

# Computer Programming Fundamentals

CS 152

Professor: Leah Buechley

TAs: Melody Horn, Noah Garcia, Andrew Geyko, Juan Ormaza

Time: MWF 10:00-10:50am

[https://handandmachine.cs.unm.edu/classes/CS152\\_Fall2021/](https://handandmachine.cs.unm.edu/classes/CS152_Fall2021/)

# TODAY: RECURSION AND FRACTALS

# **RECURSION**

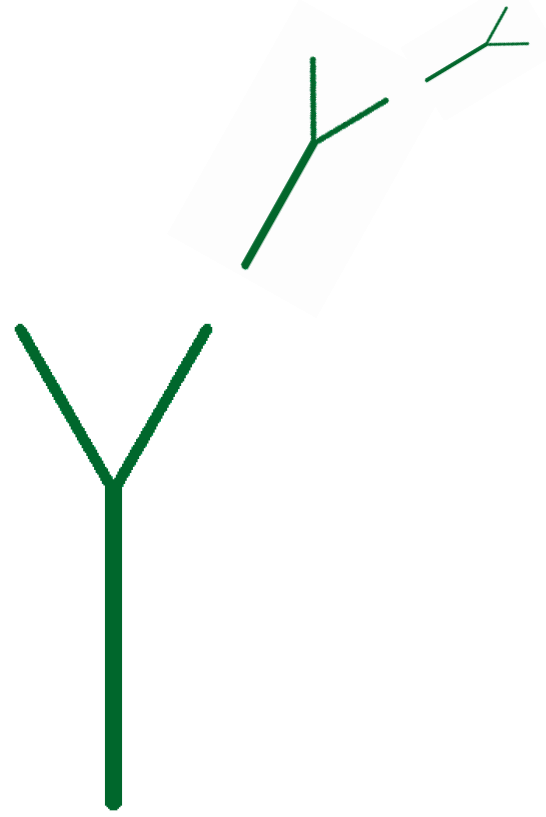
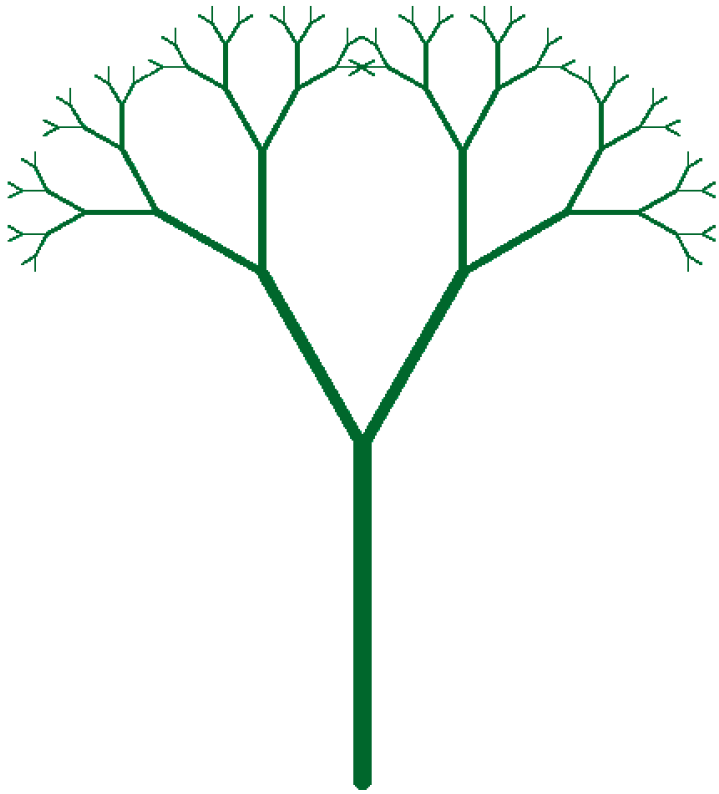
defining a problem in terms of itself

