Analyzing images motivates student learning of mathematics and statistics.

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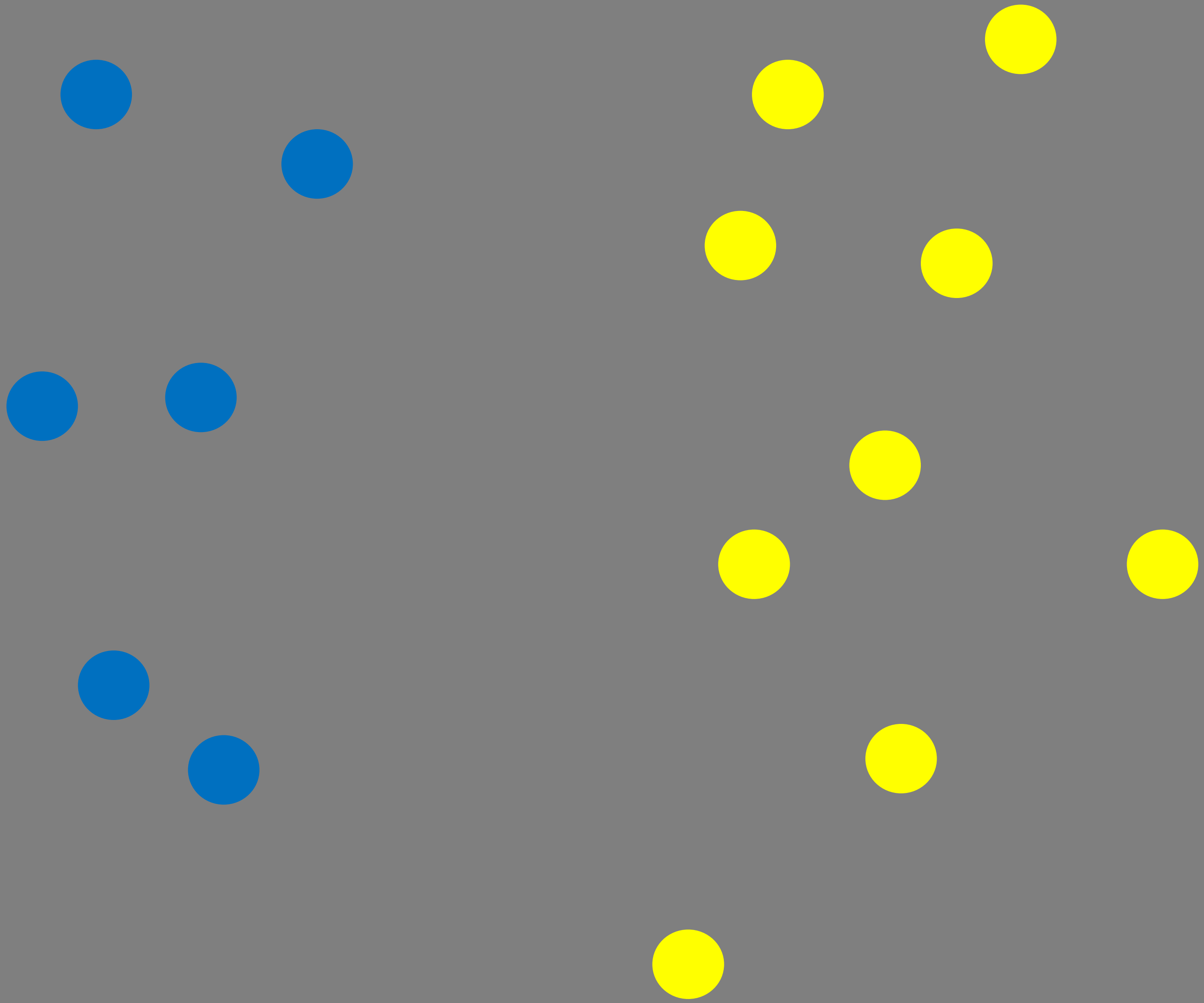
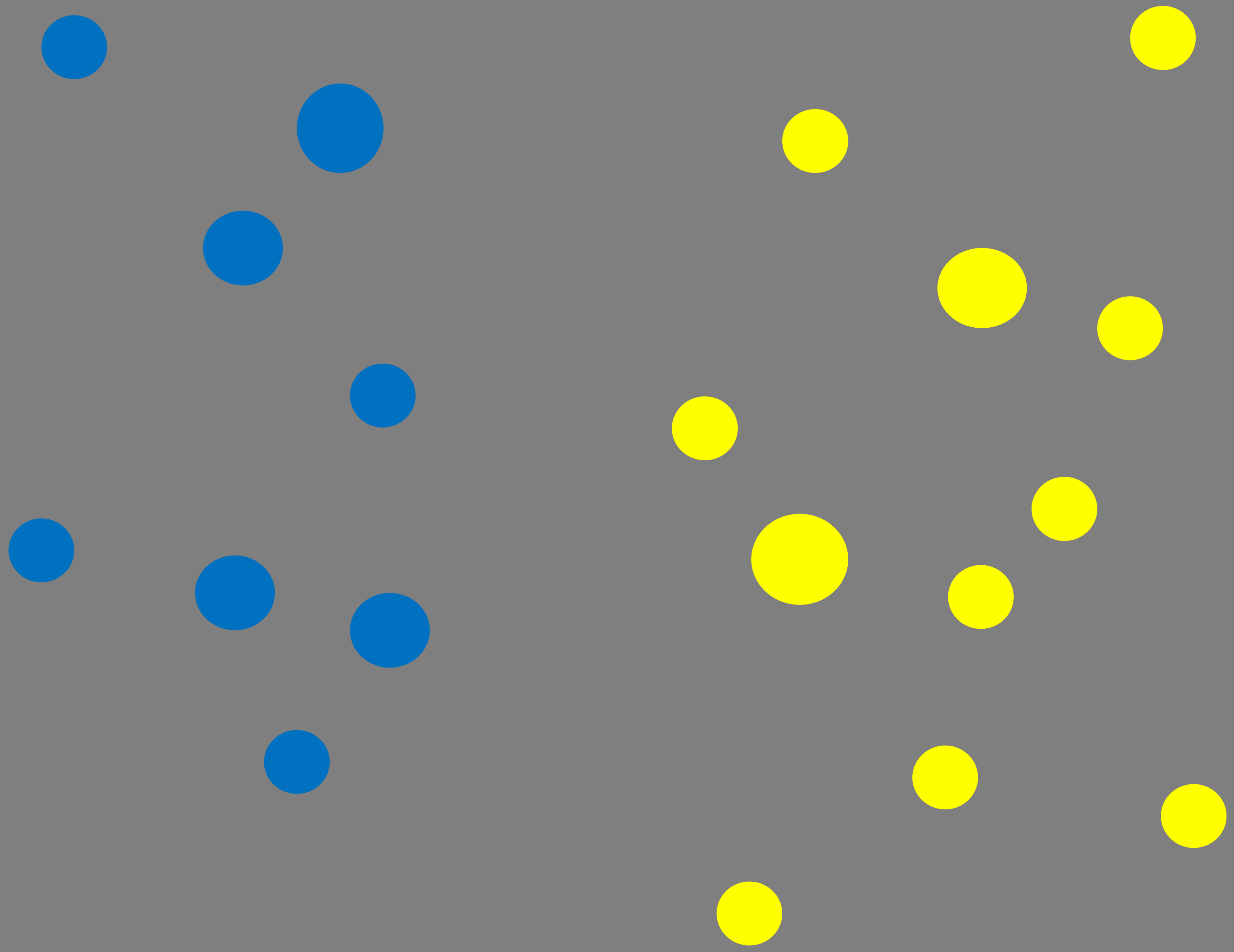
