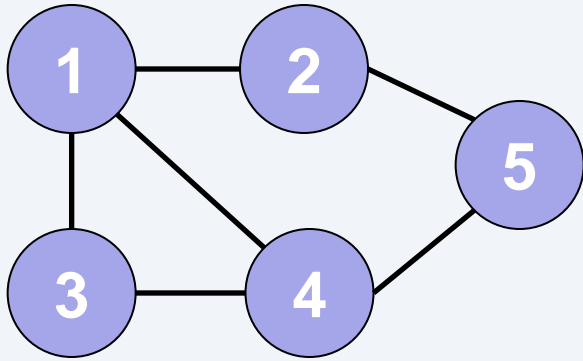


# **Graphs/Networks**

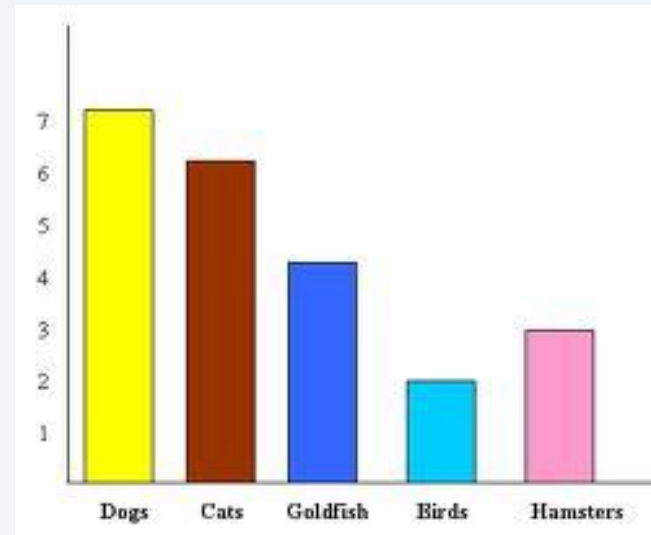
COMP 200

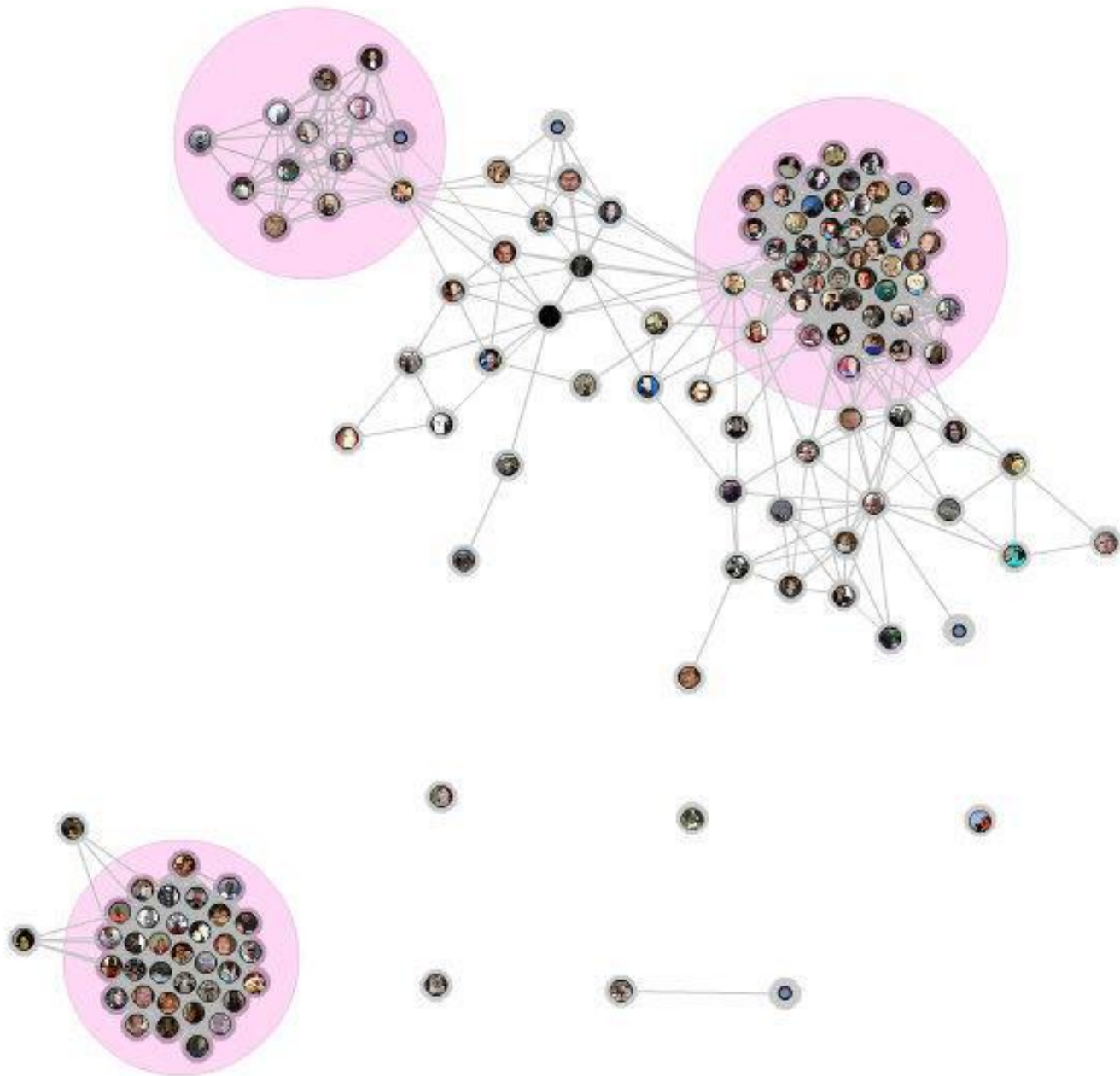
John Greiner & Stephen Wong