# **RECURSION**

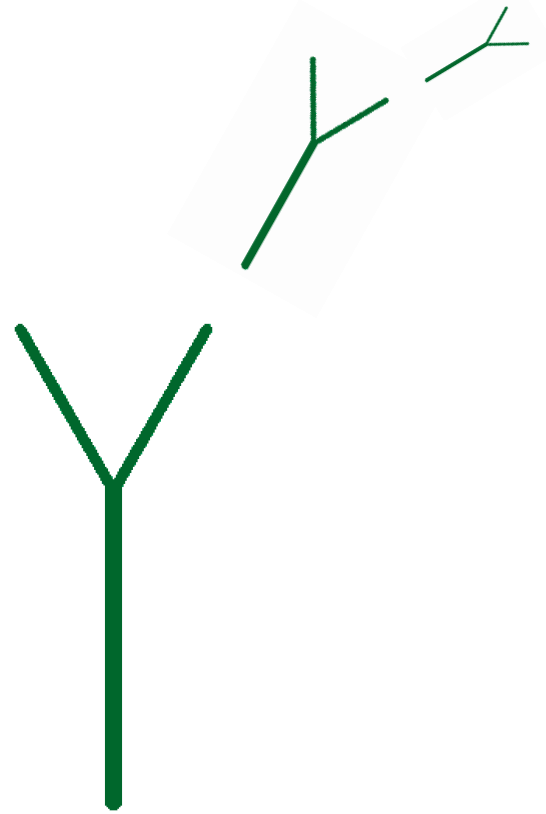
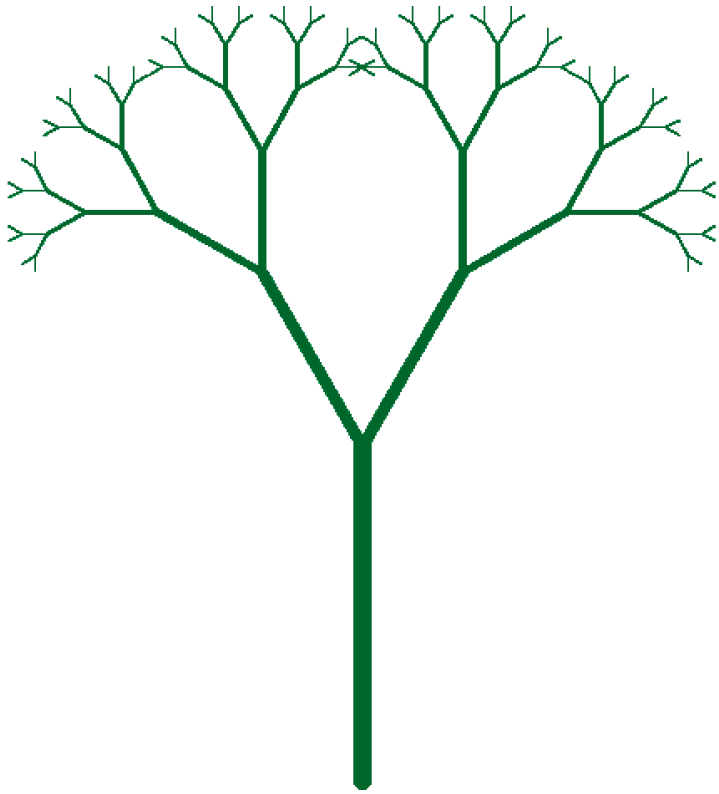
defining a structure in terms of itself



