

**PATTERNS ARE EVERYWHERE.  
WHY AND HOW?**

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VIRGINIA TECH MATHEMATICS DEPARTMENT**





Oberdorf, Oberdorf, Maxing, Germany

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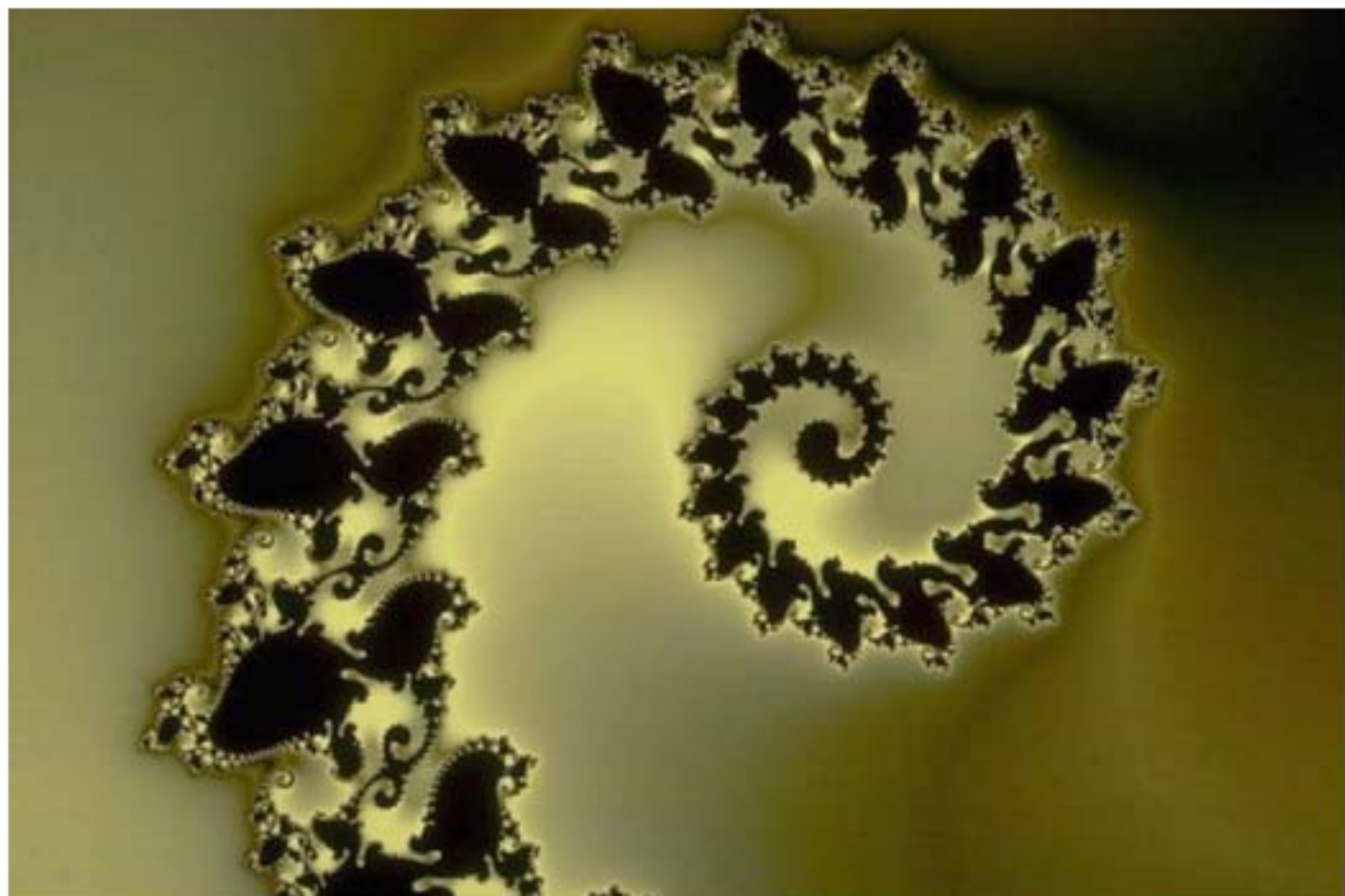


