

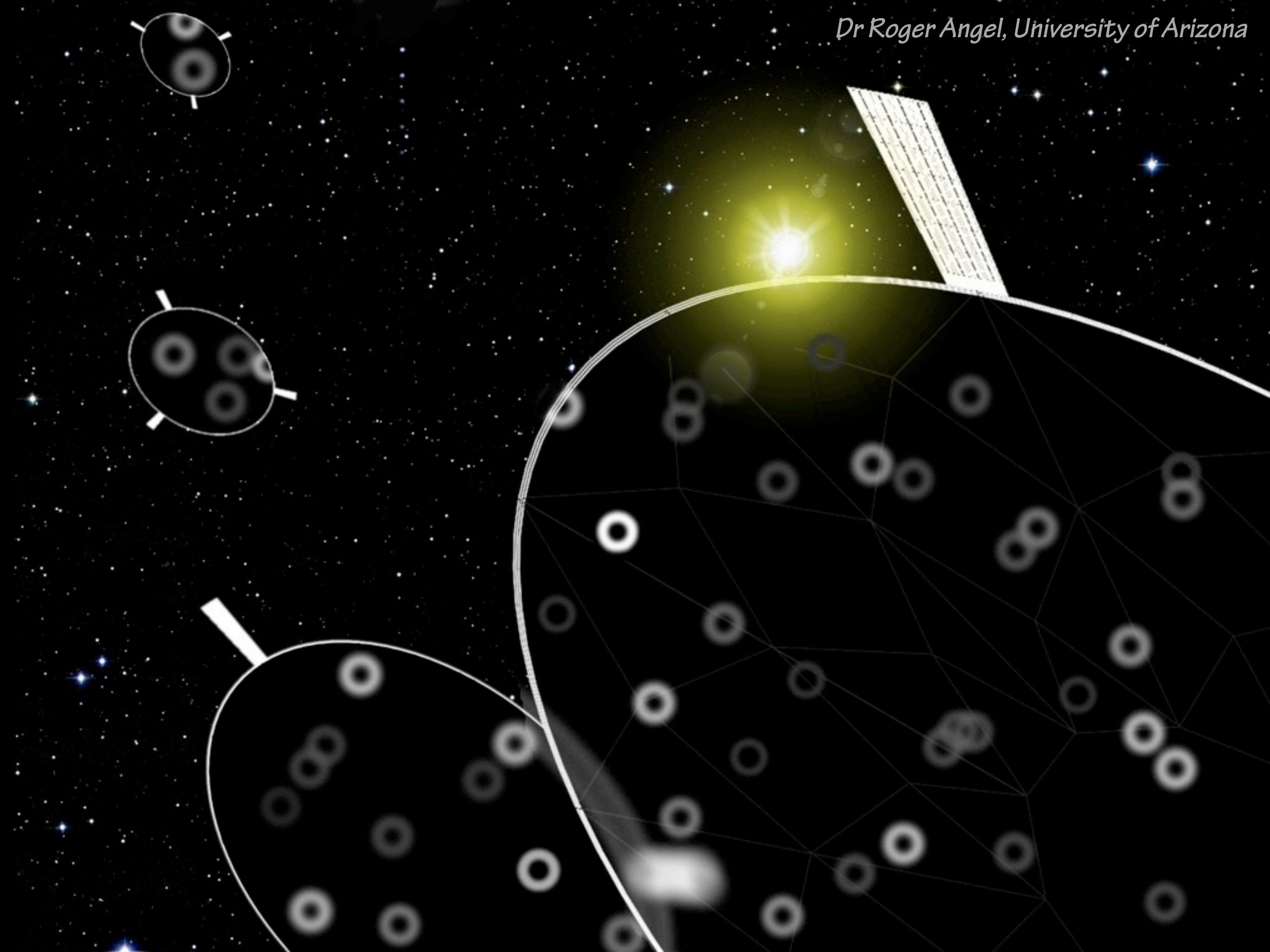
So nano, so what?

**The what, why, where
of nanotechnology**

Andrew D. Maynard

Chief Science Advisor, Project on Emerging Nanotechnologies

Woodrow Wilson International Center for Scholars (in partnership with the Pew Charitable Trusts)



A close-up portrait of Richard Smalley, an older man with white hair and a goatee, looking slightly to the right. He is wearing a light-colored shirt and a dark tie. The background is dark and out of focus.