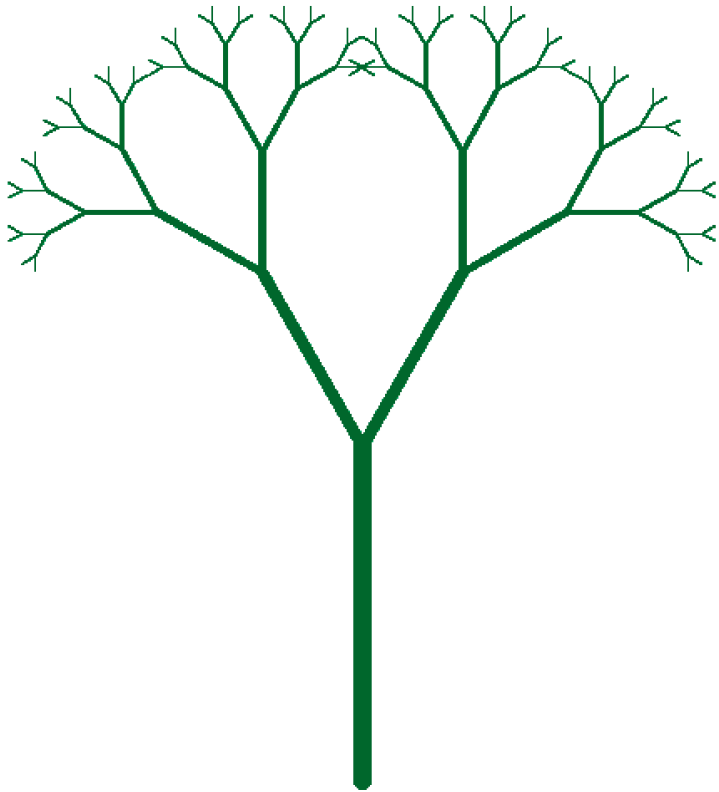
# RECURSIVE STRUCTURE



# A TREE IS MADE OF LOTS OF SMALLER TREES

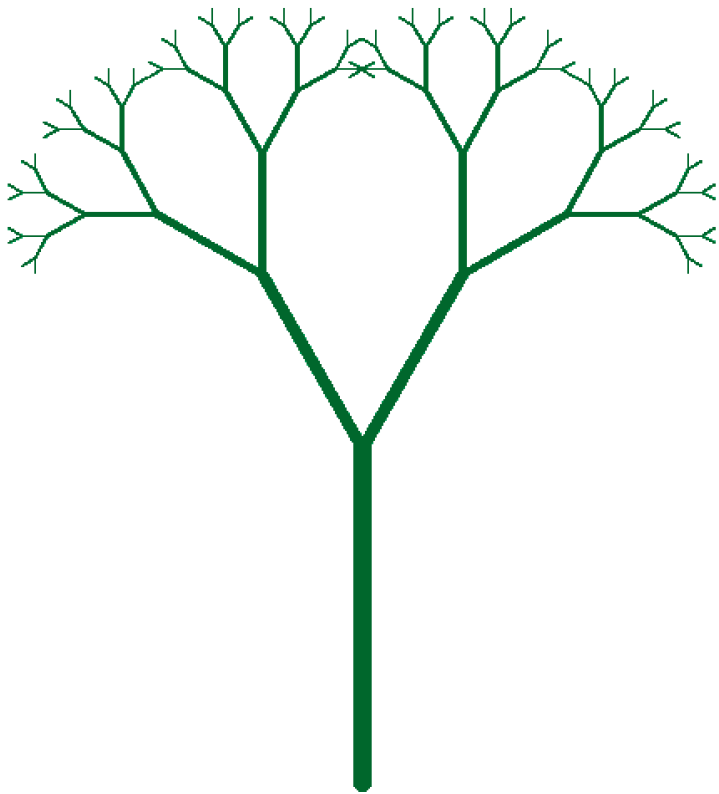


# FRACTALS



a geometric figure  
where each part  
has the same pattern  
as the whole