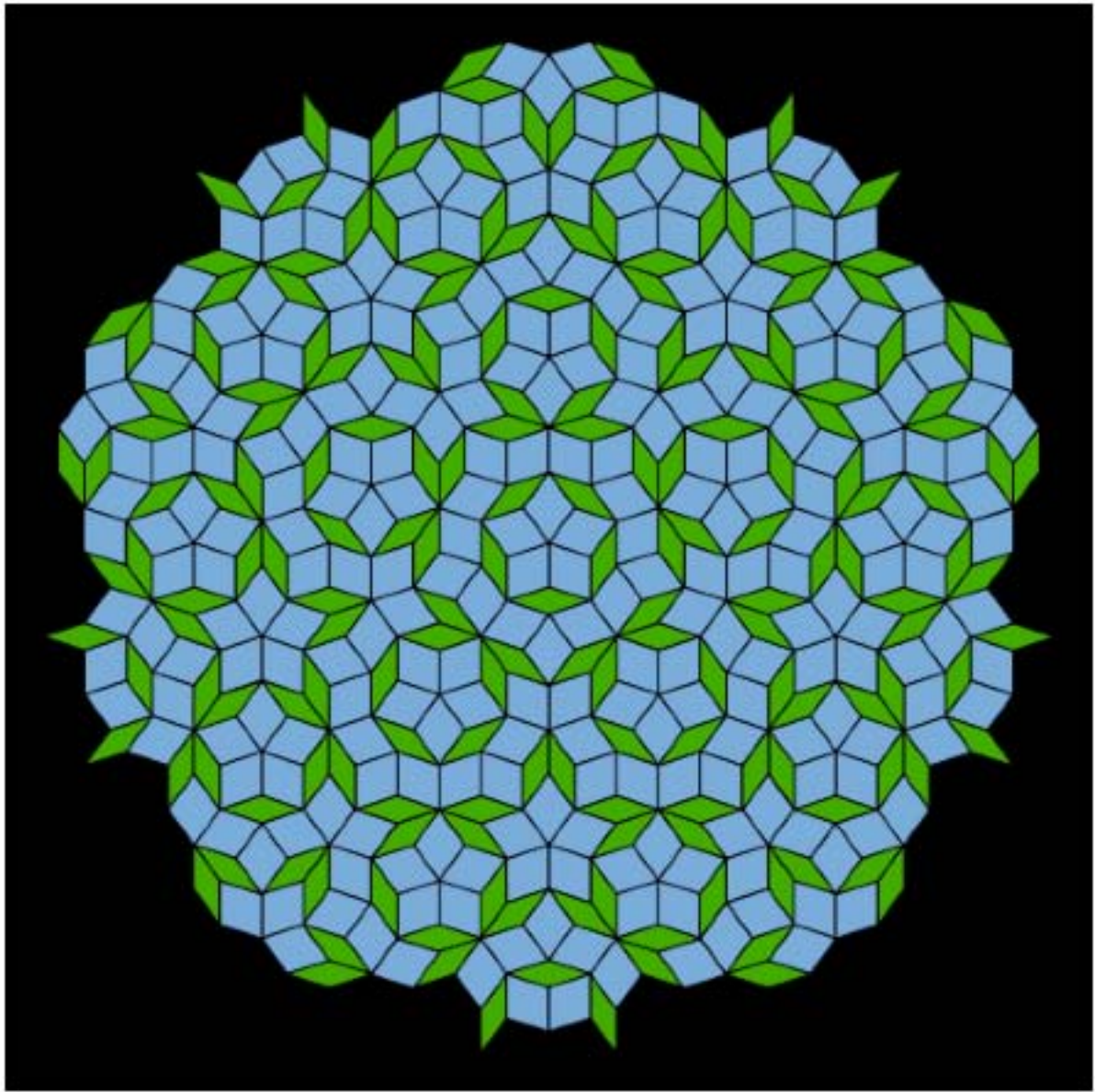












**PATTERN:** A PATTERN IS A TYPE OF  
THEME OF RECURRING EVENTS OR  
OBJECTS, SOMETIMES REFERRED TO AS  
ELEMENTS OF A SET OF OBJECTS.

THESE ELEMENTS REPEAT IN A  
PREDICTABLE MANNER.

WIKIPEDIA






**WHY ARE PATTERNS  
EVERYWHERE?**



BROWNIAN MOTION

A wide-angle photograph of a snowy mountain landscape. A person in a red jacket is skiing down a slope in the lower center. The mountain has various ridges and gullies, with some rocky outcrops visible. The sky is overcast and grey. The overall scene is a vast, open, and somewhat desolate winter environment.

**HOW DO PATTERNS  
COME ABOUT?**



2 4 6

2 4 6 8

2 4 8 16



2 4 8 16 32

1 2 3 5

1 2 3 5 8



1 2 3 5 8 13

1 2 3 5 8 13 21 34

FIBONACCI NUMBERS

LEONARDO PISANO

BIGOLLO

(1170-1250)

KNOWN AS

LEONARDO FIBONACCI





1	2	3	5	8	13	21	34
2	1.500	1.666	1.600	1.625	1.615	1.619	

34	56	90	146	236	382
1.647	1.607	1.622	1.616	1.618	

382	618
1.618	...

THE GOLDEN RATIO = 1.61803399

(ALSO KNOWN AS "DIVINE PROPORTION,"  
"GOLDEN MEAN," "GOLDEN SECTION")