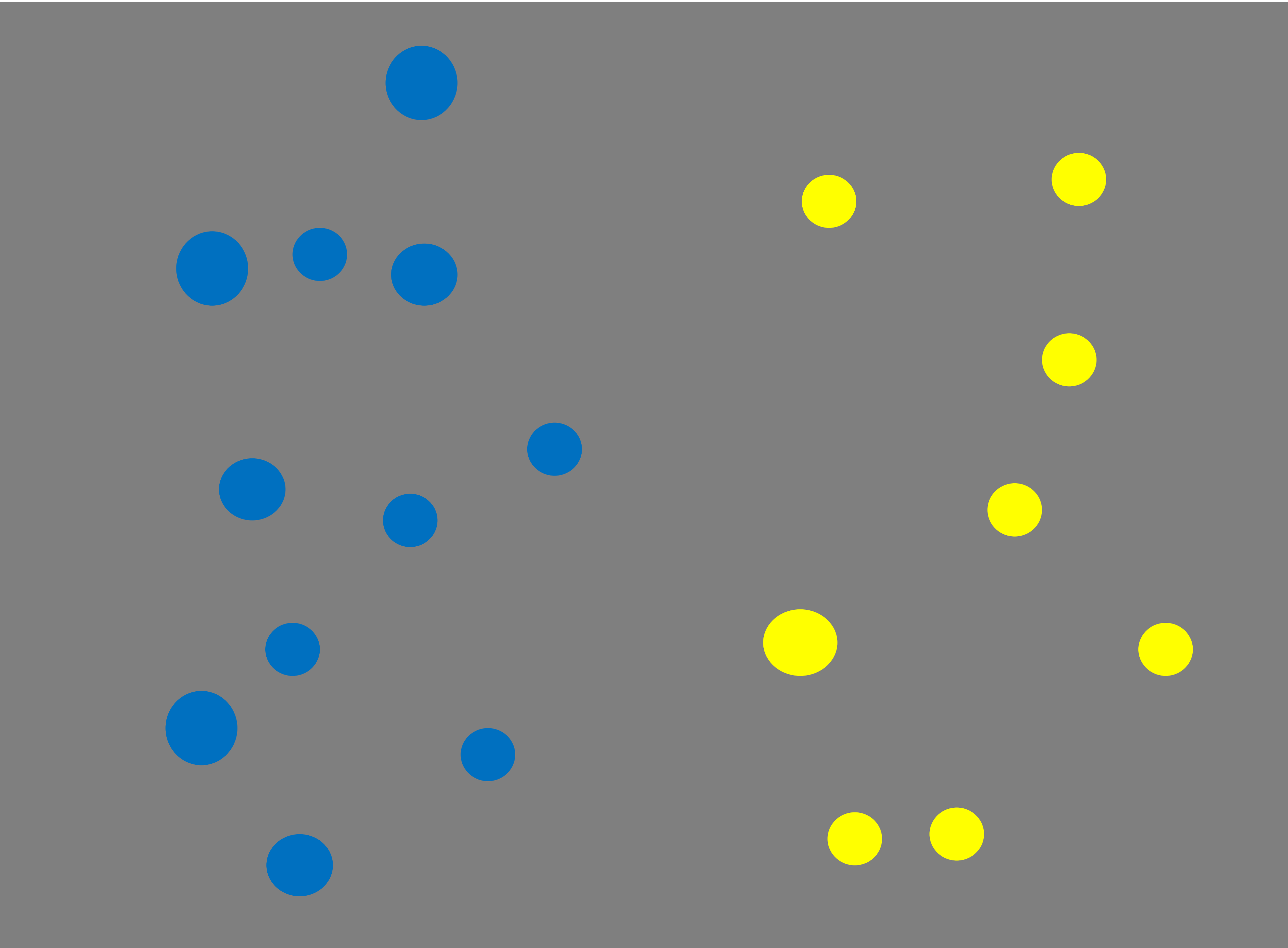
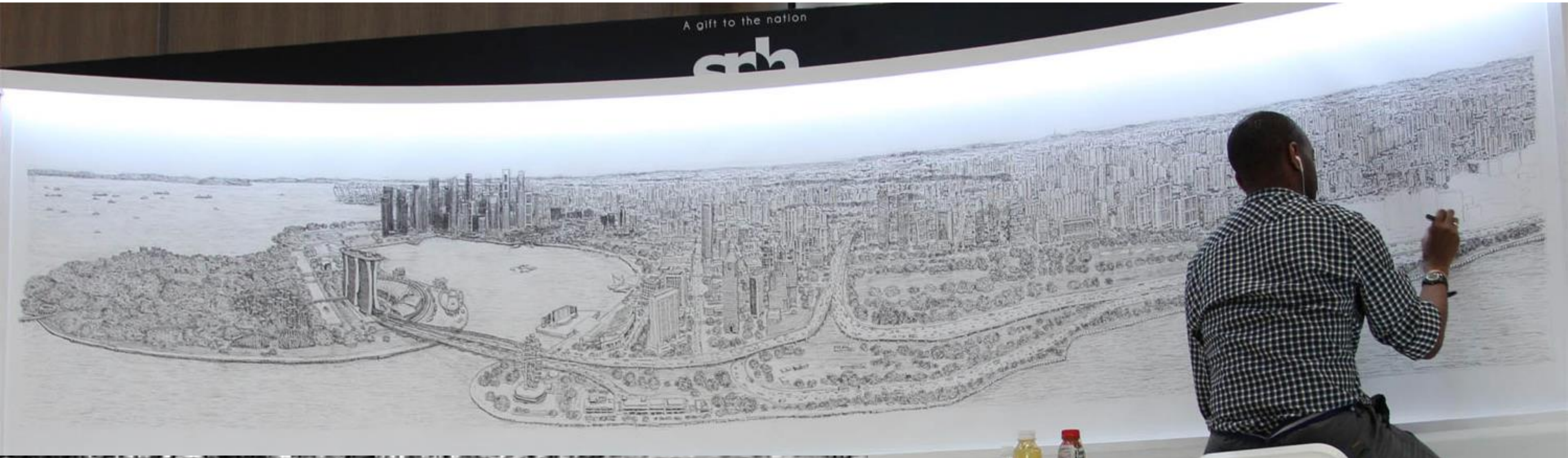
Department of Biology