# FRACTALS



a branch looks the same as a tree

# **FRACTALS IN NATURE**

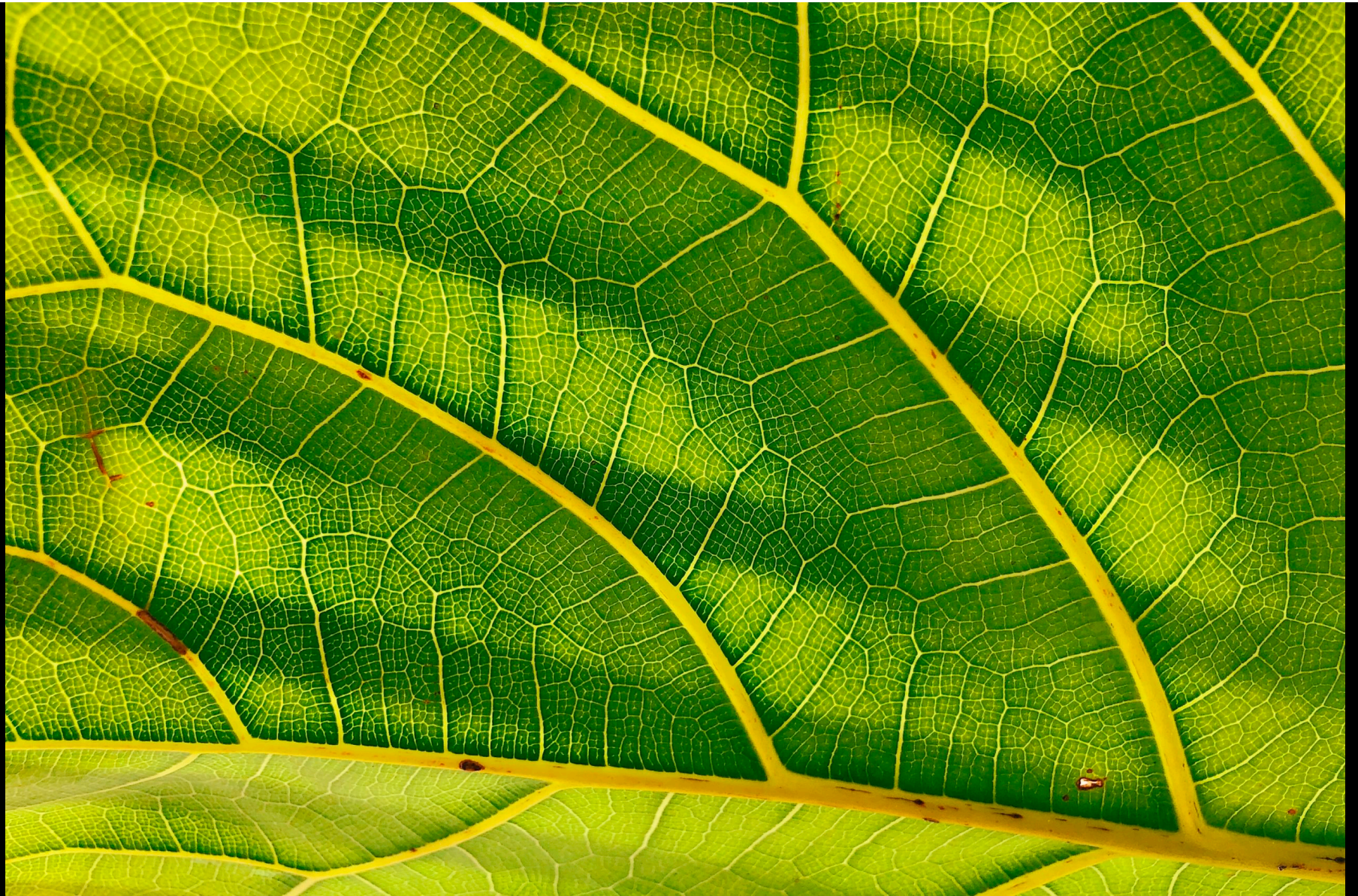




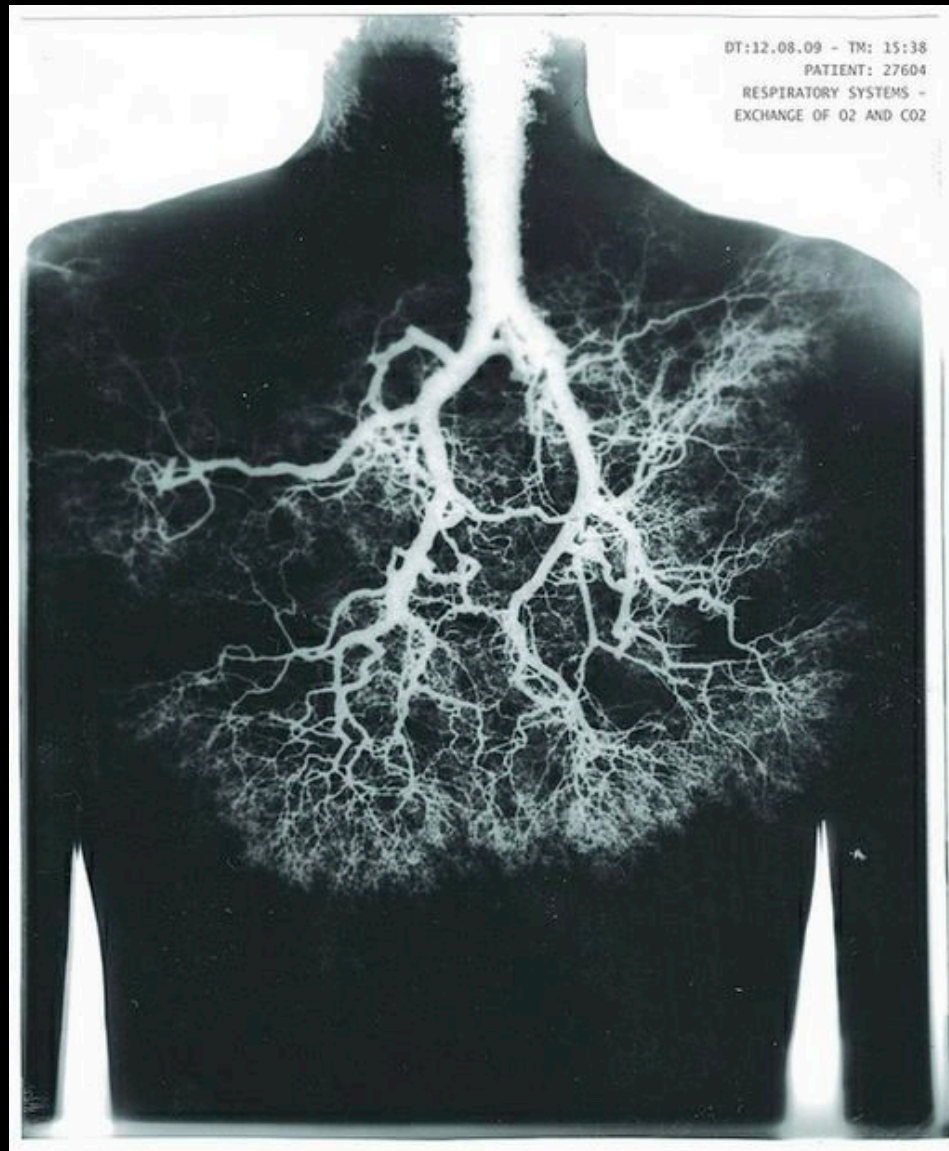




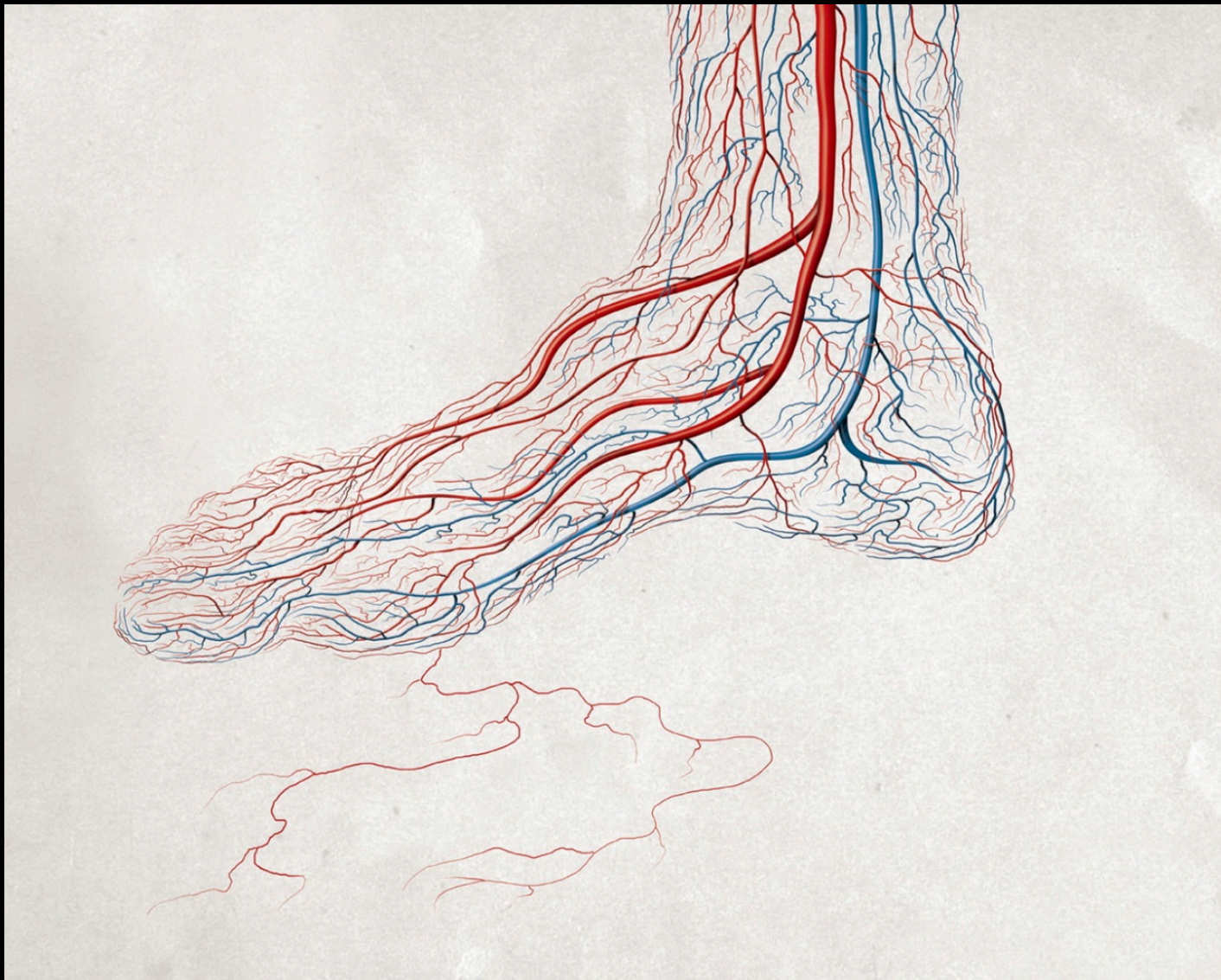








DT:12.08.09 - TM: 15:38  
PATIENT: 27604  