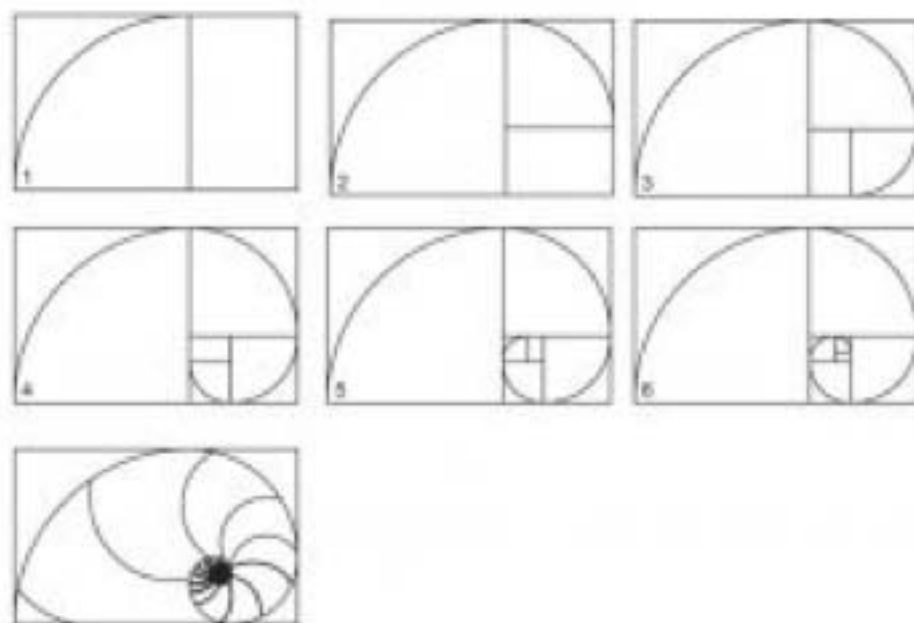


Figure 10. The Golden Ratio



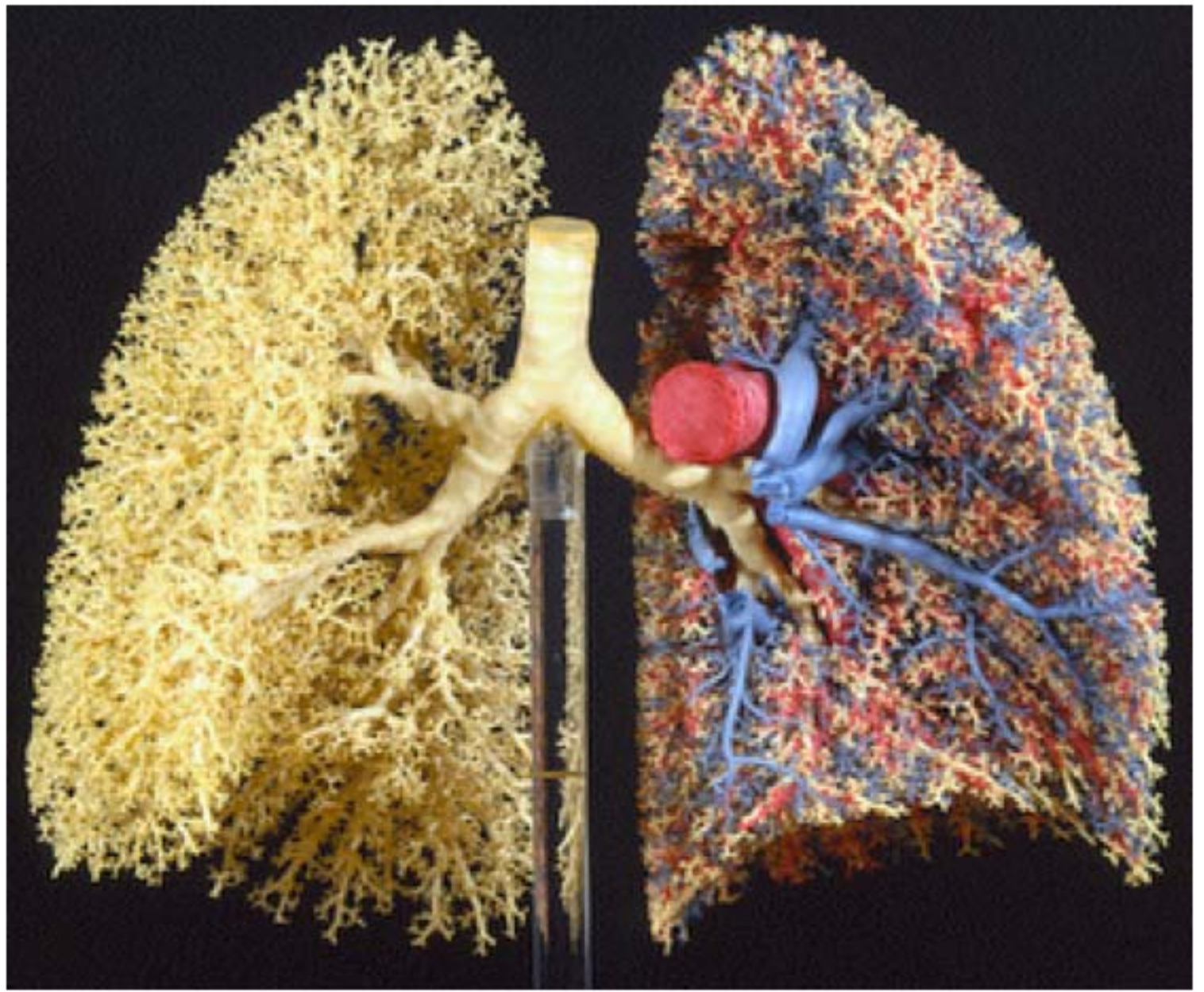




A large, curved, metallic structure, possibly a dome or a large-scale architectural element, is covered in a repeating pattern of triangles. The triangles are arranged in a way that creates a sense of depth and self-similarity, with larger triangles containing smaller, similar triangles. The overall appearance is that of a complex, fractal-like structure. The text "SELF-SIMILARITY" is overlaid in red, bold, capital letters across the center of the image.