AIMS
Analyzing Images to
learn Mathematics and Statistics

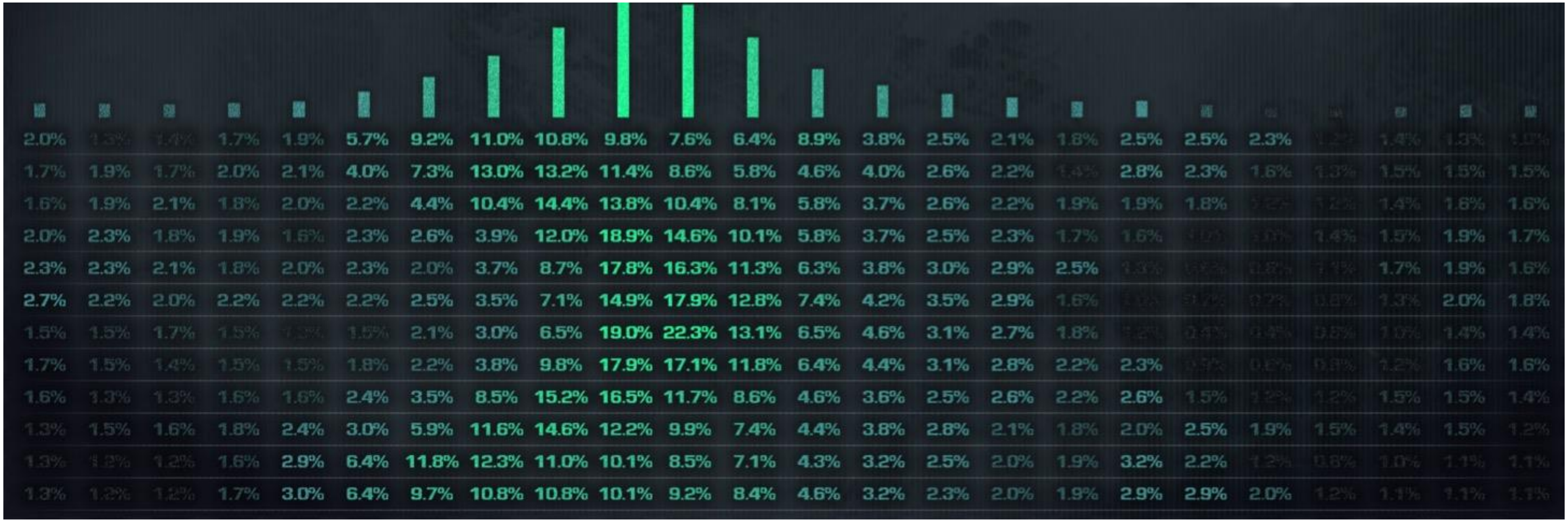




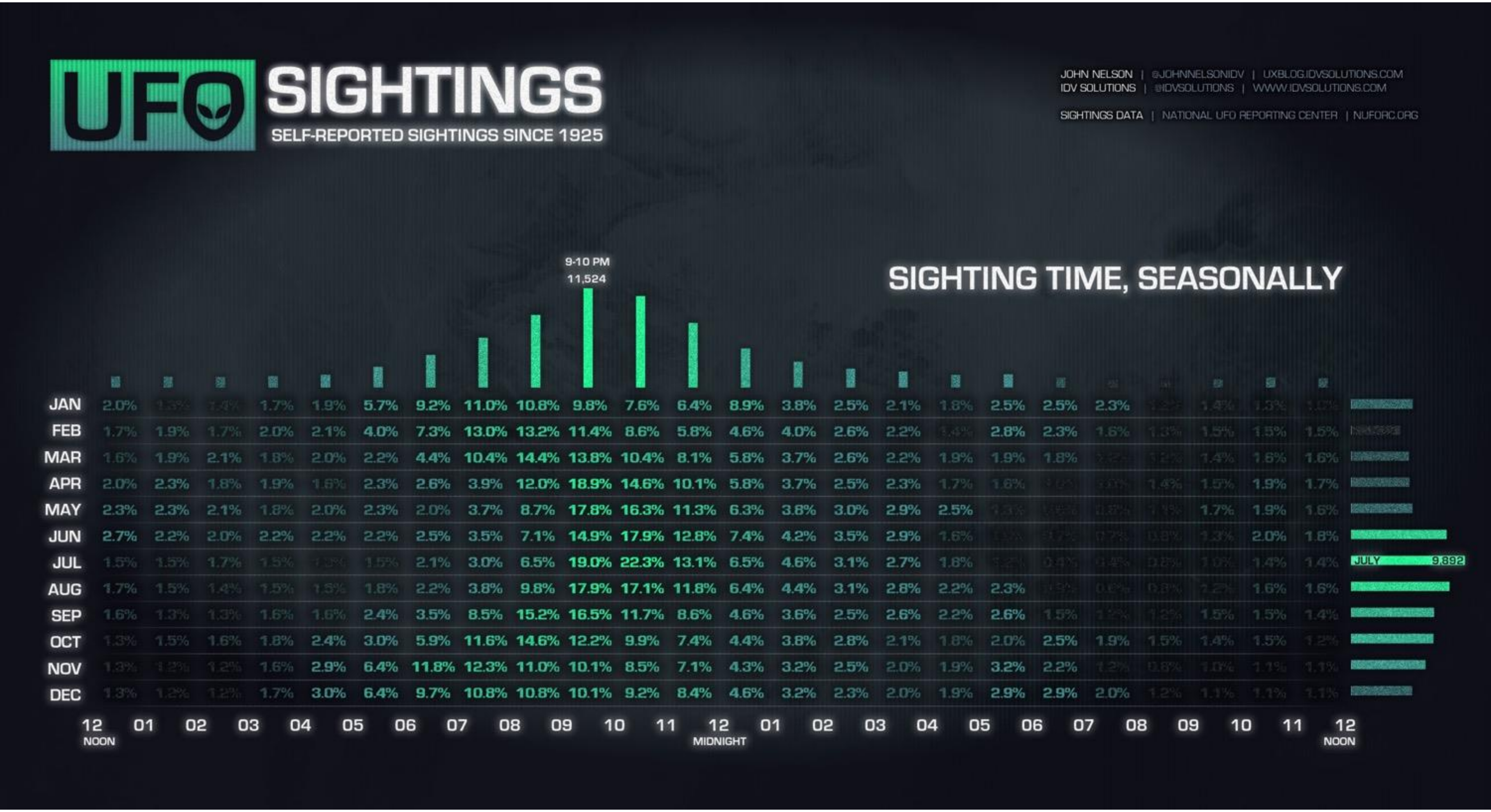



A gift to the nation

How can we capitalize on our student’s natural ability and *willingness* to visually quantify?



