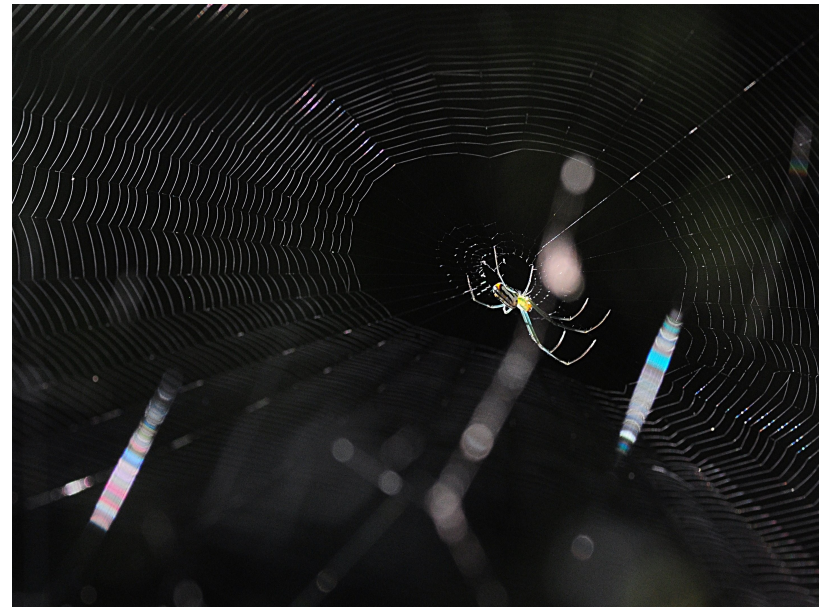


Oops – brake fire infected Hamilton  
4: Learning opportunity: What is the overheating mechanism?

# Serious Curiosity: Diffraction



Why?