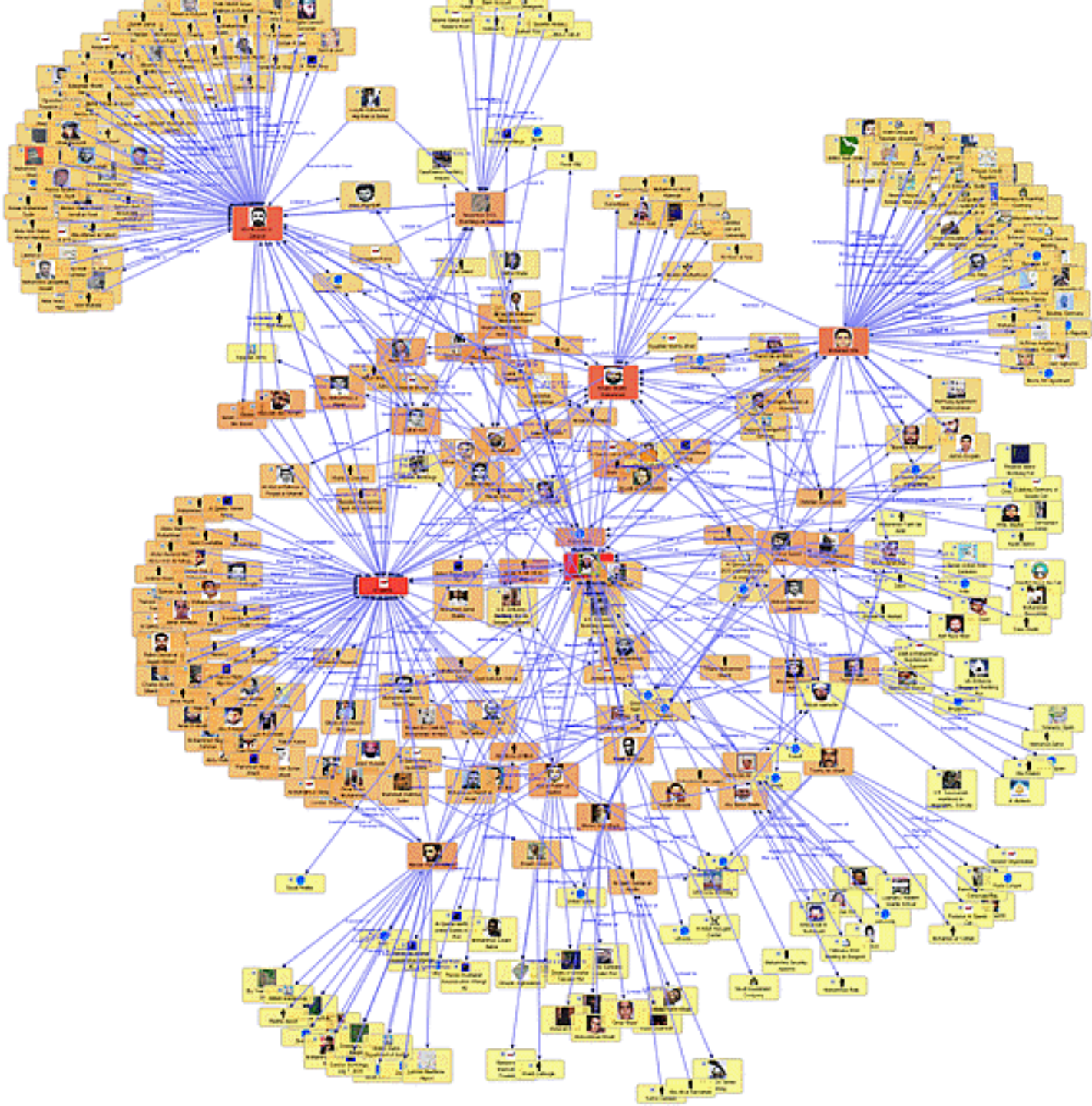
# Not the Same as Function Graphs



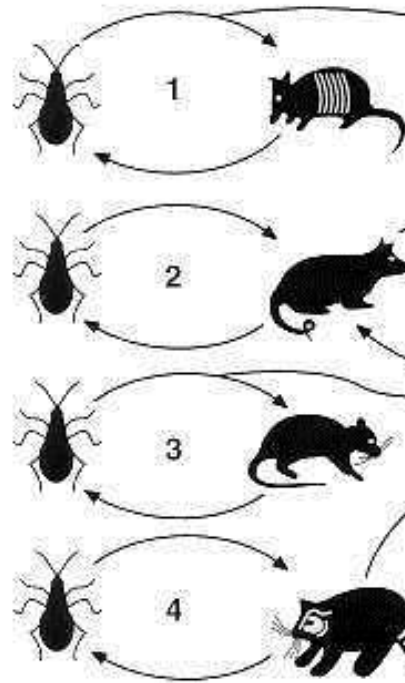
≠



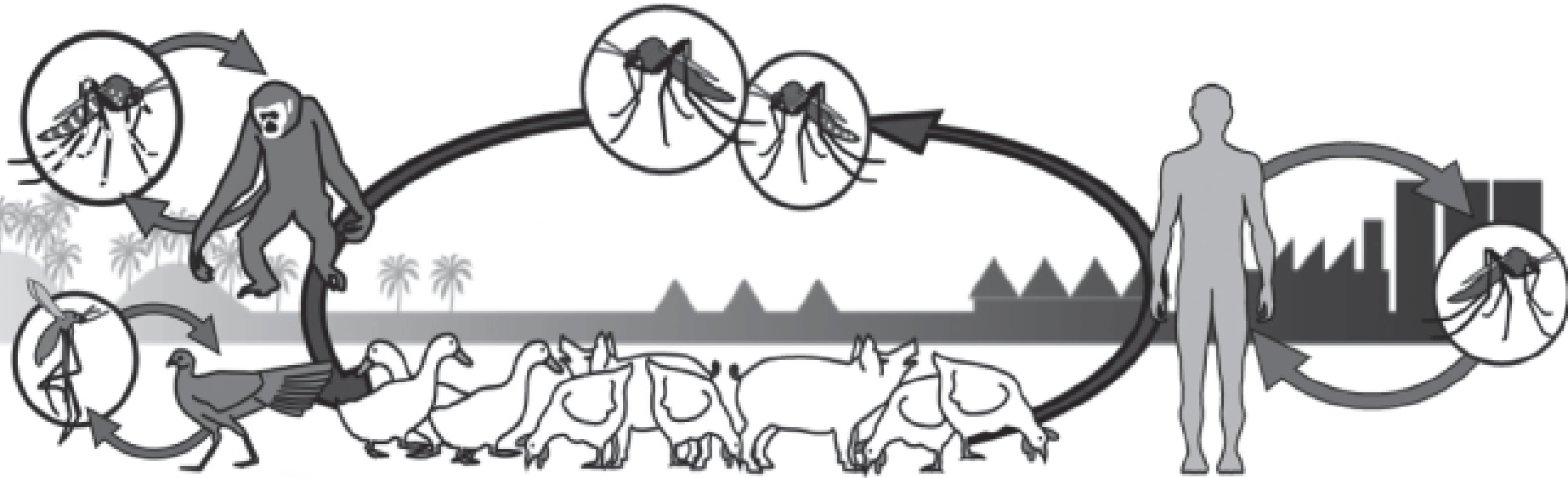
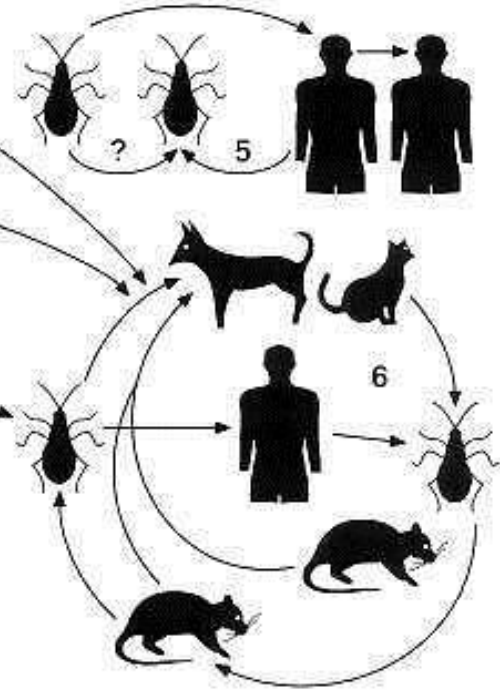