2.0%	1.3%	1.4%	1.7%	1.9%	5.7%	9.2%	11.0%	10.8%	9.8%	7.6%	6.4%	8.9%	3.8%	2.5%	2.1%	1.8%	2.5%	2.5%	2.3%	1.2%	1.4%	1.3%	1.0%
1.7%	1.9%	1.7%	2.0%	2.1%	4.0%	7.3%	13.0%	13.2%	11.4%	8.6%	5.8%	4.6%	4.0%	2.6%	2.2%	1.4%	2.8%	2.3%	1.6%	1.3%	1.5%	1.5%	1.5%
1.6%	1.9%	2.1%	1.8%	2.0%	2.2%	4.4%	10.4%	14.4%	13.8%	10.4%	8.1%	5.8%	3.7%	2.6%	2.2%	1.9%	1.9%	1.8%	1.2%	1.2%	1.4%	1.6%	1.6%
2.0%	2.3%	1.8%	1.9%	1.6%	2.3%	2.6%	3.9%	12.0%	18.9%	14.6%	10.1%	5.8%	3.7%	2.5%	2.3%	1.7%	1.6%	[illegible]	[illegible]	1.4%	1.5%	1.9%	1.7%
2.3%	2.3%	2.1%	1.8%	2.0%	2.3%	2.0%	3.7%	8.7%	17.8%	16.3%	11.3%	6.3%	3.8%	3.0%	2.9%	2.5%	1.3%	[illegible]	0.8%	1.1%	1.7%	1.9%	1.6%
2.7%	2.2%	2.0%	2.2%	2.2%	2.2%	2.5%	3.5%	7.1%	14.9%	17.9%	12.8%	7.4%	4.2%	3.5%	2.9%	1.6%	[illegible]	[illegible]	0.2%	0.8%	1.3%	2.0%	1.8%
1.5%	1.5%	1.7%	1.5%	1.3%	1.5%	2.1%	3.0%	6.5%	19.0%	22.3%	13.1%	6.5%	4.6%	3.1%	2.7%	1.8%	1.2%	0.4%	0.4%	0.8%	1.0%	1.4%	1.4%
1.7%	1.5%	1.4%	1.5%	1.5%	1.8%	2.2%	3.8%	9.8%	17.9%	17.1%	11.8%	6.4%	4.4%	3.1%	2.8%	2.2%	2.3%	[illegible]	0.6%	0.9%	1.2%	1.6%	1.6%
1.6%	1.3%	1.3%	1.6%	1.6%	2.4%	3.5%	8.5%	15.2%	16.5%	11.7%	8.6%	4.6%	3.6%	2.5%	2.6%	2.2%	2.6%	1.5%	1.2%	1.2%	1.5%	1.5%	1.4%
1.3%	1.5%	1.6%	1.8%	2.4%	3.0%	5.9%	11.6%	14.6%	12.2%	9.9%	7.4%	4.4%	3.8%	2.8%	2.1%	1.8%	2.0%	2.5%	1.9%	1.5%	1.4%	1.5%	1.2%
1.3%	1.2%	1.2%	1.6%	2.9%	6.4%	11.8%	12.3%	11.0%	10.1%	8.5%	7.1%	4.3%	3.2%	2.5%	2.0%	1.9%	3.2%	2.2%	1.2%	0.8%	1.0%	1.1%	1.1%
1.3%	1.2%	1.2%	1.7%	3.0%	6.4%	9.7%	10.8%	10.8%	10.1%	9.2%	8.4%	4.6%	3.2%	2.3%	2.0%	1.9%	2.9%	2.9%	2.0%	1.2%	1.1%	1.1%	1.1%