**SELF-SIMILARITY**







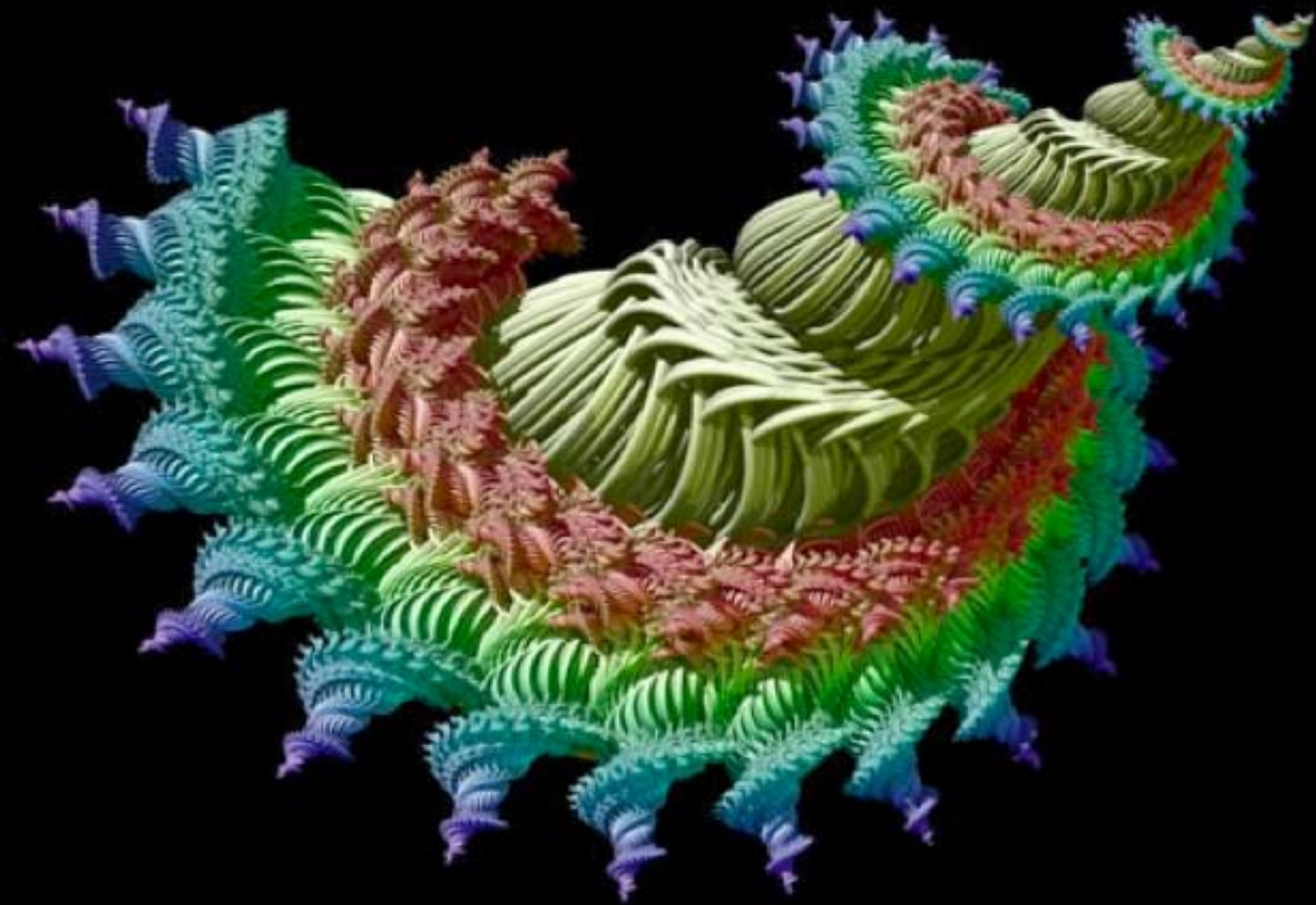


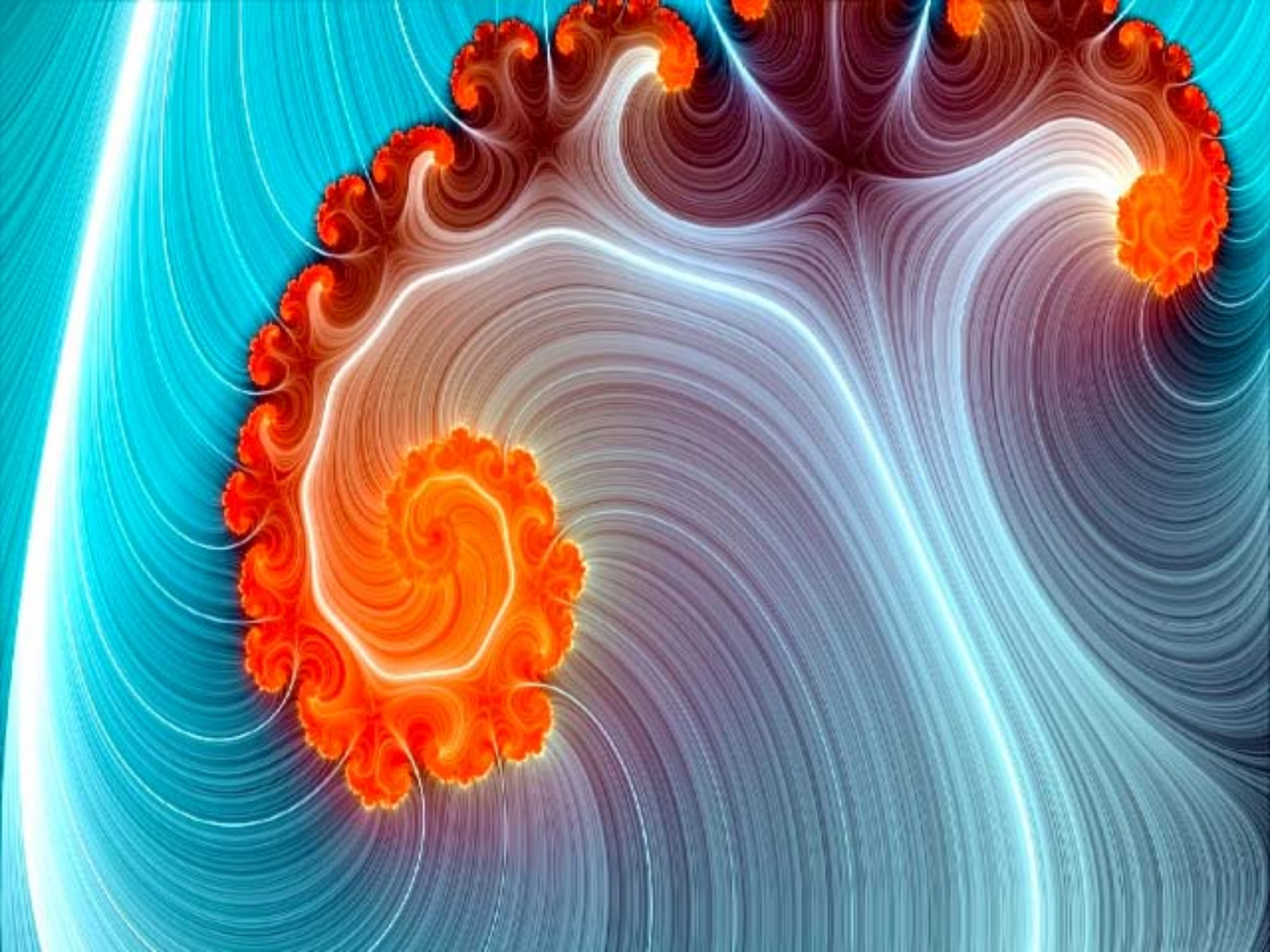


# FRACTALS

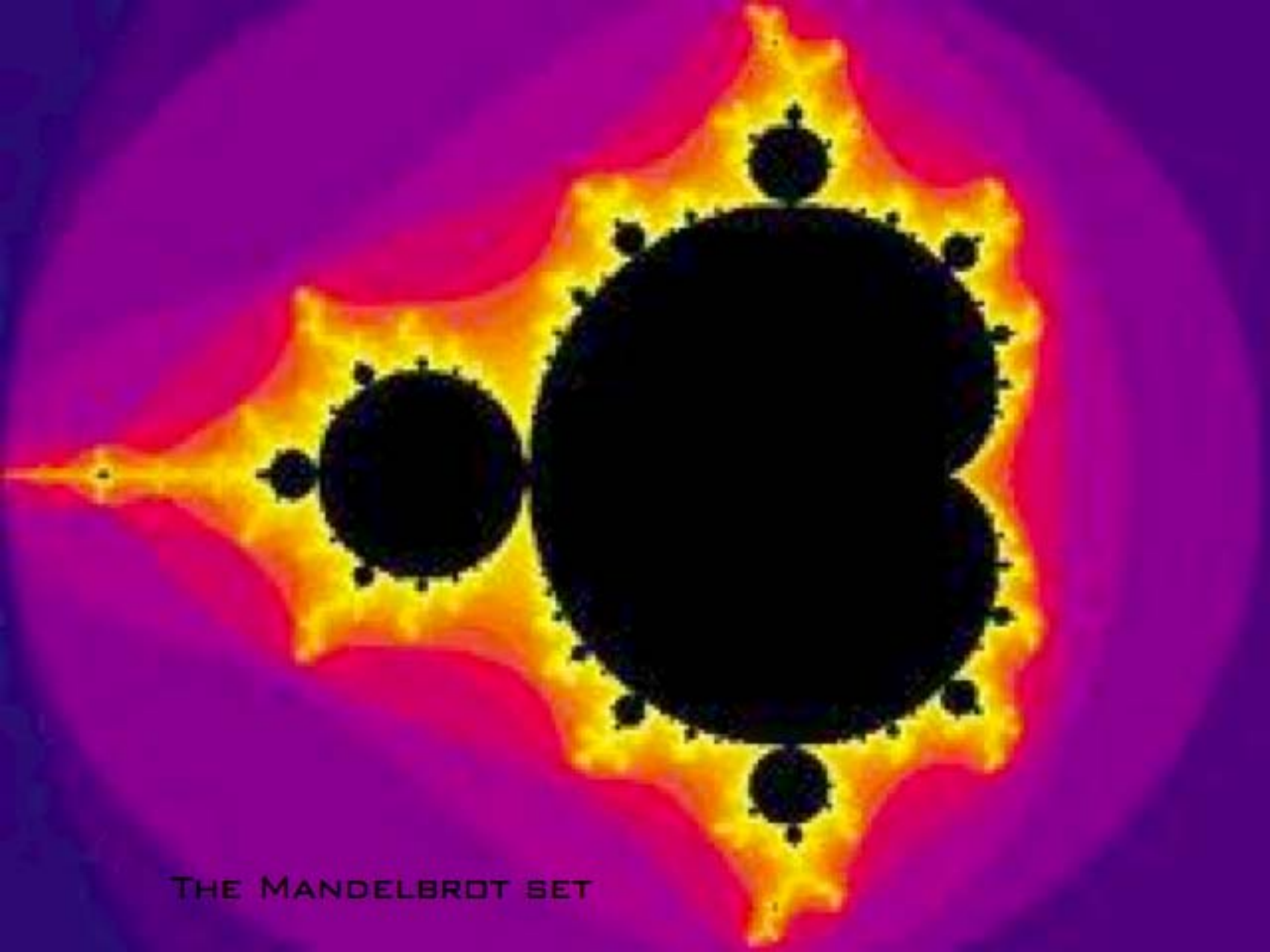
III



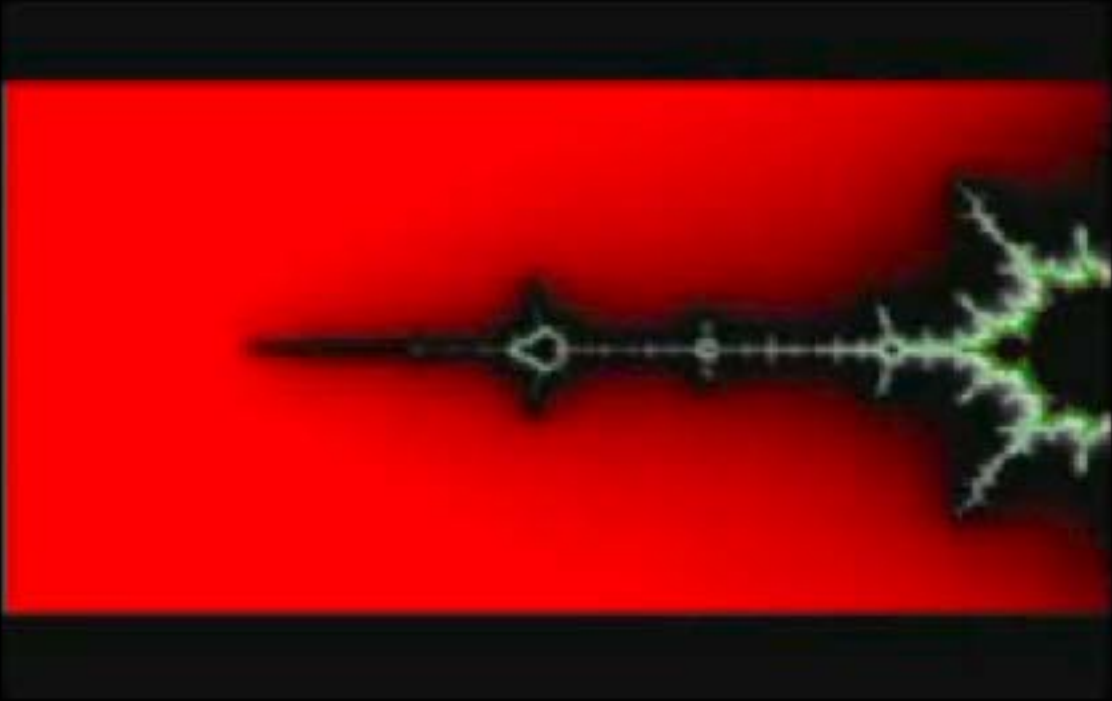








THE MANDELBROT SET



[Fractalmaker website](#)



An aerial photograph of two large, circular oceanic eddies. Each eddy has a prominent white, foamy center, likely from a storm or a large-scale mixing event. The surrounding water is a deep blue, and the sky above is a lighter blue with some white clouds. The text "DYNAMIC PATTERNS" is overlaid in the center of the image.