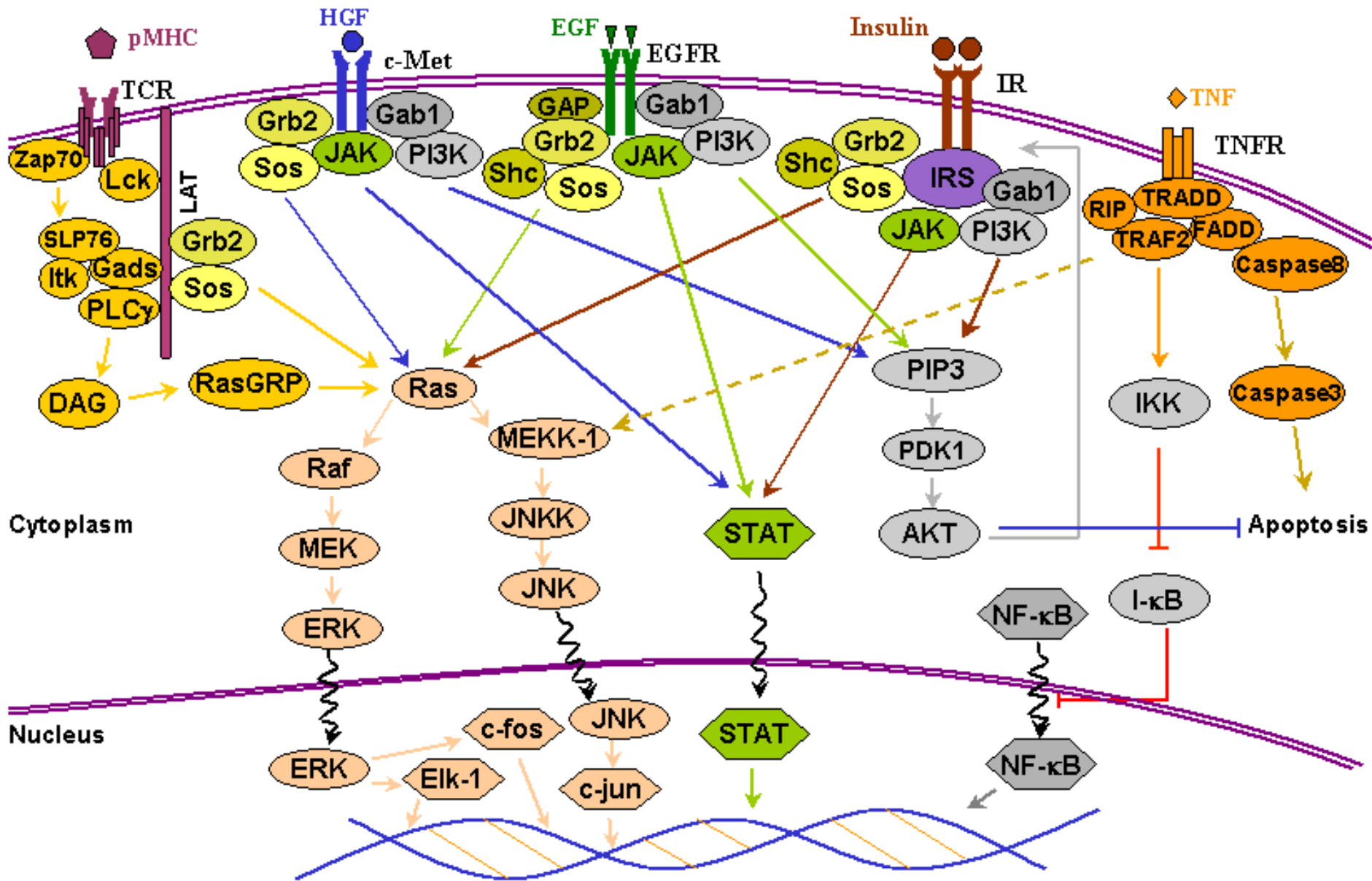
### Wild Cycles



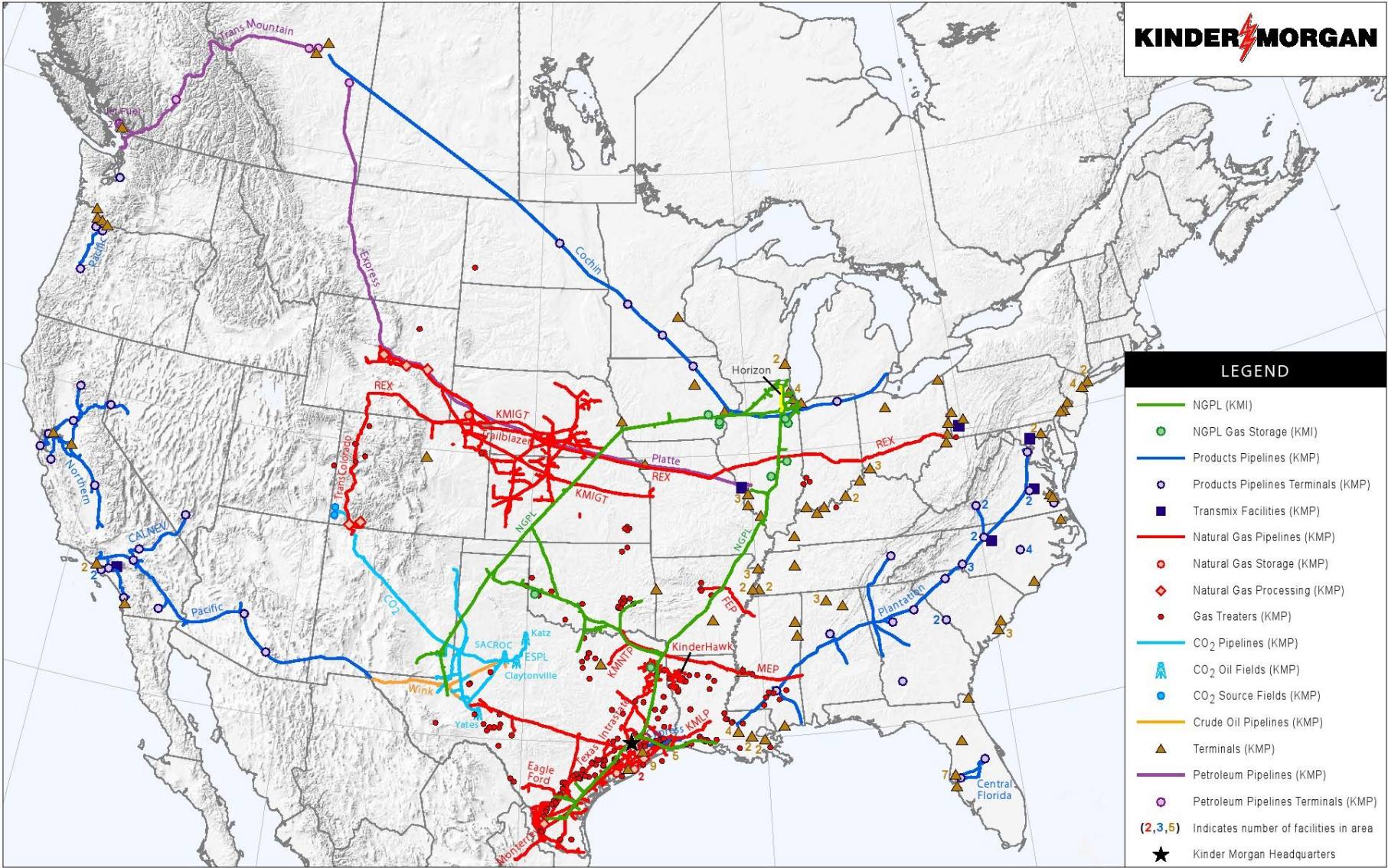
### Domiciliary Cycles



# Apoptosis – Cellular Death Pathways







**LEGEND**

- NGPL (KMI)
- NGPL Gas Storage (KMI)
- Products Pipelines (KMP)
- Products Pipelines Terminals (KMP)
- Transmix Facilities (KMP)
- Natural Gas Pipelines (KMP)
- Natural Gas Storage (KMP)
- ◇ Natural Gas Processing (KMP)
- Gas Treaters (KMP)
- CO<sub>2</sub> Pipelines (KMP)
- ▲ CO<sub>2</sub> Oil Fields (KMP)
- CO<sub>2</sub> Source Fields (KMP)
- Crude Oil Pipelines (KMP)
- ▲ Terminals (KMP)
- Petroleum Pipelines (KMP)
- Petroleum Pipelines Terminals (KMP)
- (2,3,5) Indicates number of facilities in area
- ★ Kinder Morgan Headquarters



# Visualizing The U.S. Electric Grid

The U.S. electric grid is a complex network of independently owned and operated power plants and transmission lines. Aging infrastructure, combined with a rise in domestic electricity consumption, has forced experts to critically examine the status and health of the nation's electrical systems.

THE GRID

SOURCES OF POWER

POWER PLANTS

SOLAR POWER

WIND POWER

## About This Map »

Click on the links below to switch layers on and off.

### EXISTING LINES


-  345-499 kV
-  500-699 kV
-  700-799 kV
-  1,000 kV (DC)