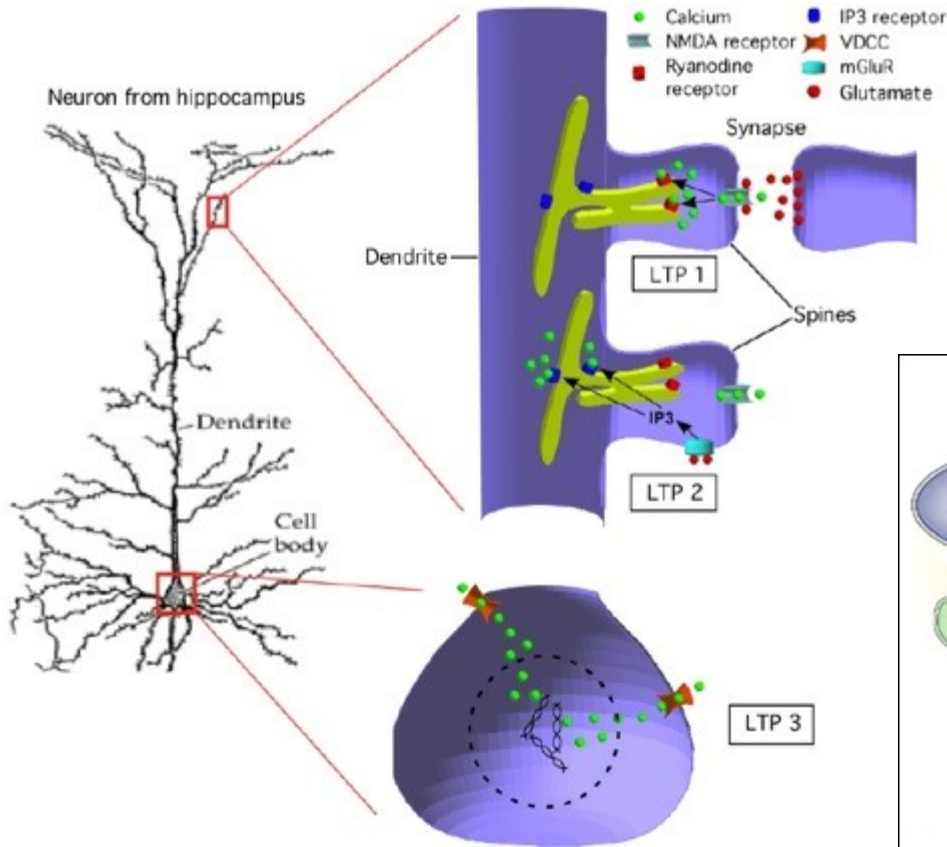
# Thank you *for being curious*



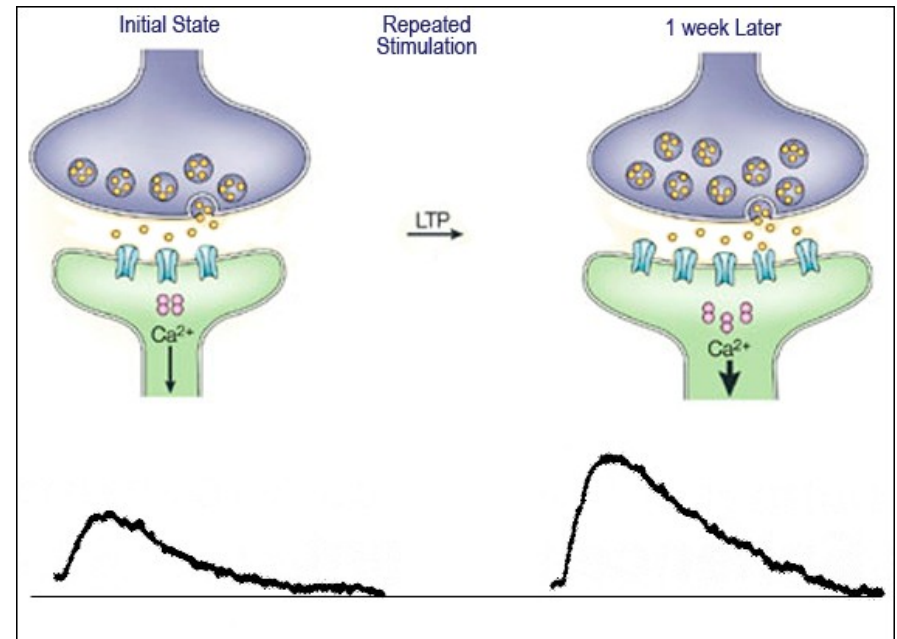


# Backup Slides

# Learning Models



Activity-dependent long term Potentiation (e.g. repetition)

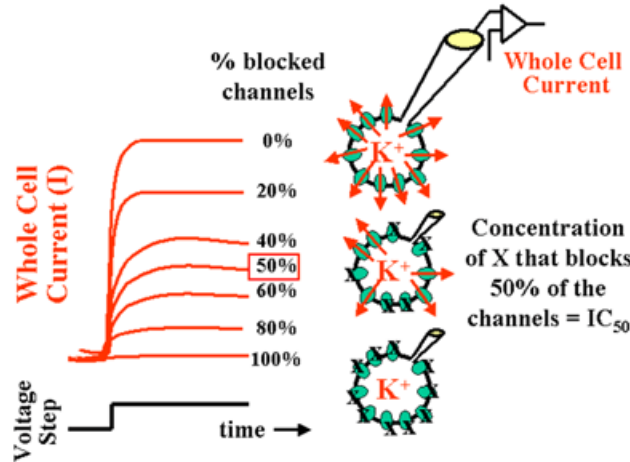


From [http://web.bvu.edu/faculty/ferguson/Course\\_Material/Gen\\_Psy\\_New/Modules\\_18\\_19\\_Memory/Default.htm](http://web.bvu.edu/faculty/ferguson/Course_Material/Gen_Psy_New/Modules_18_19_Memory/Default.htm)

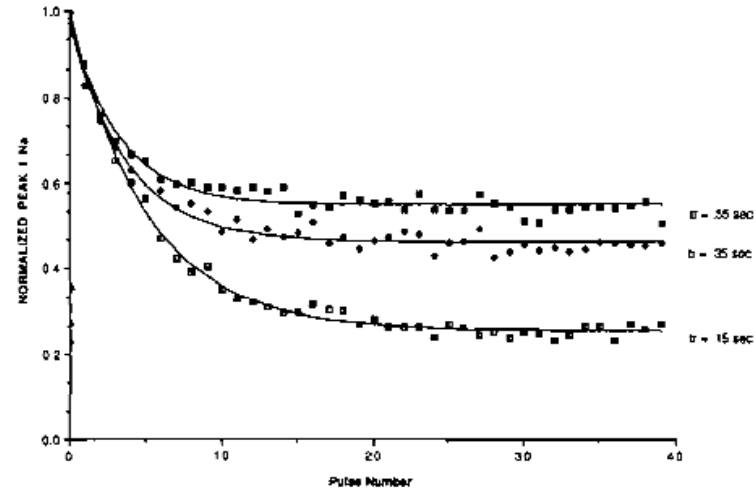
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- An example of memory:
- Cardiac Cells learn and forget