# DYNAMIC PATTERNS



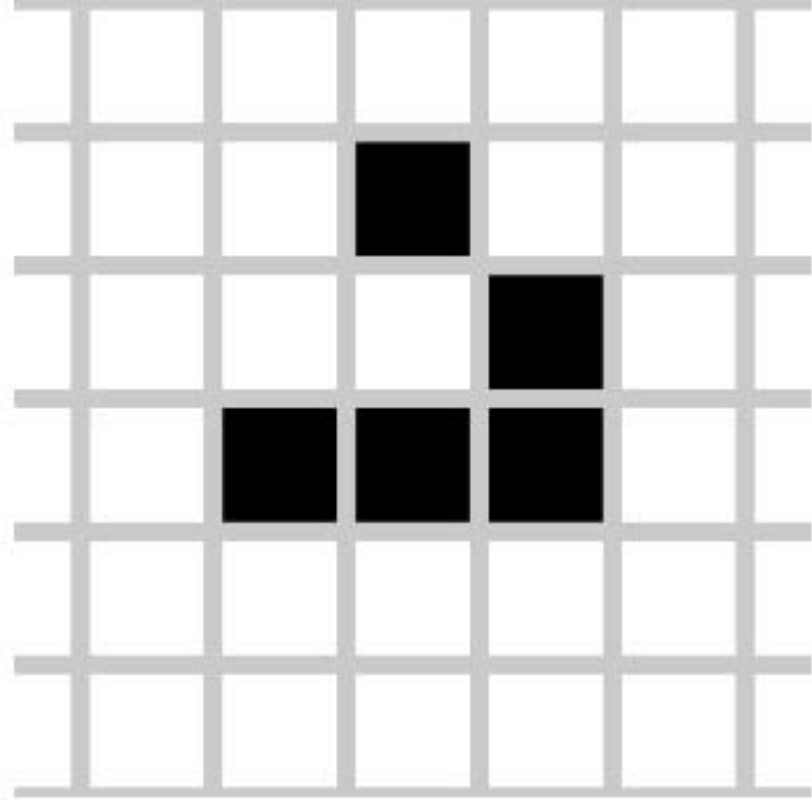




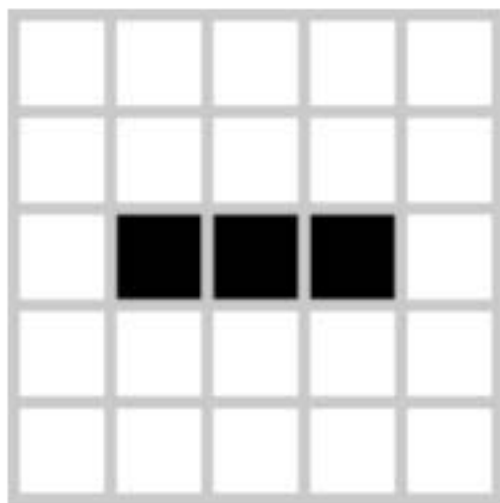
The background of the slide is a black field filled with a complex, fractal-like pattern of blue and red shapes. These shapes are composed of small, interconnected geometric forms, creating a dense, textured appearance that resembles a cellular automaton simulation or a complex network diagram. The blue shapes are more prominent and form larger, more intricate structures, while the red shapes are smaller and more scattered. The overall effect is a vibrant, abstract pattern that contrasts sharply with the black background.