Richard Smalley

nano: The

art and *science*

of **building stuff**

that **does stuff**

at the nanometer scale

Smallness

Strangeness

Sophistication

Human-scale

Nano-scale

Tennis Ball



10 cm

1 cm

Pin-head



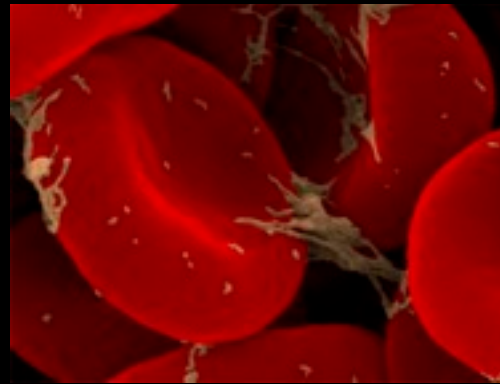
1 mm

Human hair



100 μ m

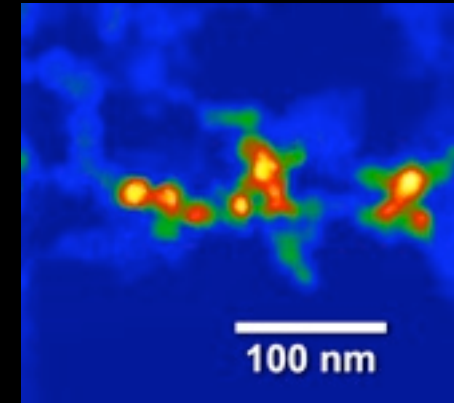
Red Blood Cell



10 μ m

1 μ m

Welding fume



100 nm

10 nm

DNA



1 nm