UFO SIGHTINGS

SELF-REPORTED SIGHTINGS SINCE 1925

JOHN NELSON | @JOHNNELSONIDV | UXBLOG.IDVSOLUTIONS.COM
IDV SOLUTIONS | @IDVSOLUTIONS | WWW.IDVSOLUTIONS.COM

SIGHTINGS DATA | NATIONAL UFO REPORTING CENTER | NUFORC.ORG

SIGHTING TIME, SEASONALLY

	12 NOON	01	02	03	04	05	06	07	08	09	10	11	12 MIDNIGHT	01	02	03	04	05	06	07	08	09	10	11
JAN	2.0%	1.3%	1.4%	1.7%	1.9%	5.7%	9.2%	11.0%	10.8%	9.8%	7.6%	6.4%	8.9%	3.8%	2.5%	2.1%	1.8%	2.5%	2.5%	2.3%	1.2%	1.4%	1.3%	1.2%
FEB	1.7%	1.9%	1.7%	2.0%	2.1%	4.0%	7.3%	13.0%	13.2%	11.4%	8.6%	5.8%	4.6%	4.0%	2.6%	2.2%	1.4%	2.8%	2.3%	1.6%	1.3%	1.5%	1.5%	1.5%
MAR	1.6%	1.9%	2.1%	1.8%	2.0%	2.2%	4.4%	10.4%	14.4%	13.8%	10.4%	8.1%	5.8%	3.7%	2.6%	2.2%	1.9%	1.9%	1.8%	[illegible]	1.2%	1.4%	1.6%	1.6%
APR	2.0%	2.3%	1.8%	1.9%	1.6%	2.3%	2.6%	3.9%	12.0%	18.9%	14.6%	10.1%	5.8%	3.7%	2.5%	2.3%	1.7%	1.6%	[illegible]	[illegible]	1.4%	1.5%	1.9%	1.7%
MAY	2.3%	2.3%	2.1%	1.8%	2.0%	2.3%	2.0%	3.7%	8.7%	17.8%	16.3%	11.3%	6.3%	3.8%	3.0%	2.9%	2.5%	1.3%	[illegible]	0.8%	1.1%	1.7%	1.9%	1.6%
JUN	2.7%	2.2%	2.0%	2.2%	2.2%	2.2%	2.5%	3.5%	7.1%	14.9%	17.9%	12.8%	7.4%	4.2%	3.5%	2.9%	1.6%	[illegible]	[illegible]	0.7%	0.8%	1.3%	2.0%	1.8%
JUL	1.5%	1.5%	1.7%	1.5%	1.3%	1.5%	2.1%	3.0%	6.5%	19.0%	22.3%	13.1%	6.5%	4.6%	3.1%	2.7%	1.8%	1.2%	0.4%	0.4%	0.8%	1.0%	1.4%	1.4%
AUG	1.7%	1.5%	1.4%	1.5%	1.5%	1.8%	2.2%	3.8%	9.8%	17.9%	17.1%	11.8%	6.4%	4.4%	3.1%	2.8%	2.2%	2.3%	1.5%	0.6%	0.8%	1.2%	1.6%	1.6%
SEP	1.6%	1.3%	1.3%	1.6%	1.6%	2.4%	3.5%	8.5%	15.2%	16.5%	11.7%	8.6%	4.6%	3.6%	2.5%	2.6%	2.2%	2.6%	1.5%	1.2%	1.2%	1.5%	1.5%	1.4%
OCT	1.3%	1.5%	1.6%	1.8%	2.4%	3.0%	5.9%	11.6%	14.6%	12.2%	9.9%	7.4%	4.4%	3.8%	2.8%	2.1%	1.8%	2.0%	2.5%	1.9%	1.5%	1.4%	1.5%	1.2%
NOV	1.3%	1.2%	1.2%	1.6%	2.9%	6.4%	11.8%	12.3%	11.0%	10.1%	8.5%	7.1%	4.3%	3.2%	2.5%	2.0%	1.9%	3.2%	2.2%	1.2%	0.8%	1.0%	1.1%	1.1%
DEC	1.3%	1.2%	1.2%	1.7%	3.0%	6.4%	9.7%	10.8%	10.8%	10.1%	9.2%	8.4%	4.6%	3.2%	2.3%	2.0%	1.9%	2.9%	2.9%	2.0%	1.2%	1.1%	1.1%	1.1%

12 NOON

AIMS

Analyzing Images to learn Mathematics and Statistics

Context

Leaf cutter ants, like the species *Atta columbica* from Central America, live in colonies of several million individuals. These ants farm a particular fungus species in their nests, and feed from the fruiting bodies of the fungus. In order to feed the fungus they cut ....

- * ***Grab student interest***
- * ***Motivate study***
- * ***Frame problems***
- * ***Provide necessary system-specific knowldege***

aimslabs.com

Phenotypic plasticity and predation

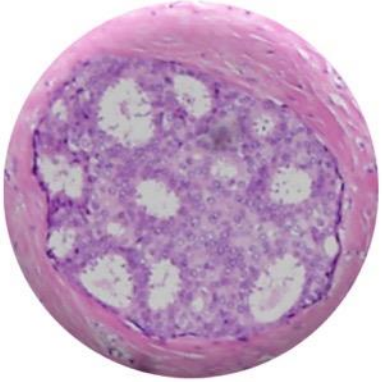
Students learn about experimental design and ***ANOVA*** while examining plasticity in tadpole development under different predator regimes. (Open inquiry)

Dendroclimatology

Students learn ***linear regression*** and ***exponential functions*** while studying the relationship between climate and tree growth, using tree ring analysis. (Open inquiry)

3D breast cancer tissue reconstruction

Students learn how ***modeling*** complements empirical work, and about ***histograms***, ***cross-correlation***, and/or ***diagnostic error rates*** by reconstructing breast cancer tissues in three dimensions. (Retrace path of scientific discovery)



Simple

- Students like pictures, puzzles
- Give visual analogs to abstract concepts
- Verbally reinforce that students are already good at deep scientific skills
  - Observing pattern, comparing magnitude
- Build intuition for math/stat models with photographic, graphical, physical models