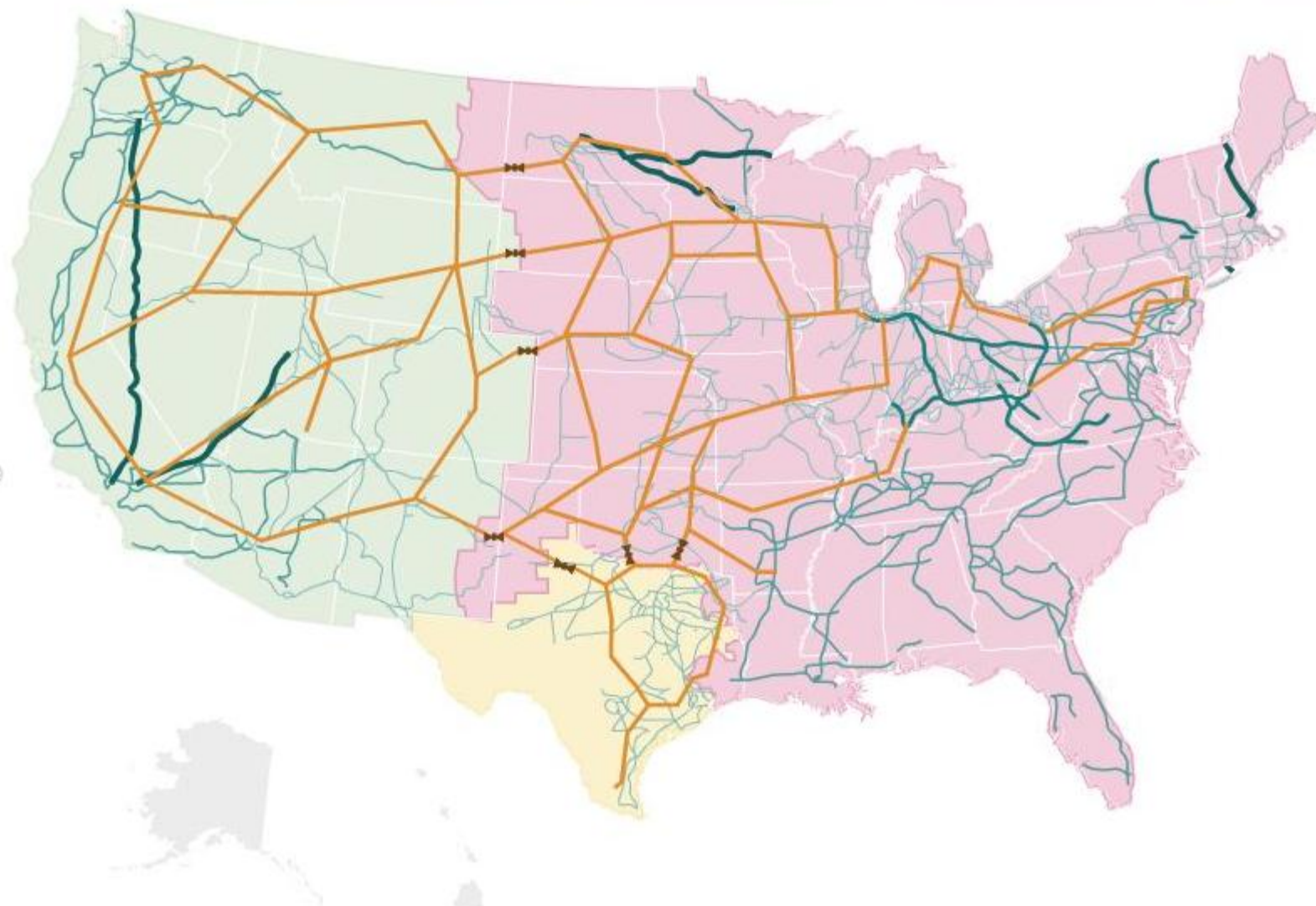
### PROPOSED LINES

-  New 765 kV
-  AC-DC-AC Links

### INTERCONNECTIONS

#### Major sectors of the U.S. electrical grid

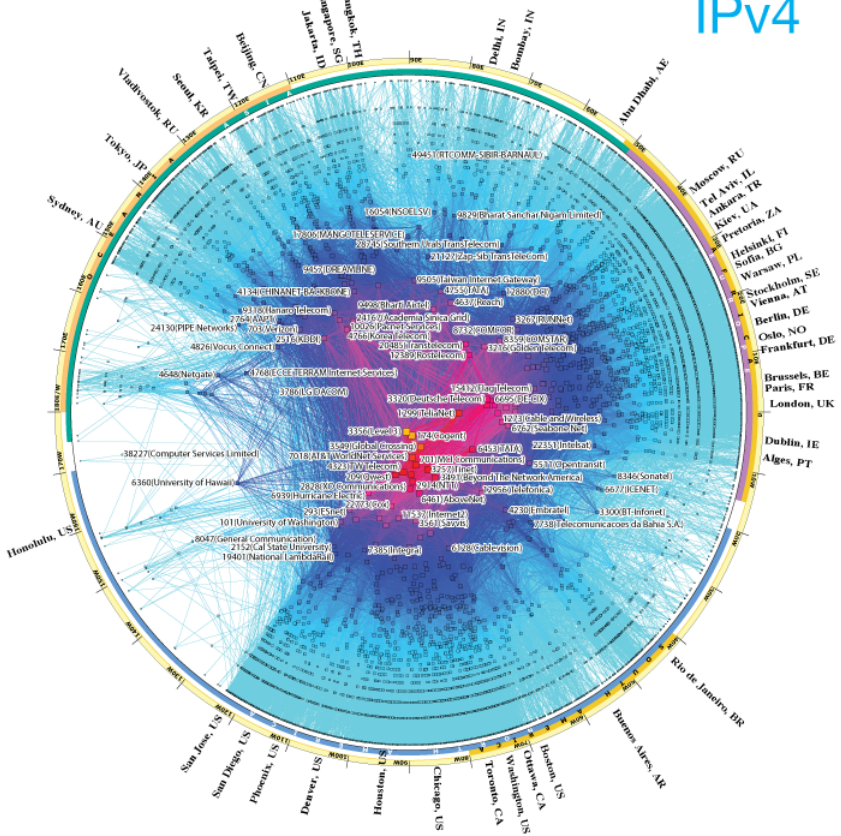
-  Eastern
-  Western
-  Texas (ERCOT)



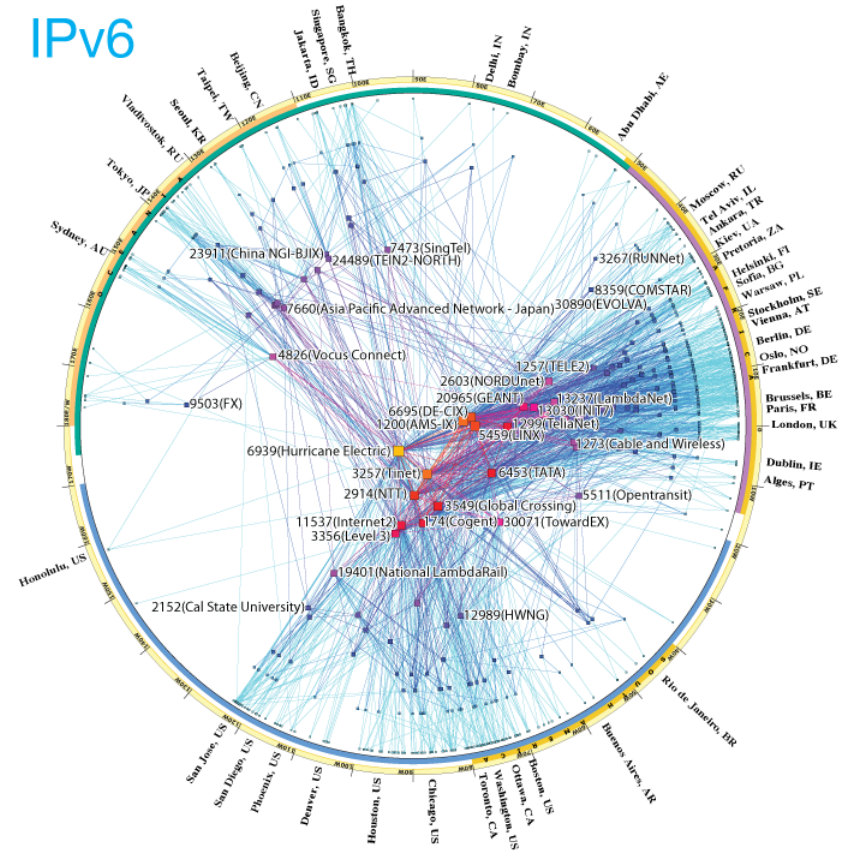
# CAIDA's IPv4 & IPv6 AS Core AS-level INTERNET GRAPH