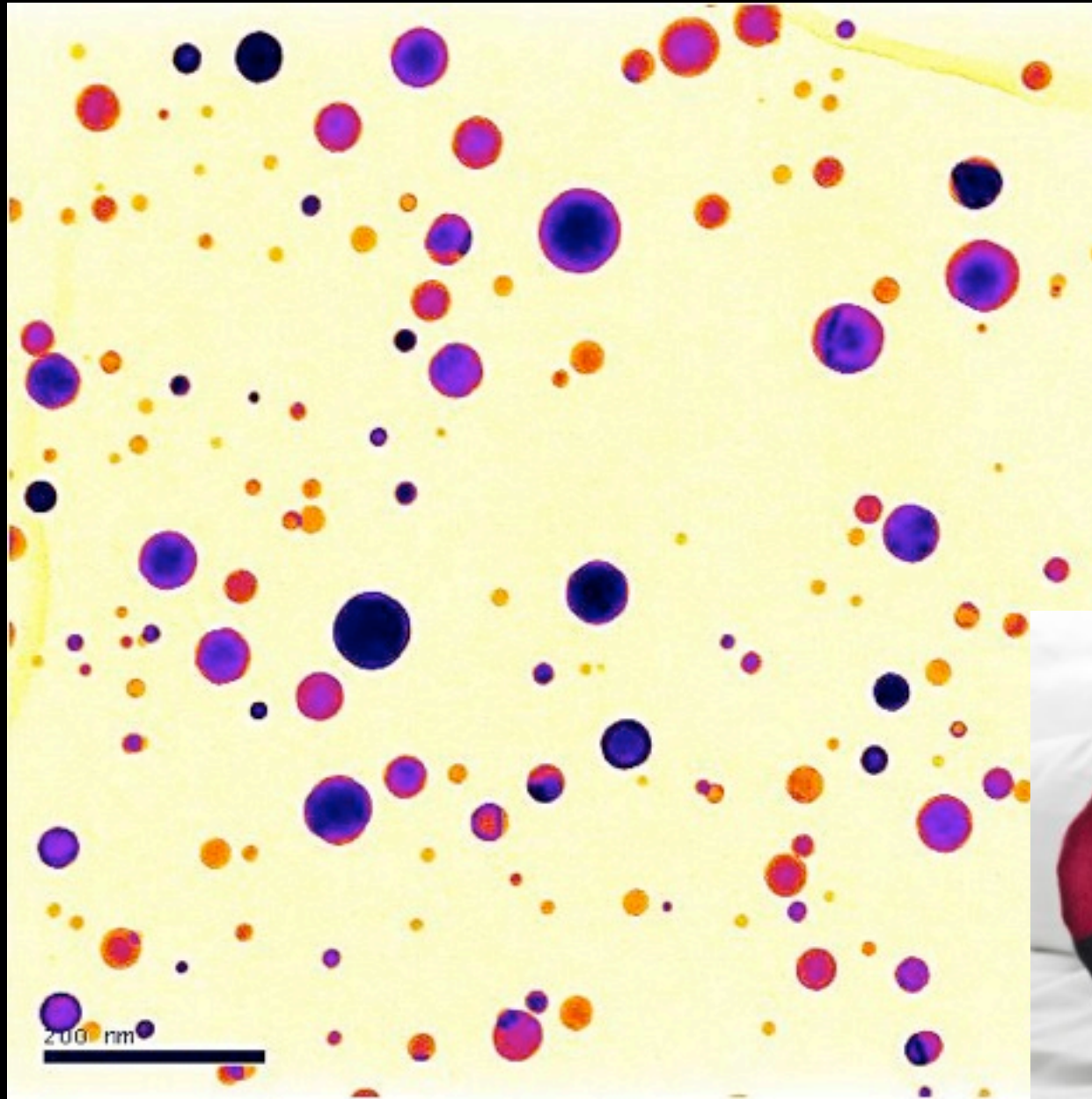
Relative sizes

Smallness



Gets you to new places

Smallness



Silver

Small

Suffocated bugs

Sweet feet

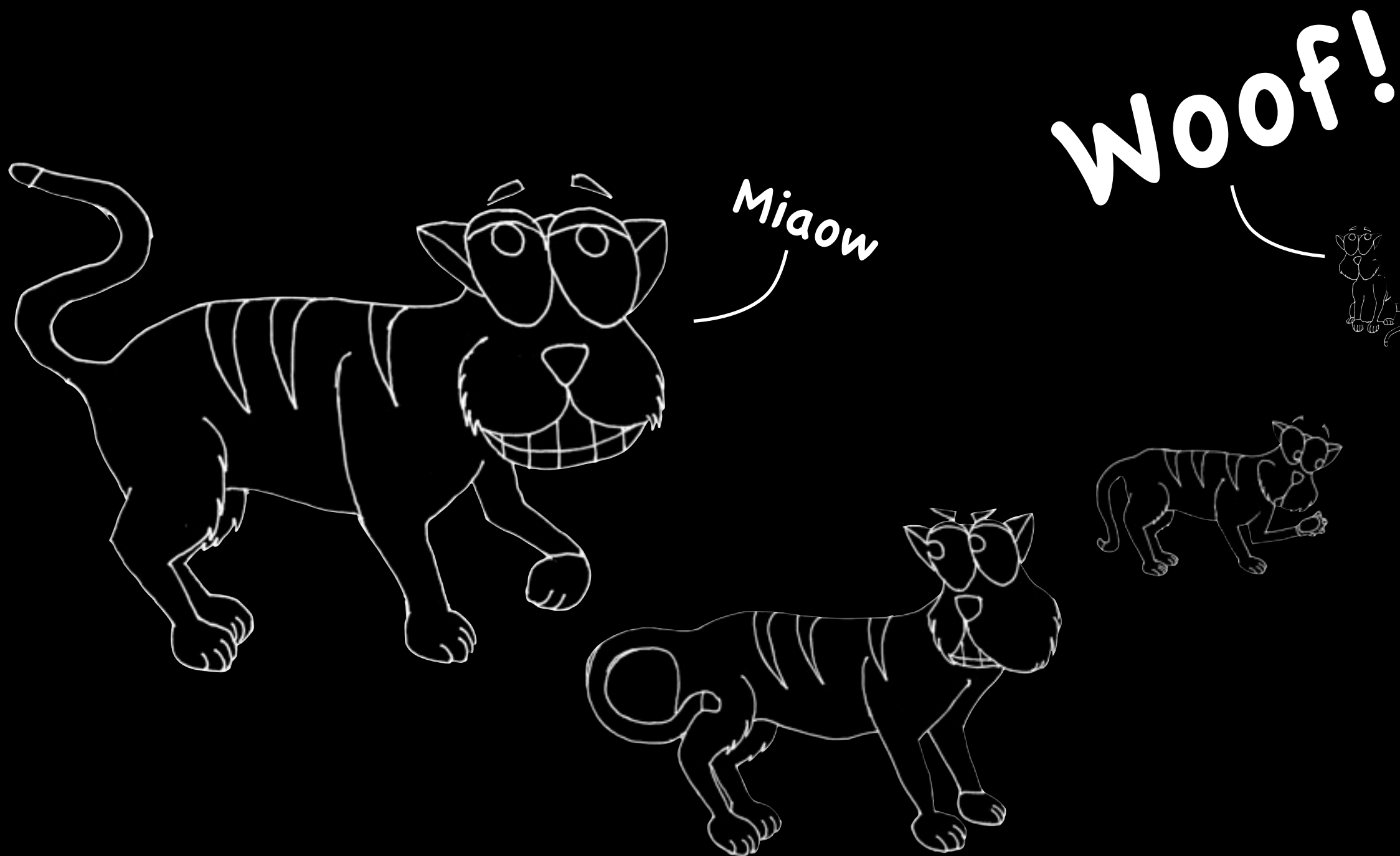


Gets you to new places



http://www.youtube.com/watch?v=oPG7UXaAB_g

Strangeness



Behaves in unexpected ways

Strangeness

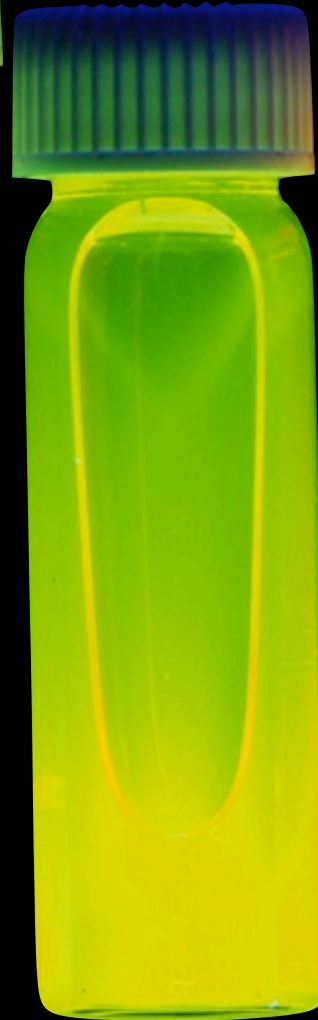
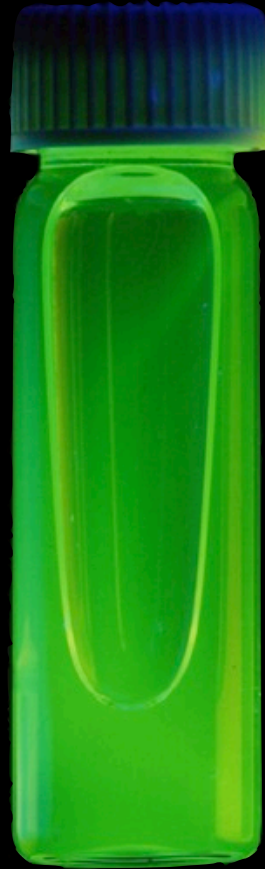
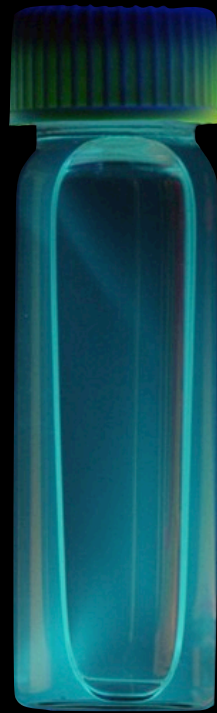