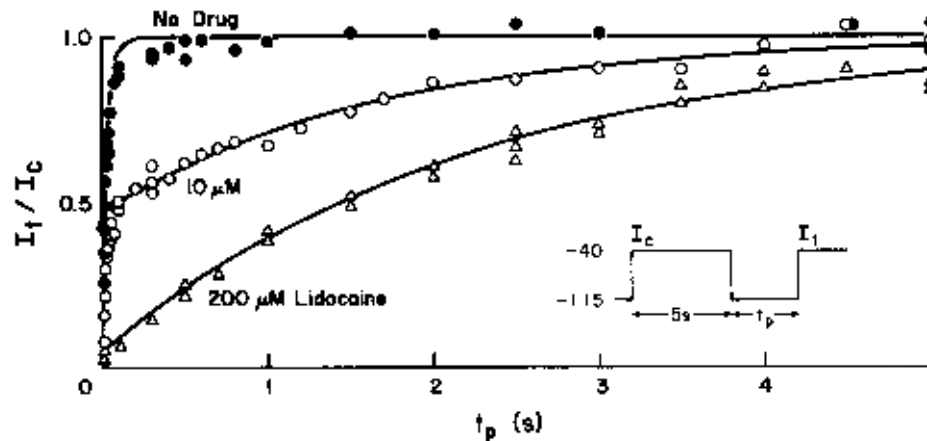
Gold Standard Assay: Whole Cell Voltage Clamp



734 *Circulation Research* Vol 65, No 3, September 1989



Cardiac Learning

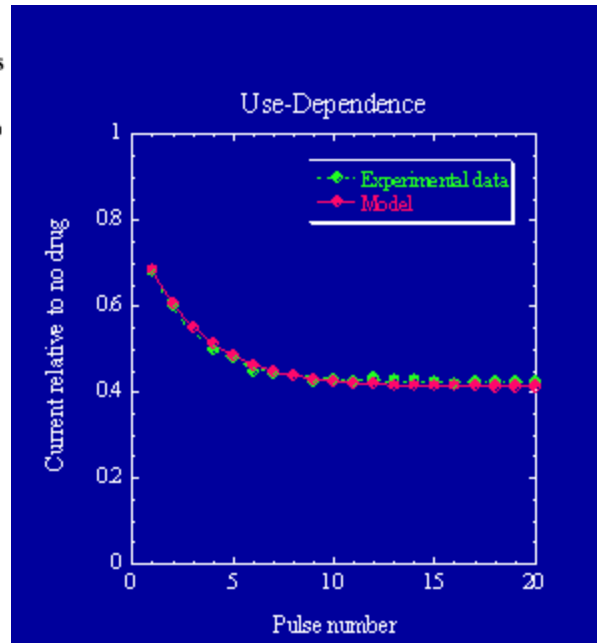
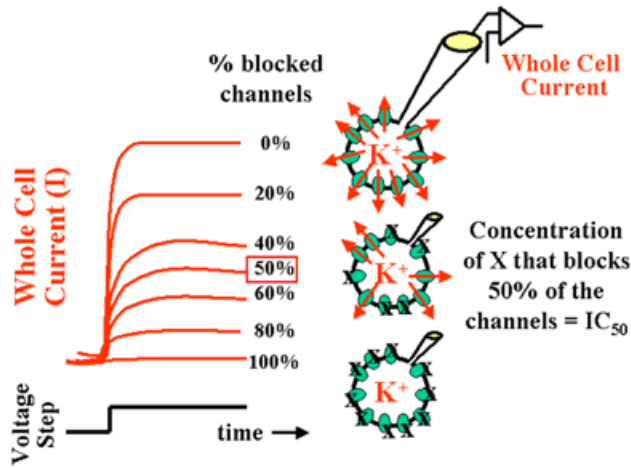