Archipelago August 2010

## IPv4



## IPv6

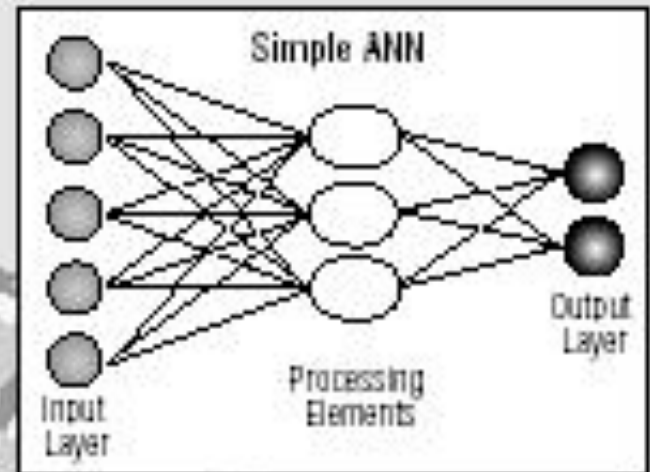


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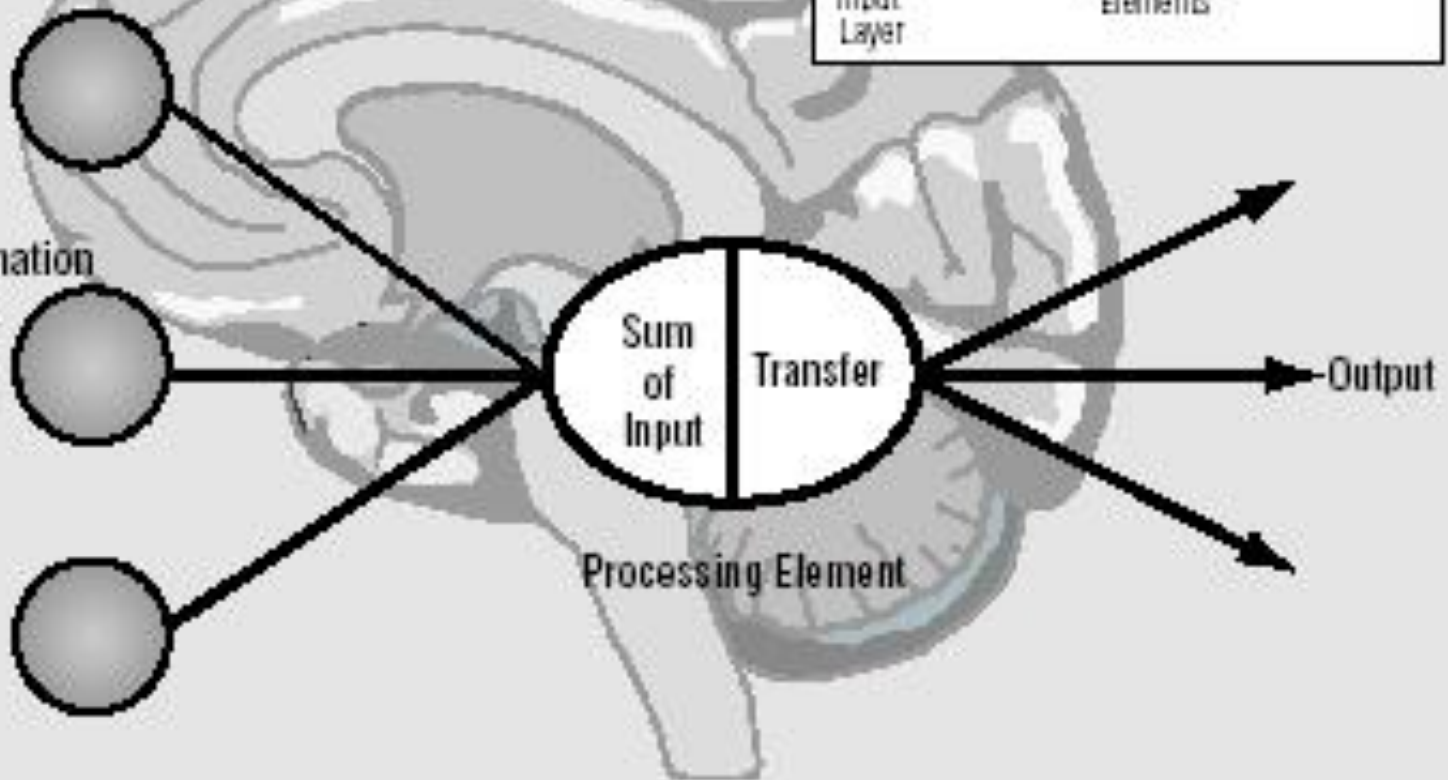


# Artificial Neural Network (ANN)

Artificial neurons simulate the basic functions of biological neurons: input, processing, output, and passing information to other neurons. Each input is given a weight to signify how important it is compared to other input.

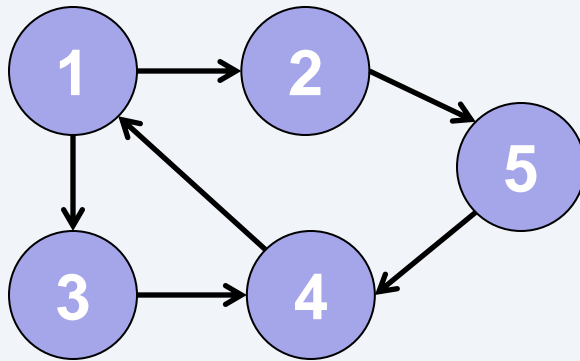


Input Information  
(with varying  
weights of  
importance)

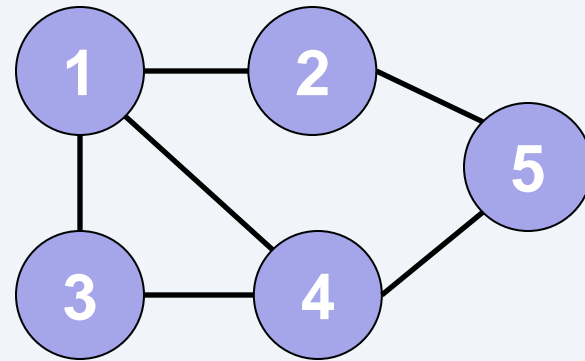


# Graphs (or Networks)

Vertices/nodes + edges connecting vertices

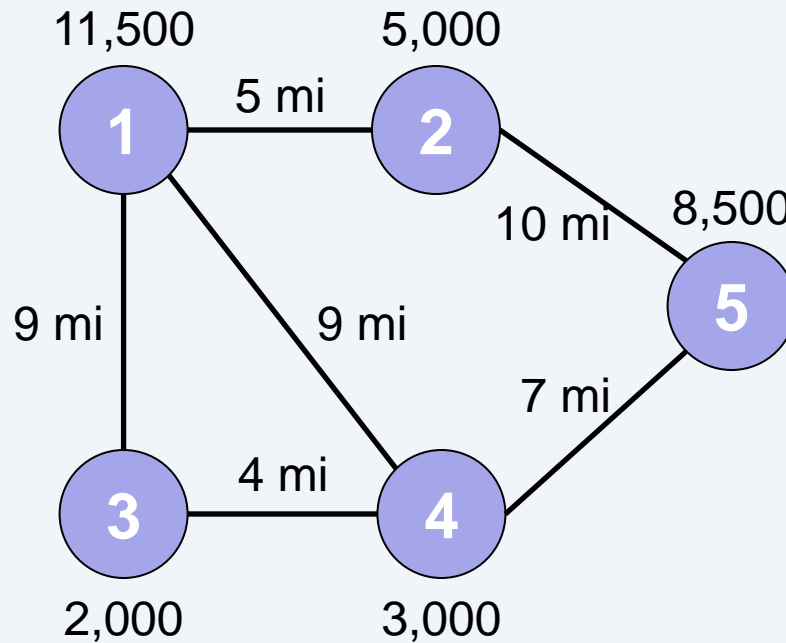


Directed



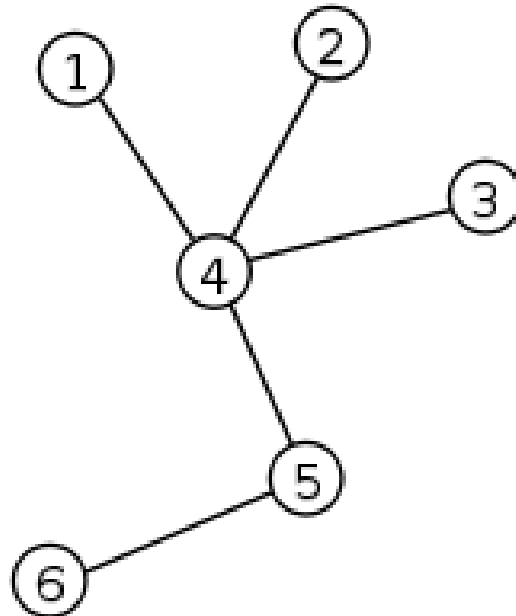
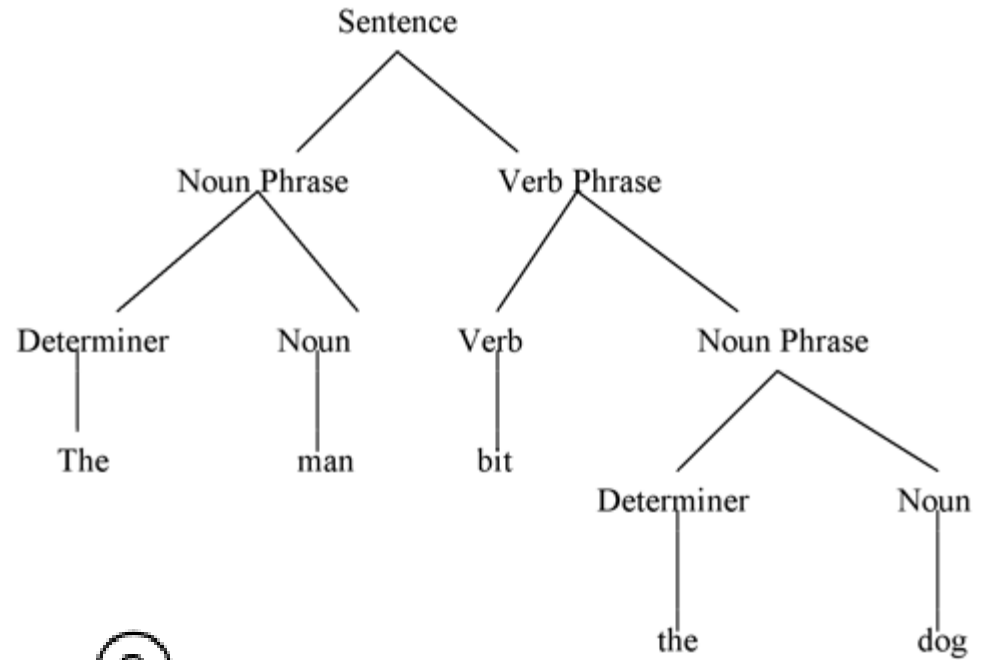
Undirected