Lycurgus Cup

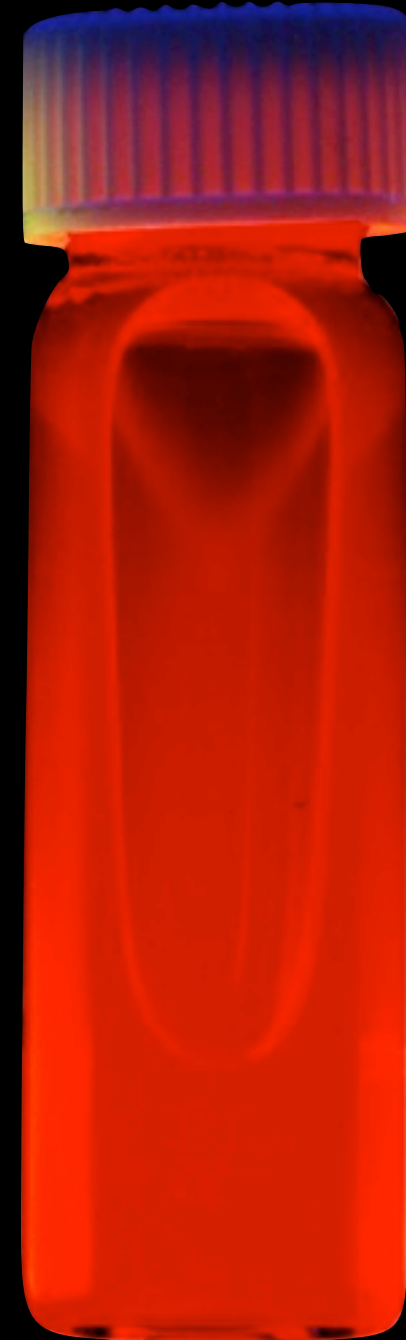


Behaves in unexpected ways

Smallest



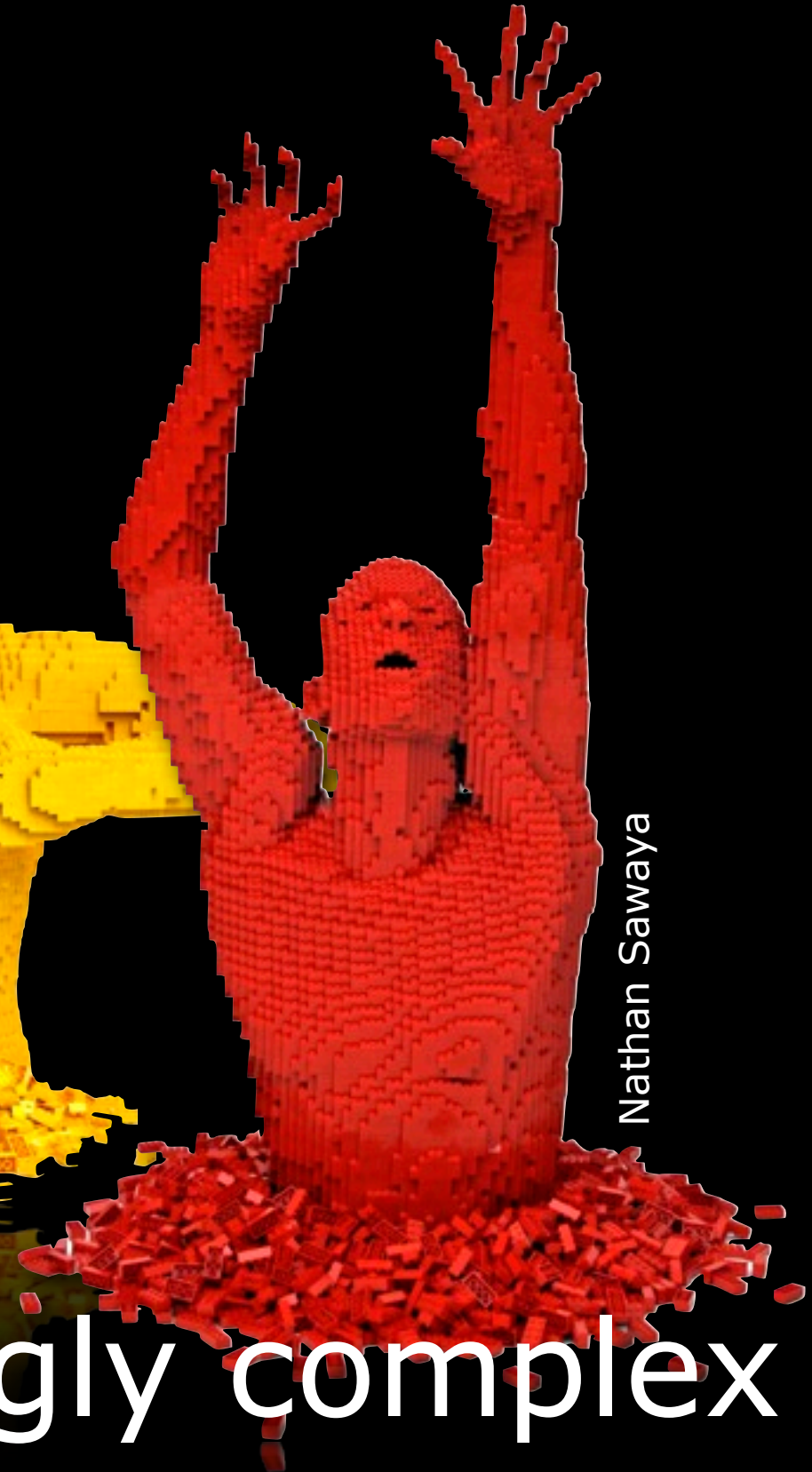
Largest



*Cadmium Selenide
"Quantum Dots"*

©Felice Frankel

Sophistication

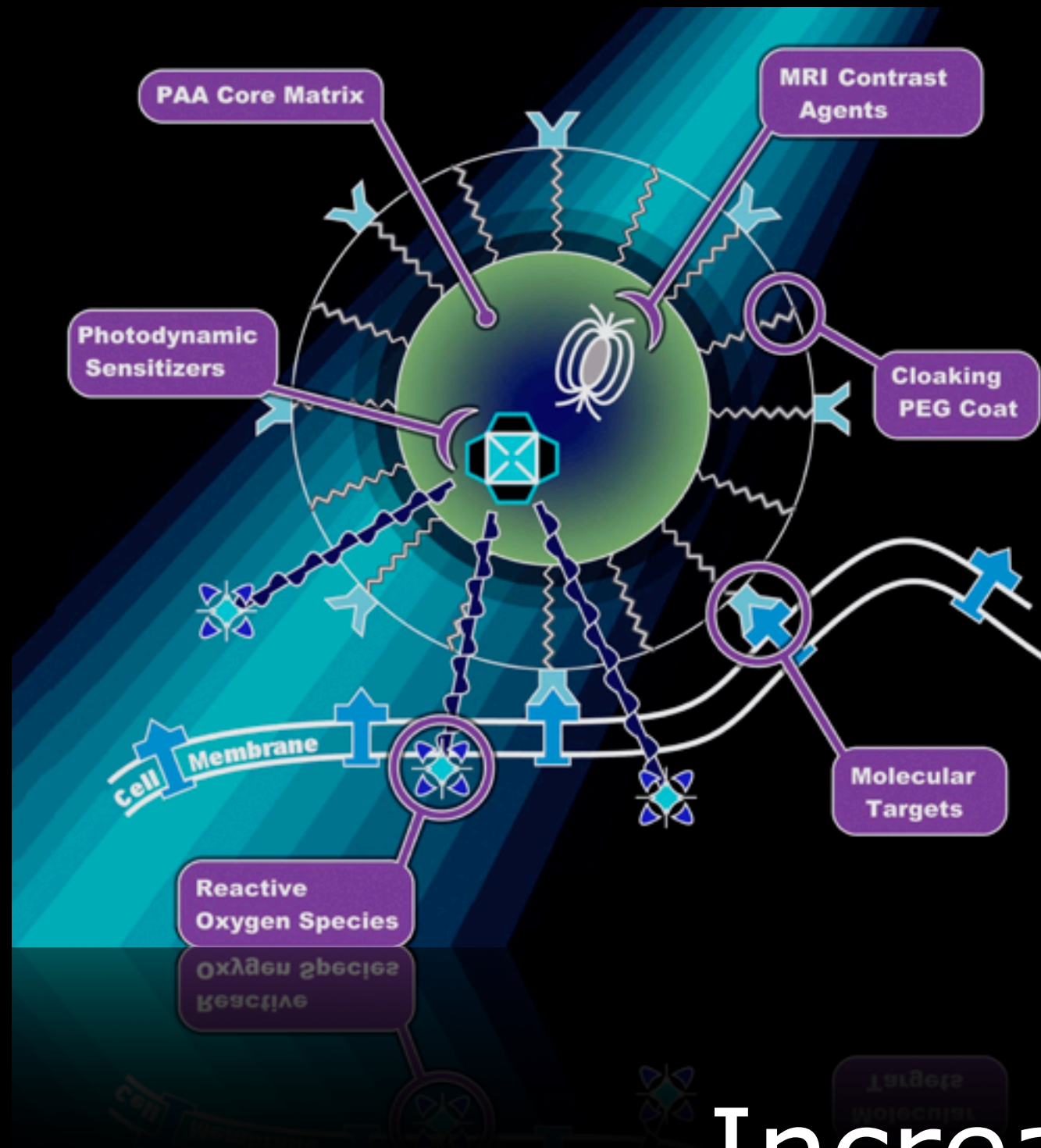


Nathan Sawaya

Increasingly complex

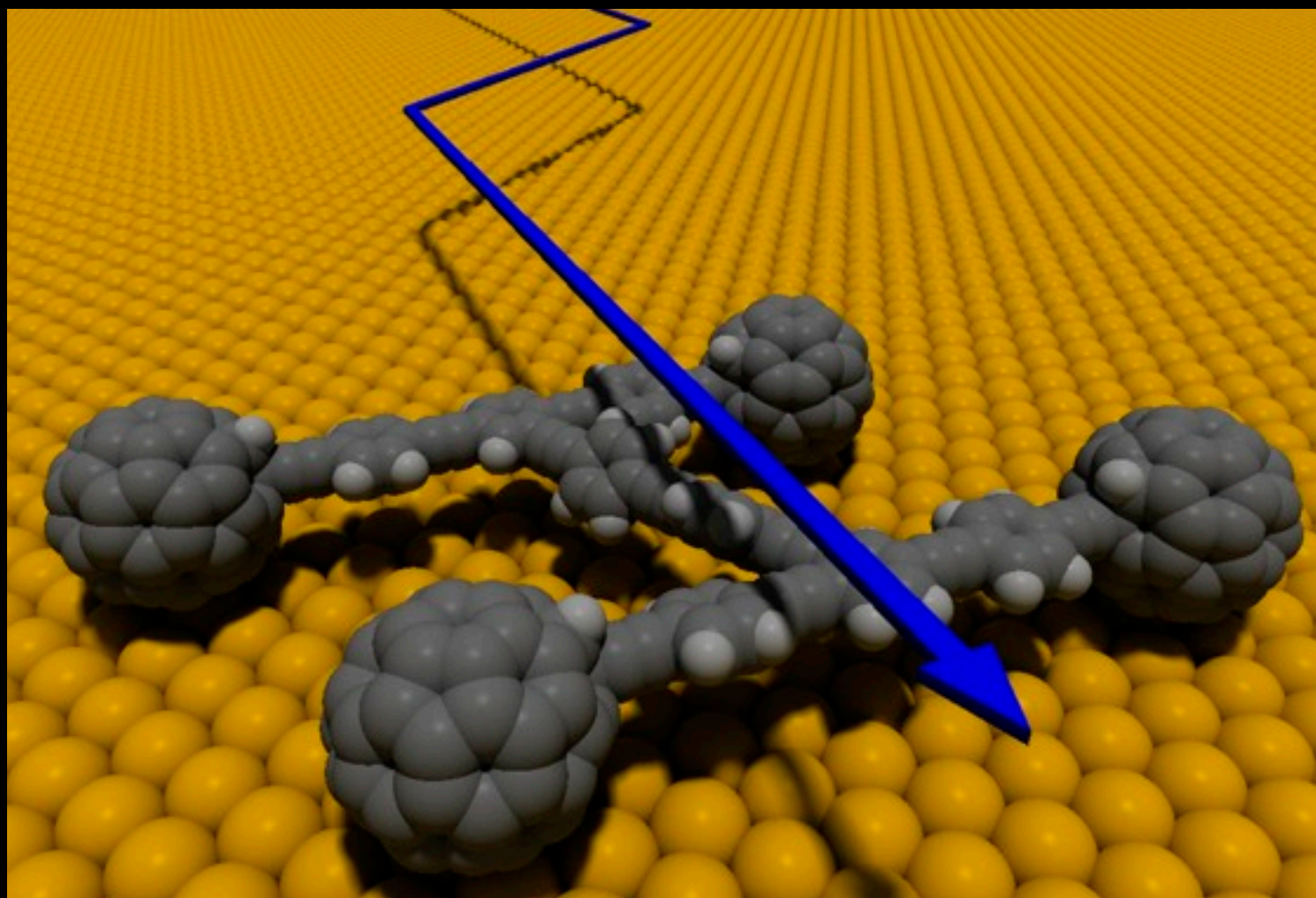