Cardiac Forgetting

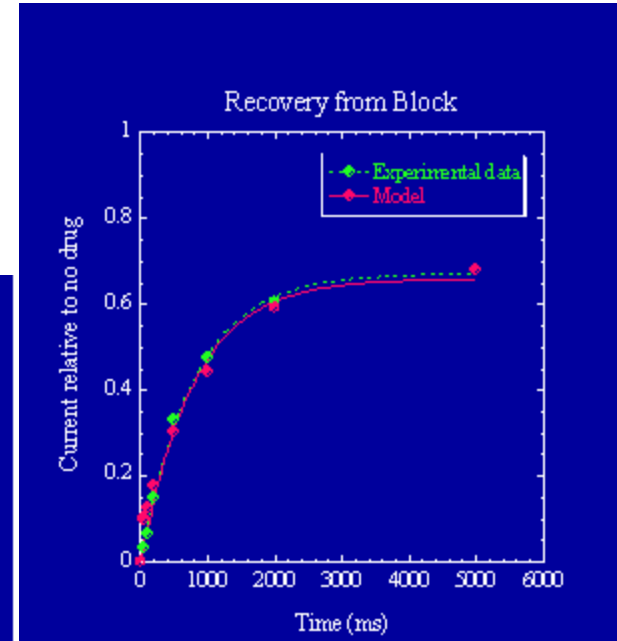


# Antiarrhythmic Drug Blockade: Cardiac use-dependent learning

Gold Standard Assay: Whole Cell Voltage Clamp



Learning



Forgetting



*Nephila pillipes* and  
*Argyrodes flavescens*

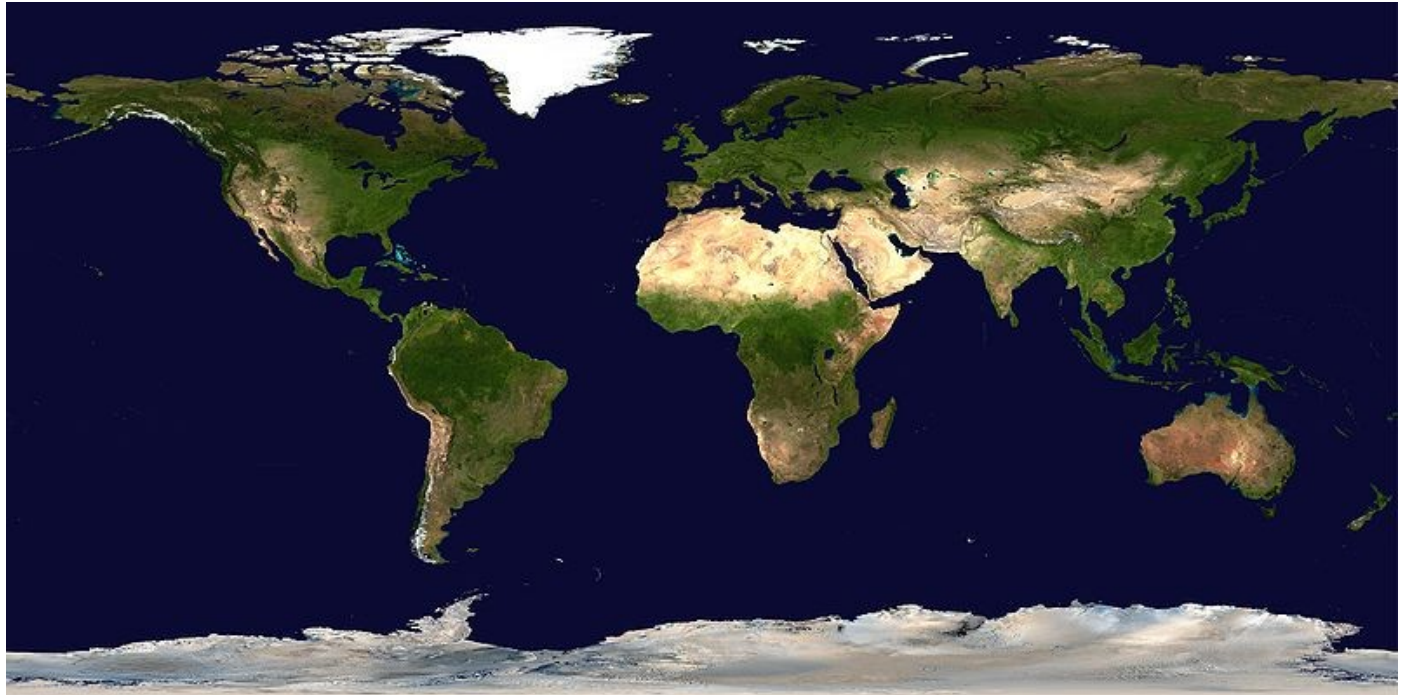




## False Eyes



# Focusing Curiosity: Location



# Geographic Focus: Queensway Secondary School Near our flat



# Geographic Focus: Bintan