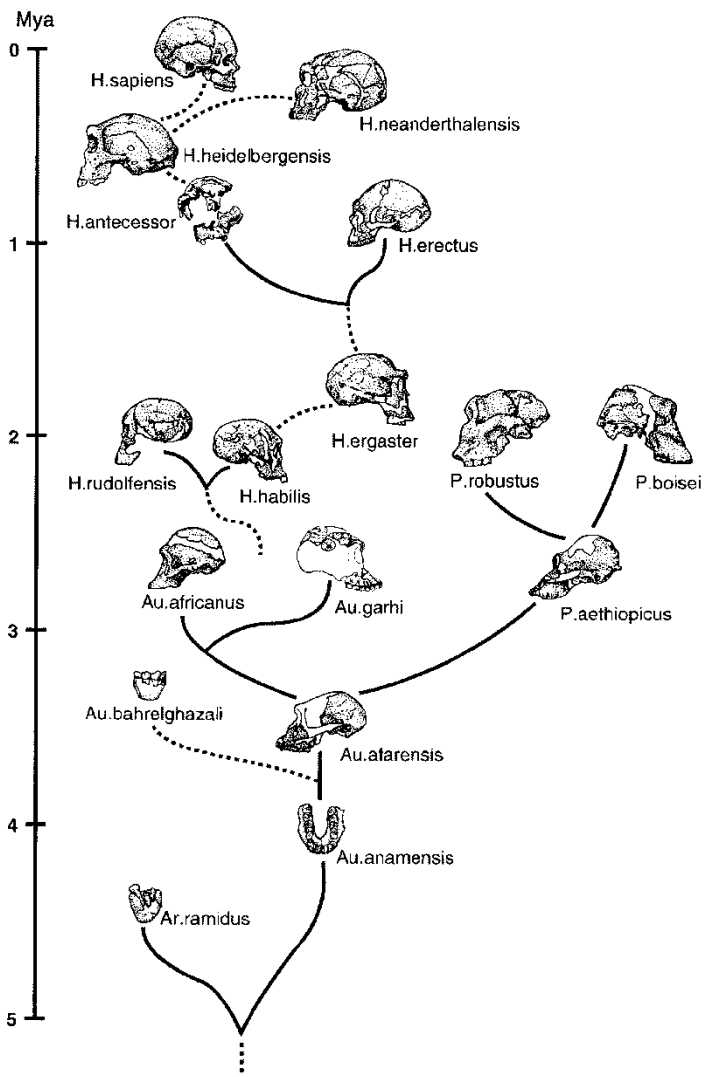
# Can Label/Annotate Nodes or Edges



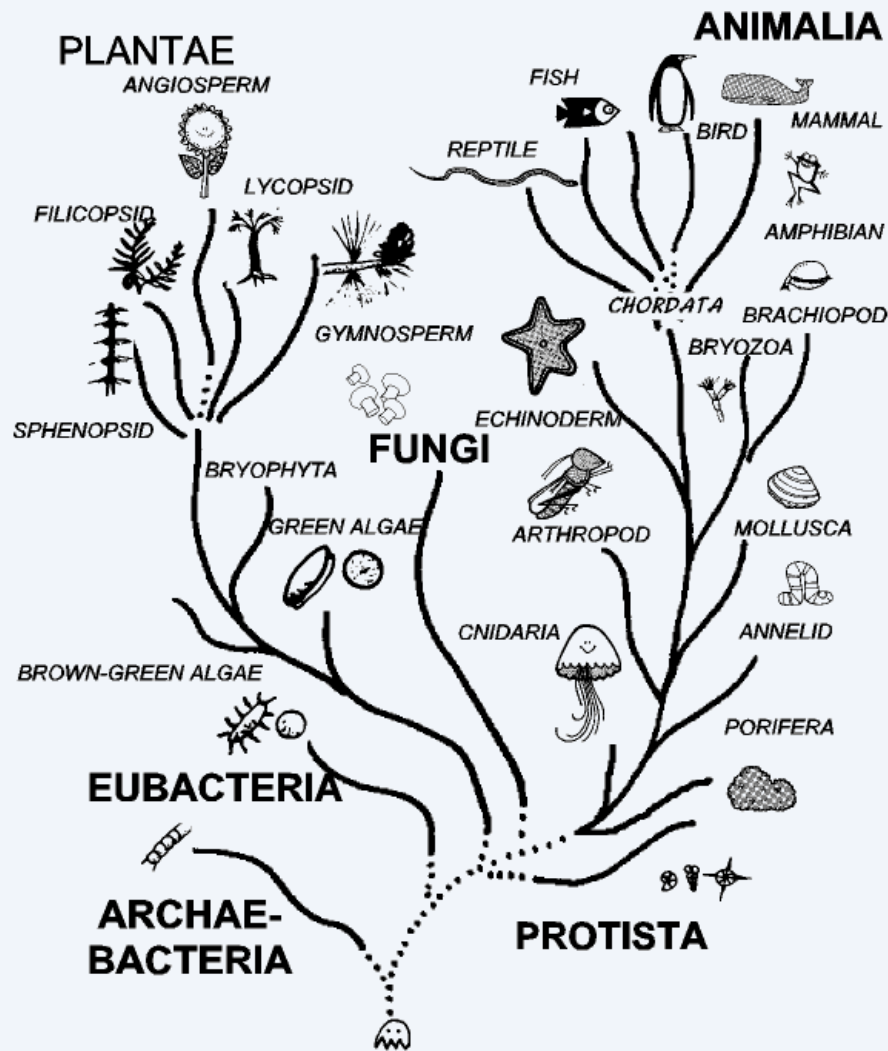
E.g., populations and distances

# Trees are Simple Graphs

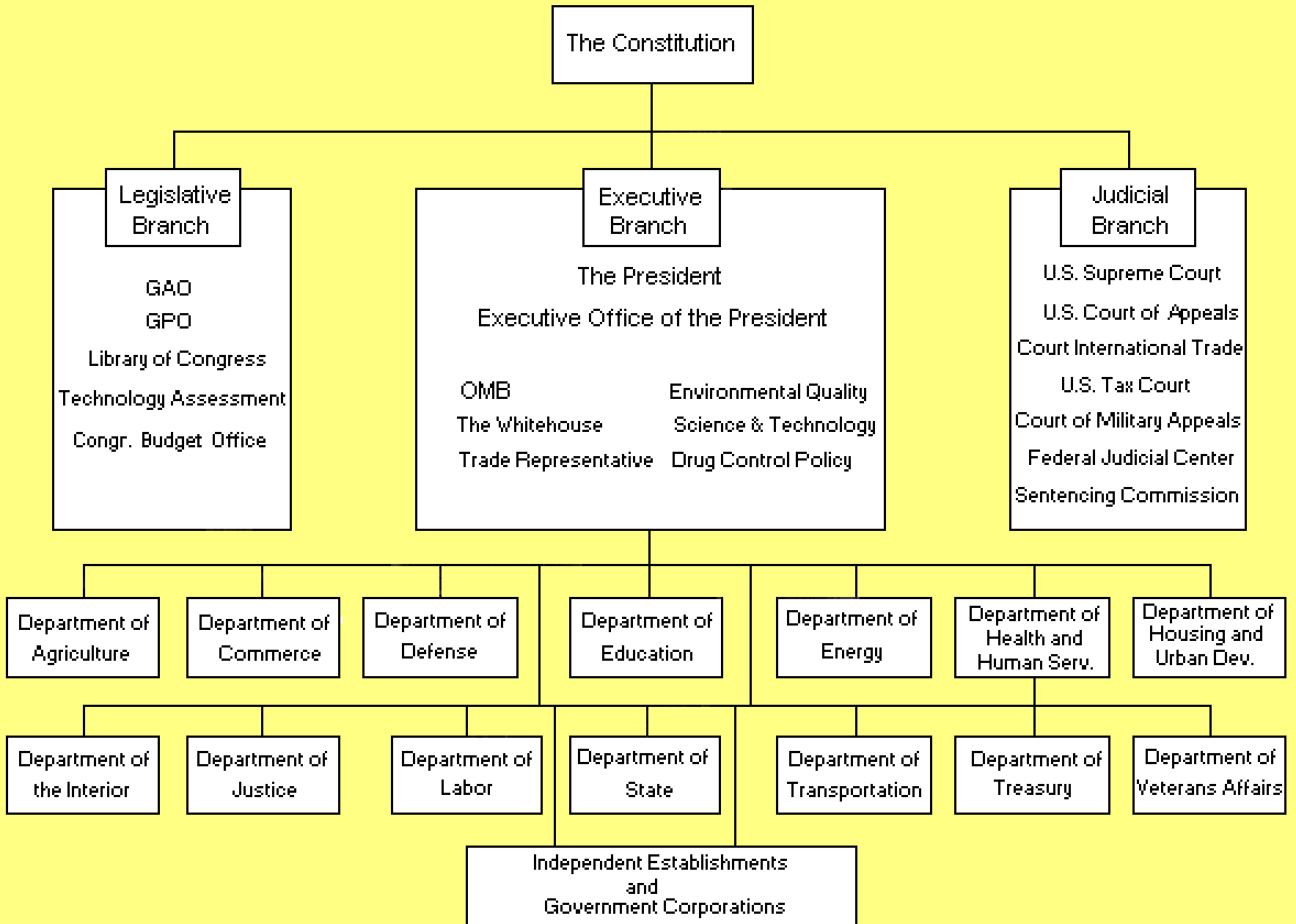