Sophistication

*Smart
Drugs*

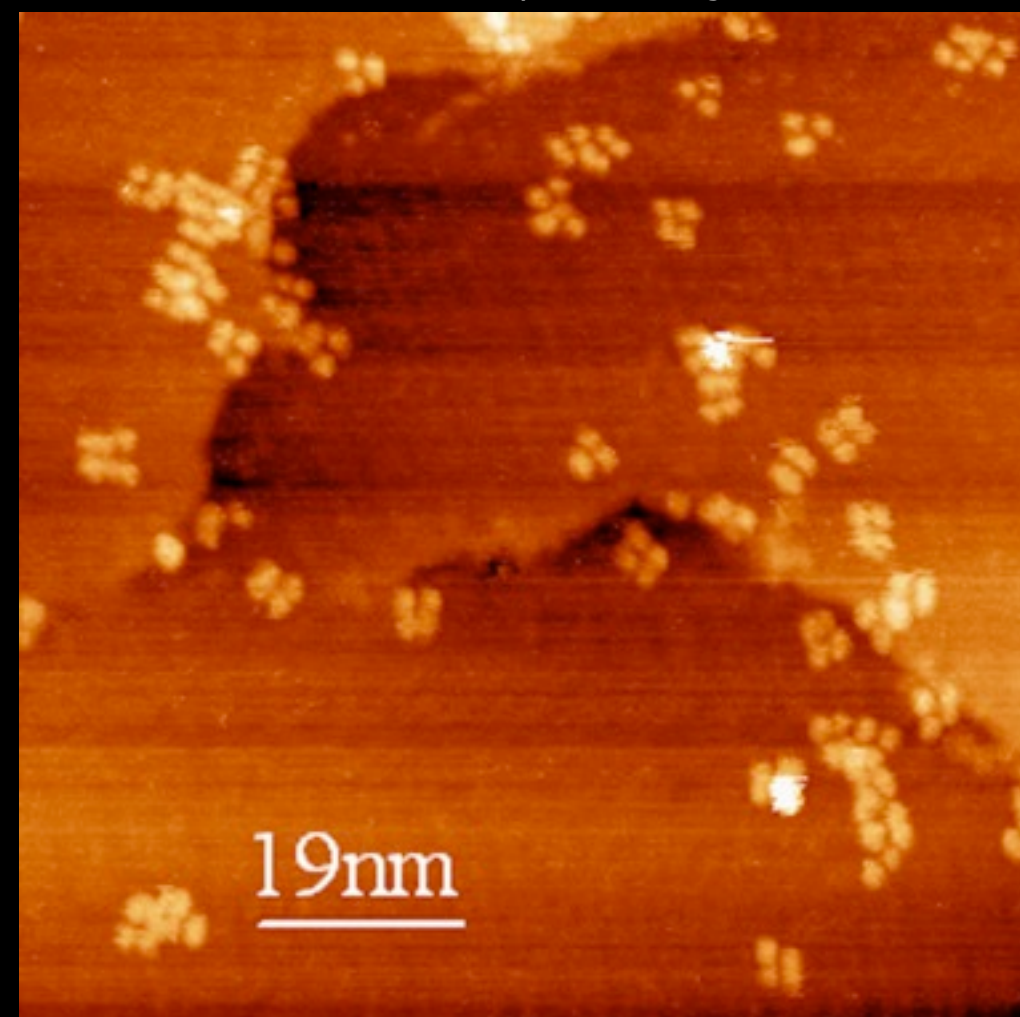


Increasingly complex

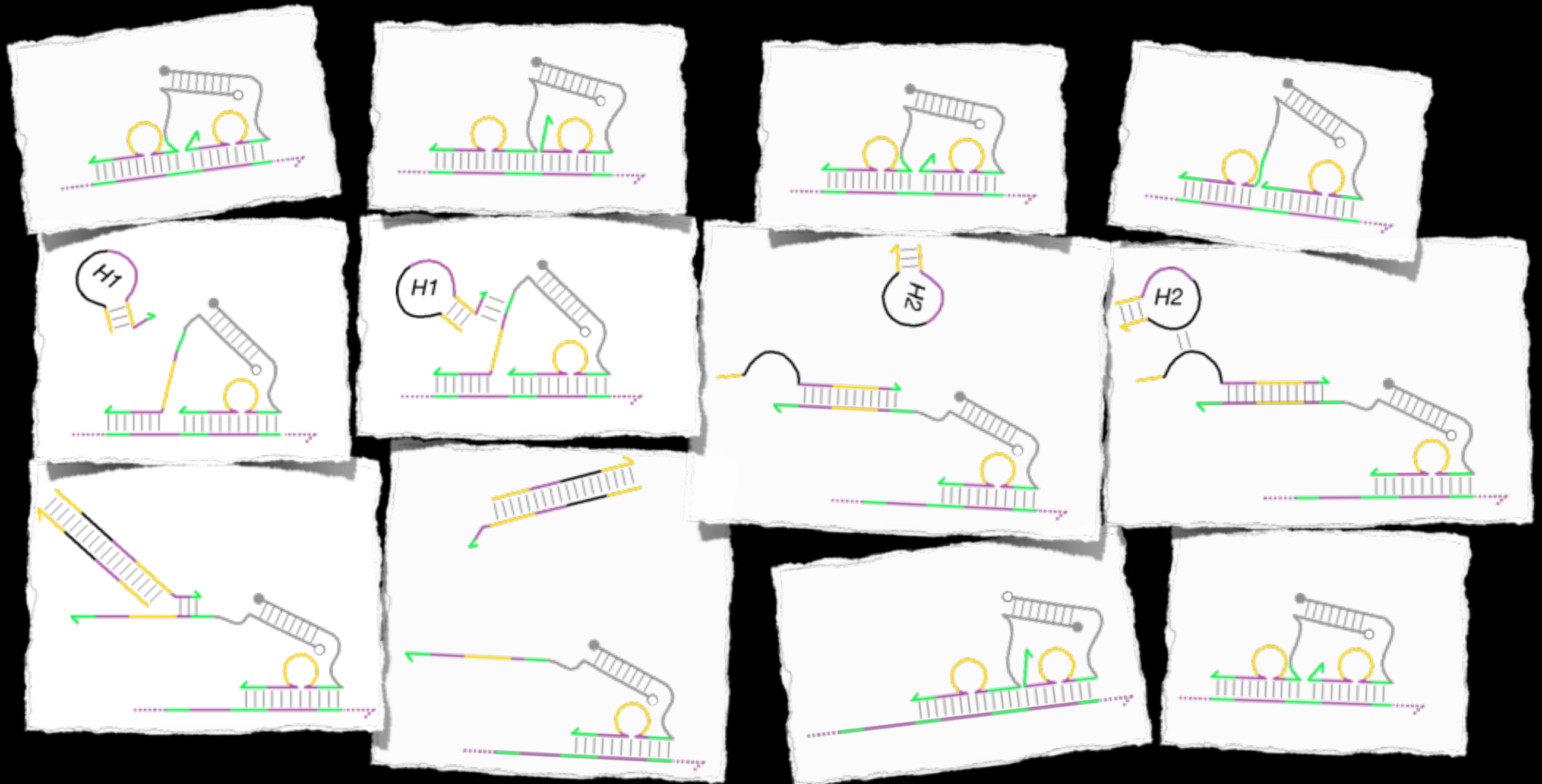
Y. Shirai/Rice University



K. Kelly and A. Osgood/Rice University



A synthetic molecular motor



Smallness

Strangeness

Sophistication

Nanoscale control:

Adding value to products

I wish my sunscreen wasn't so unsightly



I wish my socks didn't smell so much!



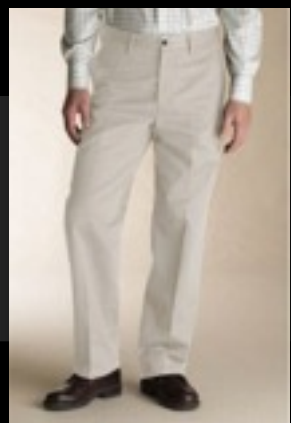
I wish my tennis racquet was lighter and stronger



I wish I could keep leftovers for longer, before they go off



I wish spilt red wine would run off my pants without staining



I wish I could get more songs on my iPod



Over 800 listed manufacturer-identified nanotech consumer products:
www.nanotechproject.org/consumerproducts

Nanoscale control:

Adding value to products

I wish my sunscreen
wasn't so unsightly



Over 800 listed manufacturer-identified nanotech consumer products:
www.nanotechproject.org/consumerproducts