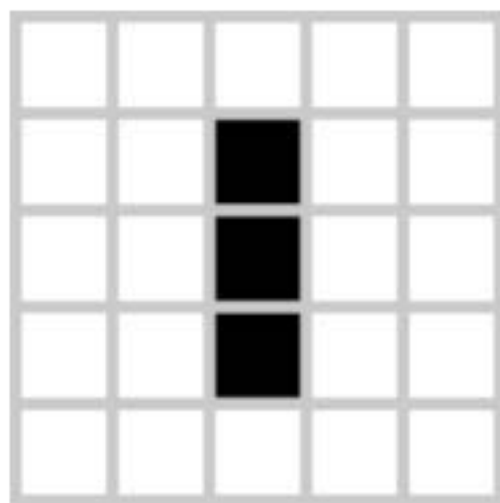
# THE GAME OF LIFE

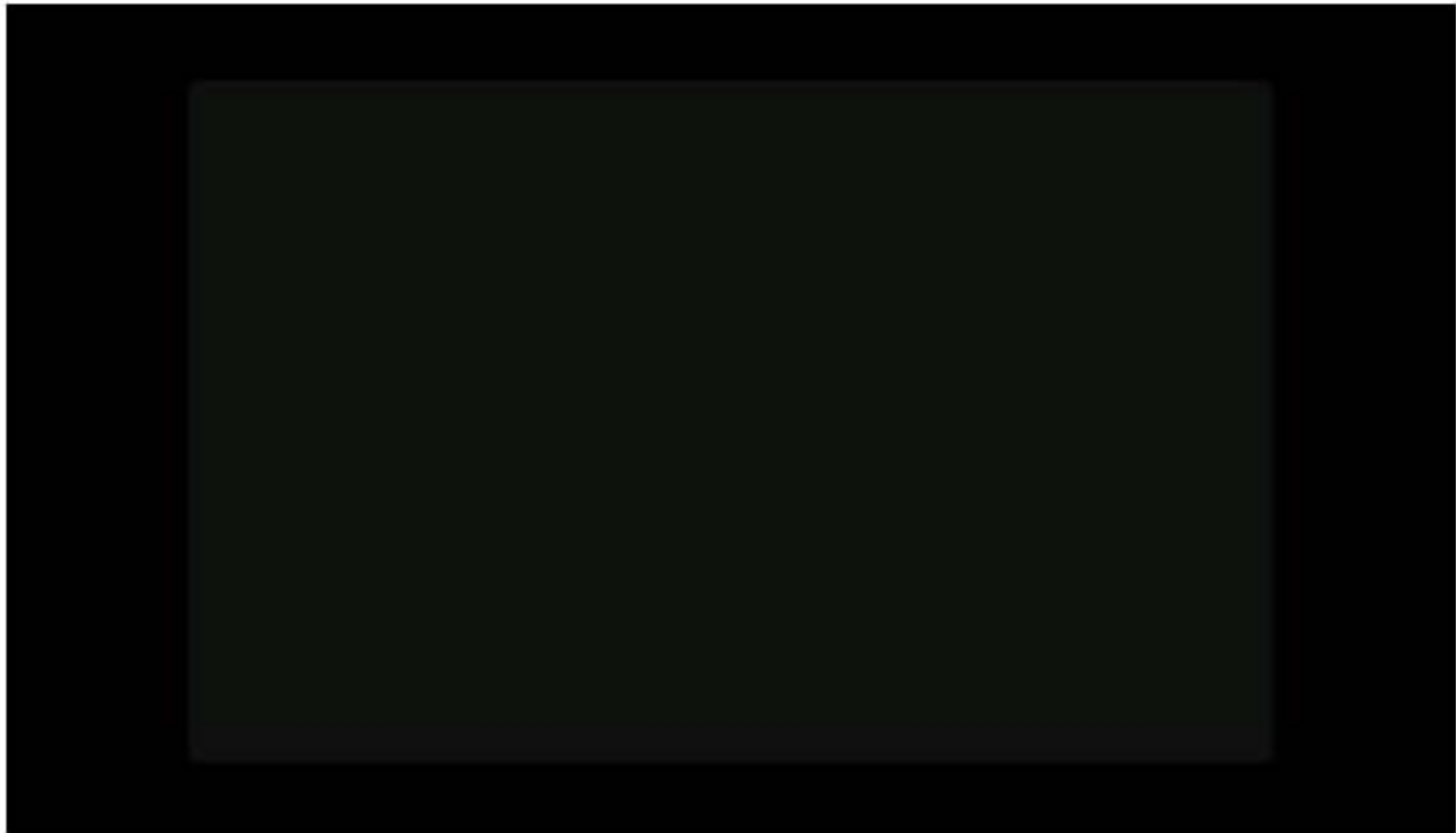




1. A cell with no or only one live neighbor dies.
2. A cell with two live neighbors stays the same.
3. A cell with three live neighbors lives.
4. A cell with 4 or more live neighbors dies.







## The Game of Life



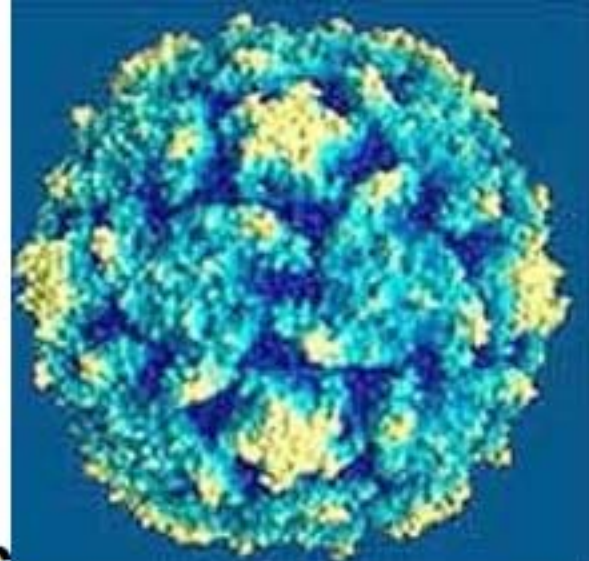
# Epstein-Barr Virus:

Infects 9 in 10 people

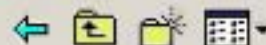
Can cause mononucleosis

Can cause cancer in children

Sometimes causes organ transplants  
in children to fail



Save in: beta\_vids



History



Desktop



My Documents



My Computer



My Network P...

File name: \_LAUNCH\_3D.avi

Save as type: AVI File (\*.avi)

Open movie when finished

Save

Cancel

432h00m00s Elapsed: 00h00m02s

PathSim: Run 101

Global

6.0

Red  
Green  
Blue  
Yellow  
Cyan  
Magenta  
Black

CORTONA  
movie maker

LET'S DANCE

- PATTERNS ARE EVERYWHERE
- LACK OF PATTERNS = CHAOS
- PATTERNS ARE SOMETIMES HIDDEN
- SIMPLE RULES CAN GENERATE VERY COMPLEX PATTERNS
- THE BETTER WE ARE AT DISCOVERING HIDDEN PATTERNS THE BETTER WE UNDERSTAND THE WORLD.
- YOU CAN BE A PROFESSIONAL PATTERN HUNTER!



**THE LANGUAGE OF PATTERNS IS  
MATHEMATICS**