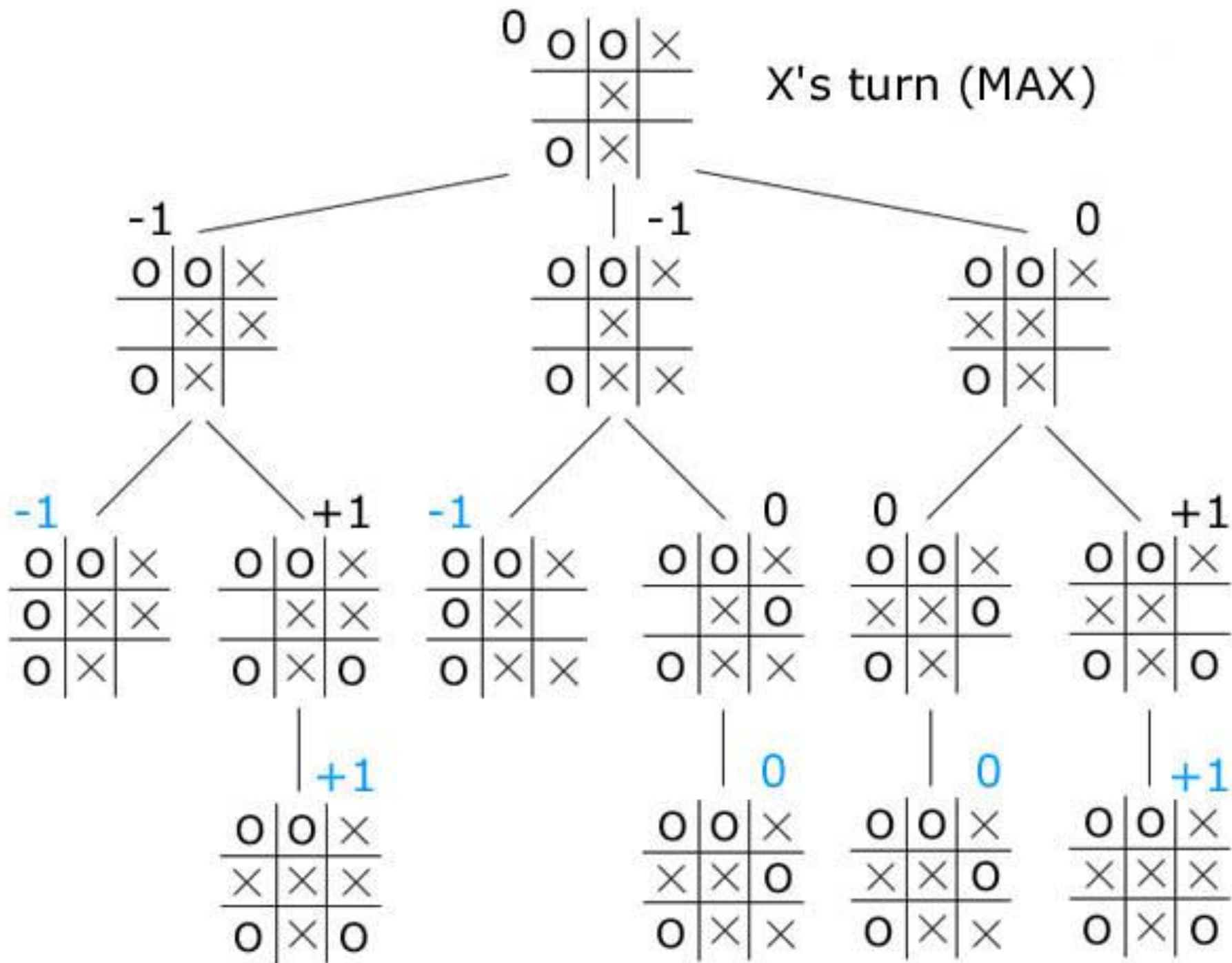


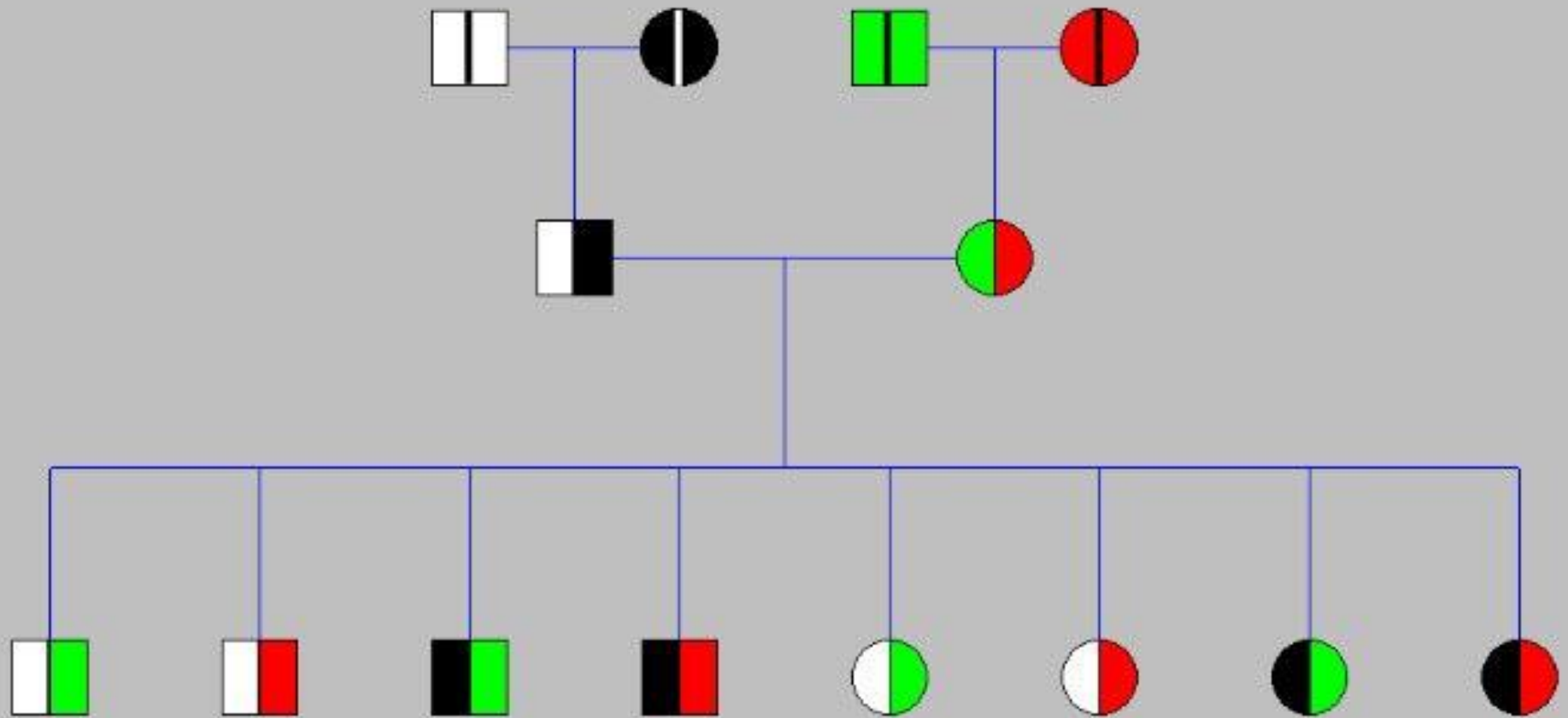
# TREE OF LIFE



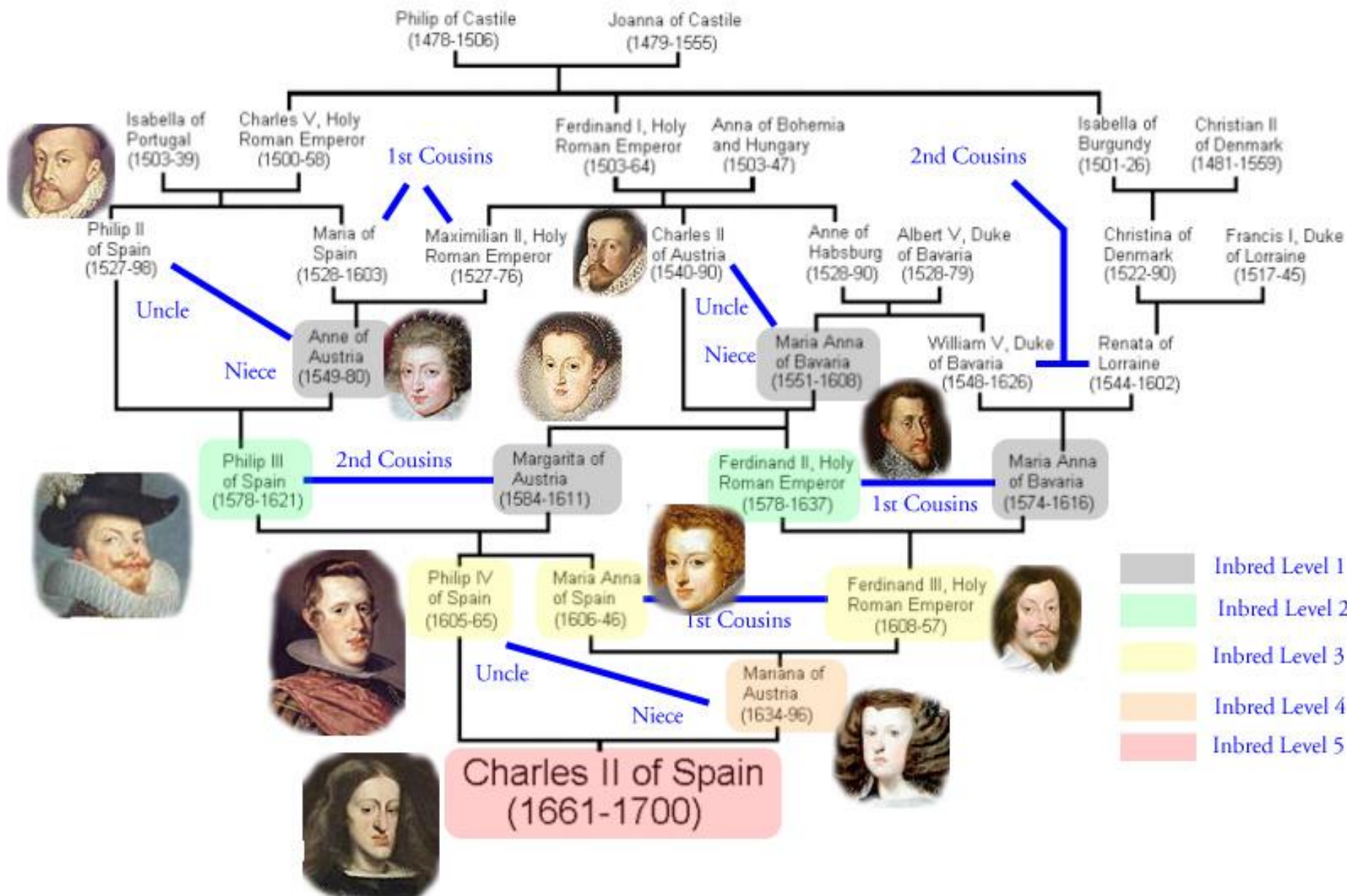


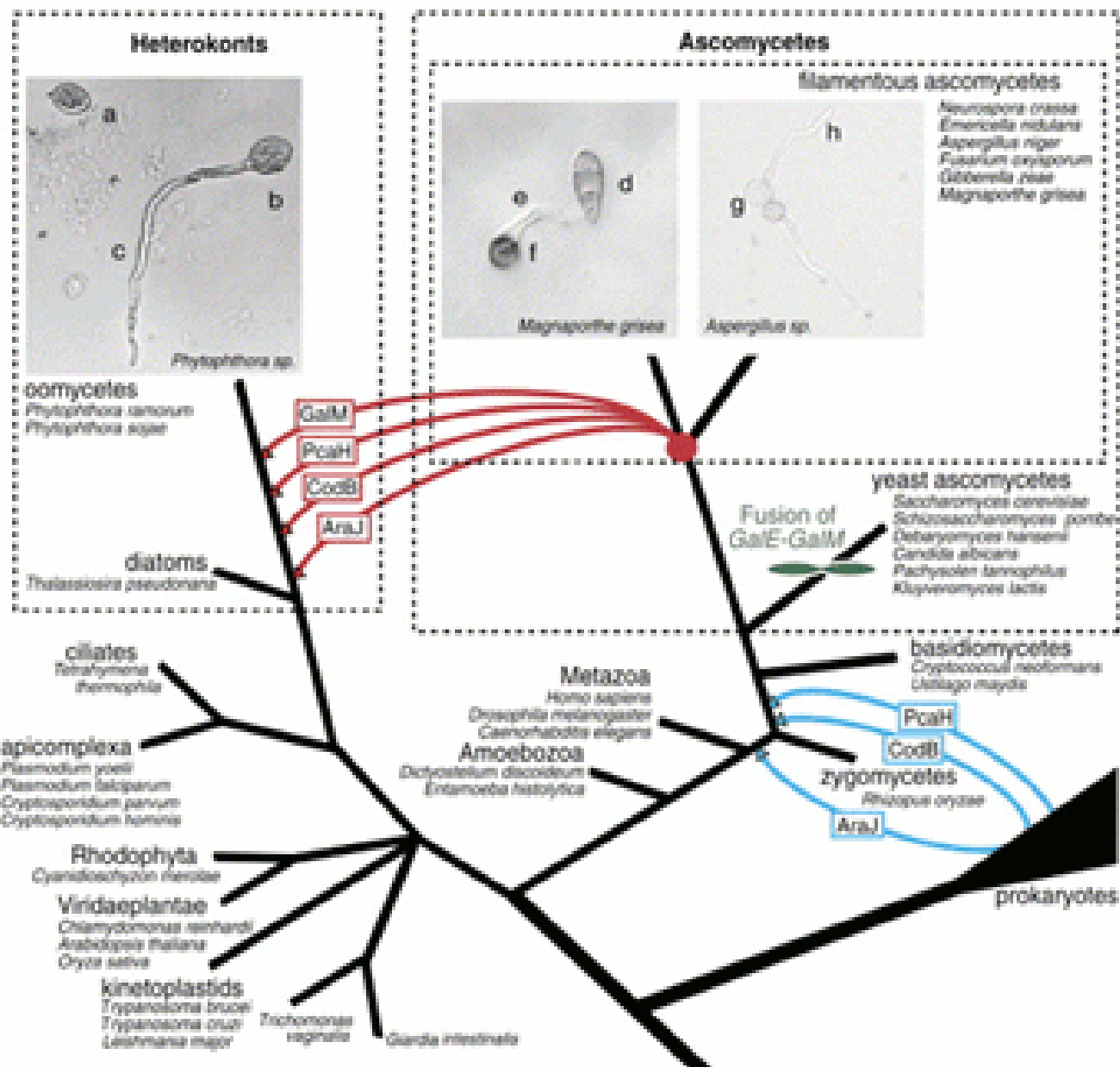






# The Inbreeding of Charles II of Spain (1661-1700)





Horizontal Gene Transfer between filamentous osomotrophic plant pathogens. See Richards et al., 2006 Curr. Biol. 15, 1857-64 for more details