Ideas

Tanya Dewey

Arietta Fleming-Davies

AIMS
Analyzing Images to
learn Mathematics and Statistics

aimslabs.com

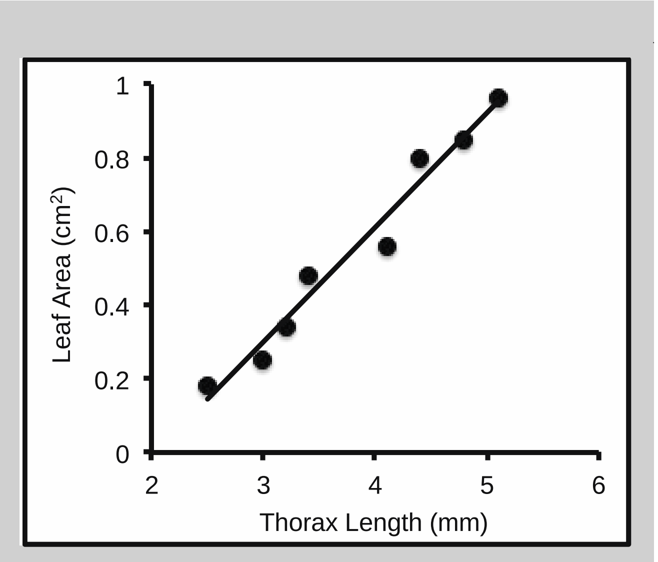
BIOMAAP
Biology Student Math Attitudes and Anxiety Program