RESPIRATORY SYSTEMS -  
EXCHANGE OF O2 AND CO2

















# **A CLOSER LOOK AT TREES**



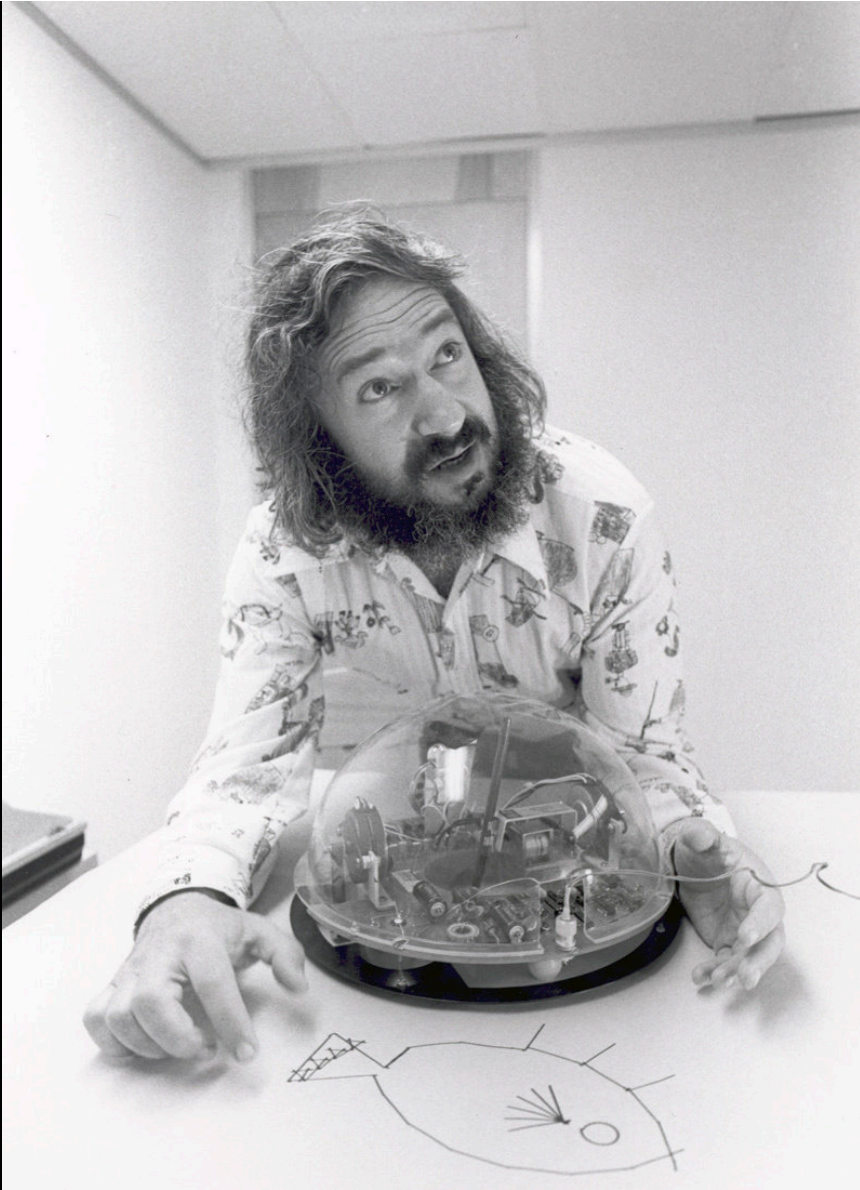
**TREES ARE IMPORTANT  
STRUCTURES IN CS**

# **DRAWING TREES WITH CODE**

**WE WILL USE A NEAT DRAWING TOOL:  
A LOGO TURTLE**

# LOGO

- A programming language designed to enable children to explore mathematics and computers
- You direct a “turtle” to move around giving it simple directions
- Developed in 1967 by Seymour Papert, Cynthia Solomon, and Wally Feurzeig
- An embodied approach to geometry
- Turtle robot in 1969
- Turtle Geometry published in 1981



Seymour Papert and students, 1969

**WE'LL USE A LOGO TURTLE  
LIBRARY I WROTE**

questions?

# Thank you!

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