biomaap.org

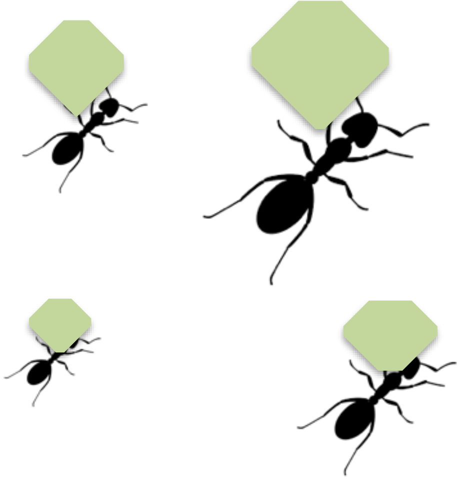
QUBES

qubeshub.org

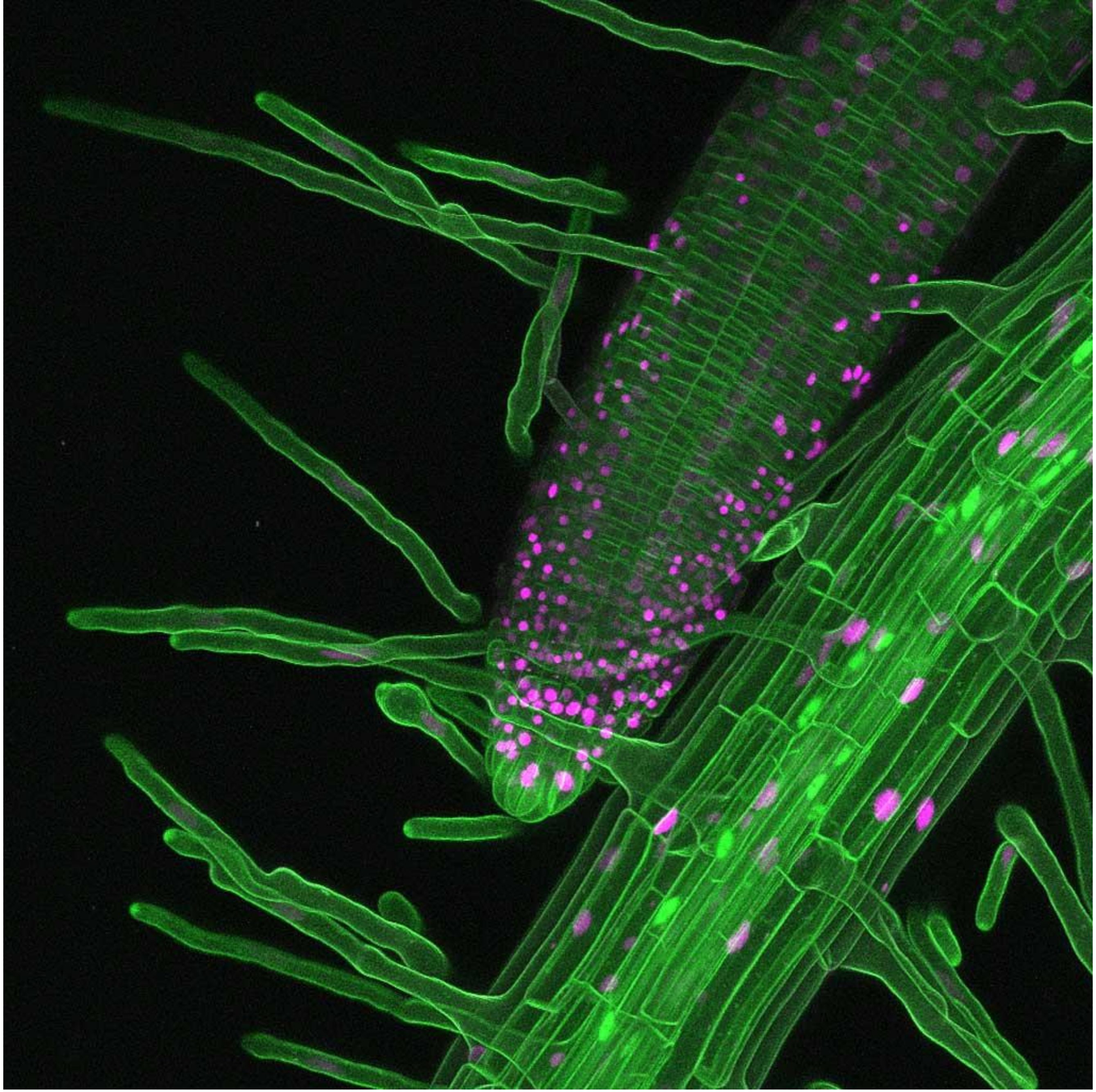
NSF



Variance = 10

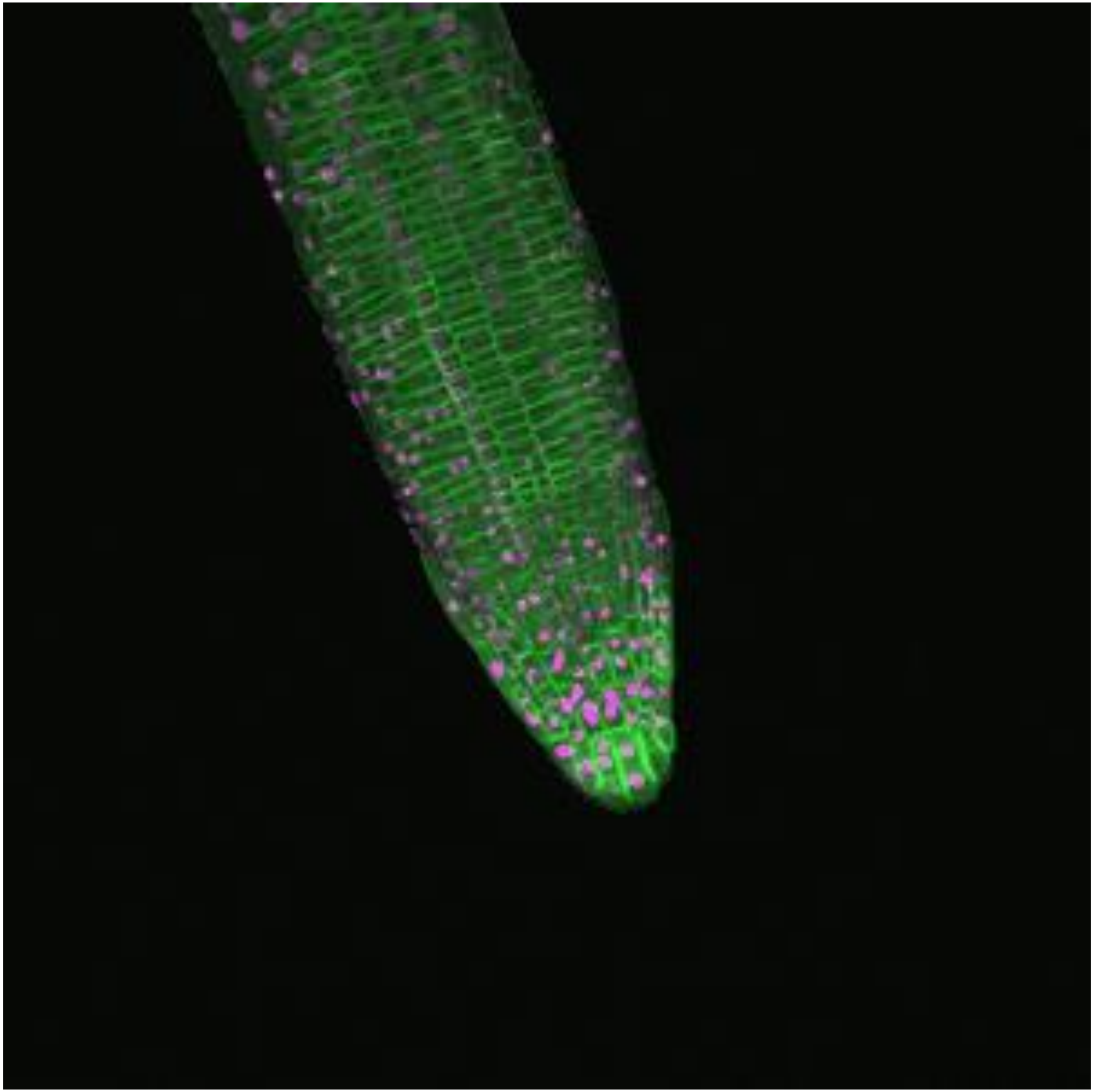


Body Size
Variance = 100



HHMI BioInteractive Image of the Week

Wangenheim et al. Institute of Science and Technology, Austria



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