Solar Rx

SPF 30+ Nano-Zinc Oxide
Therapeutic
Sunblock

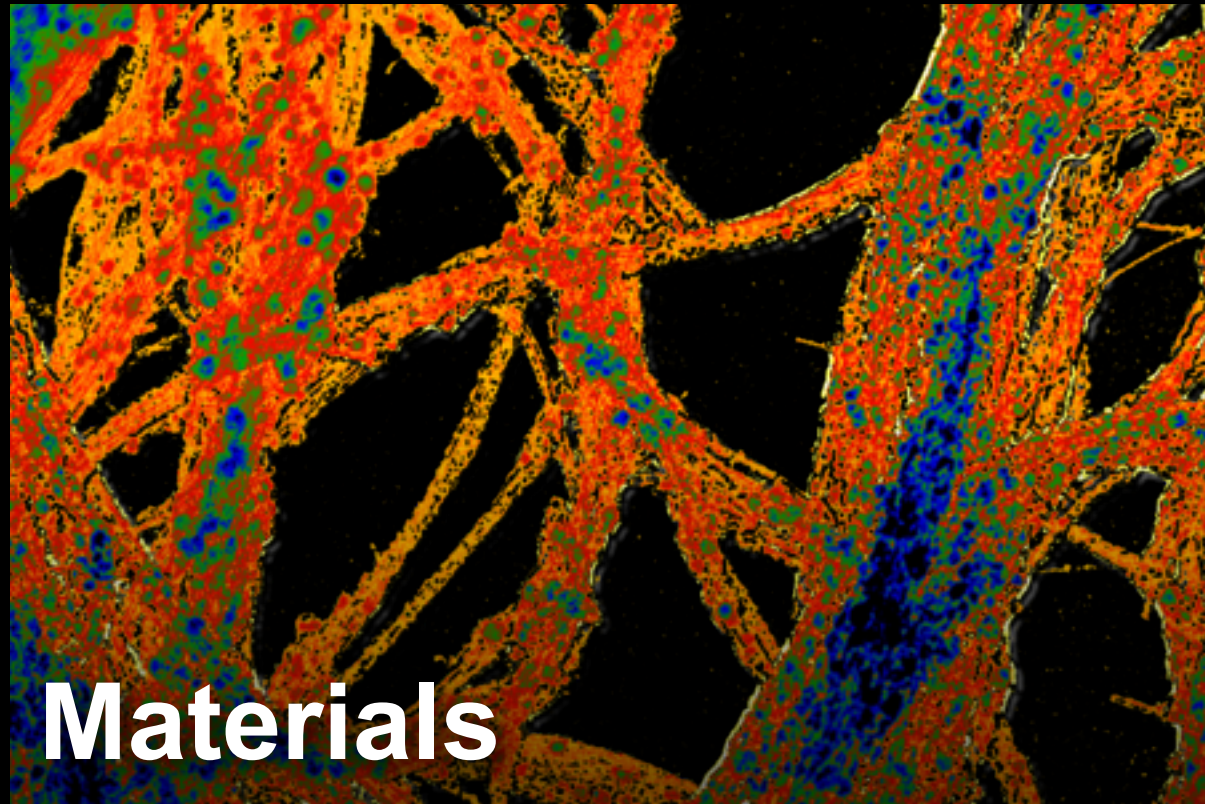
Chemical-Free
Skin Health

Net Contents 100 ml



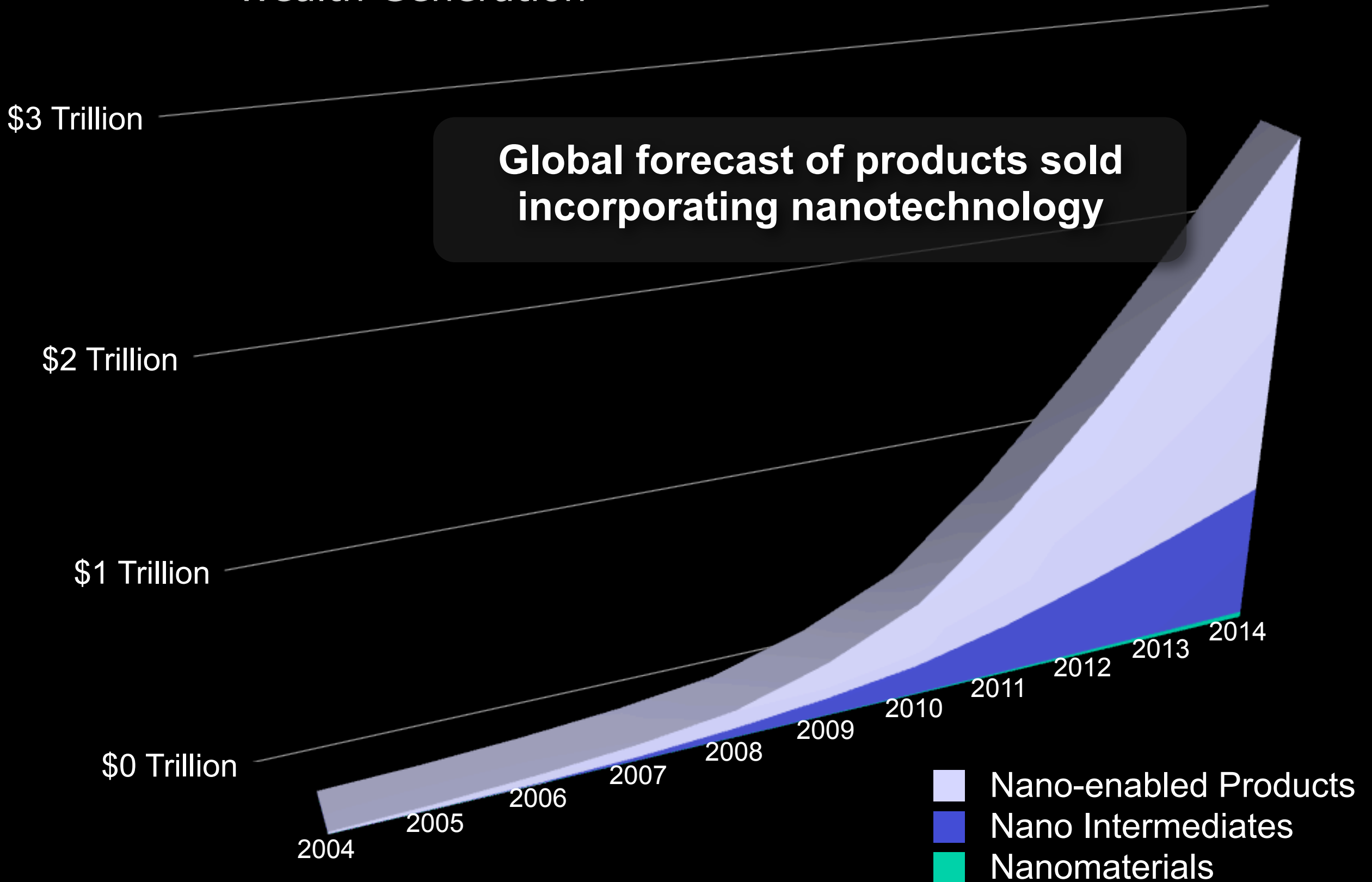
Nanoscale control:

Solutions to problems



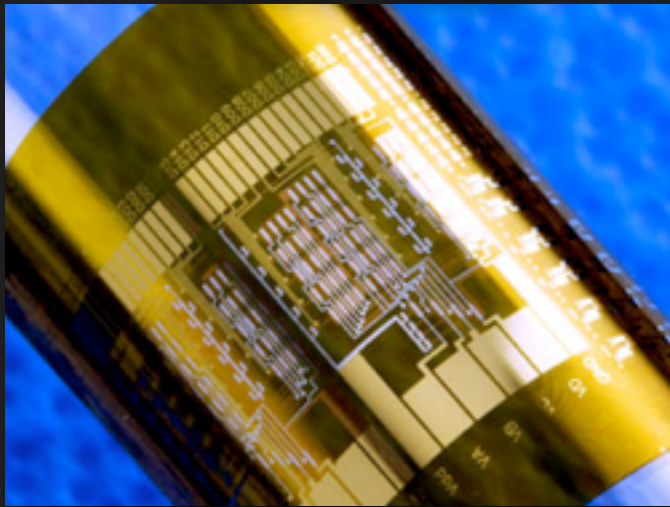
Nanoscale control:

Wealth Generation



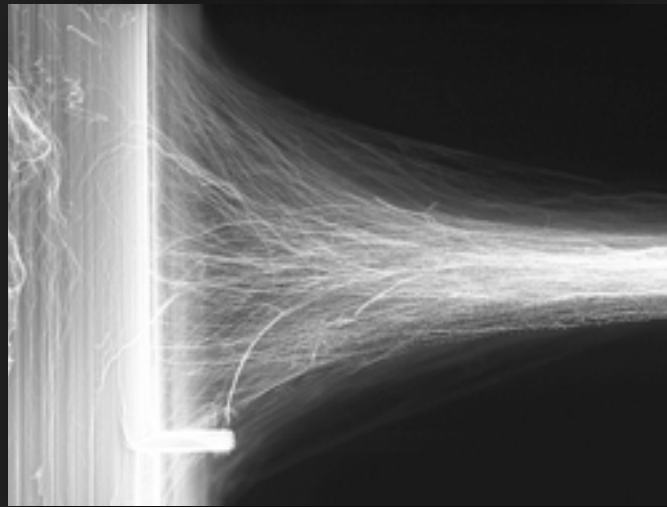
Source: 2004 Lux Research Report: "Sizing nanotechnology's value chain"

Electronics



© Beckman Institute

Artificial muscles



blog.wired.com

Spun textiles

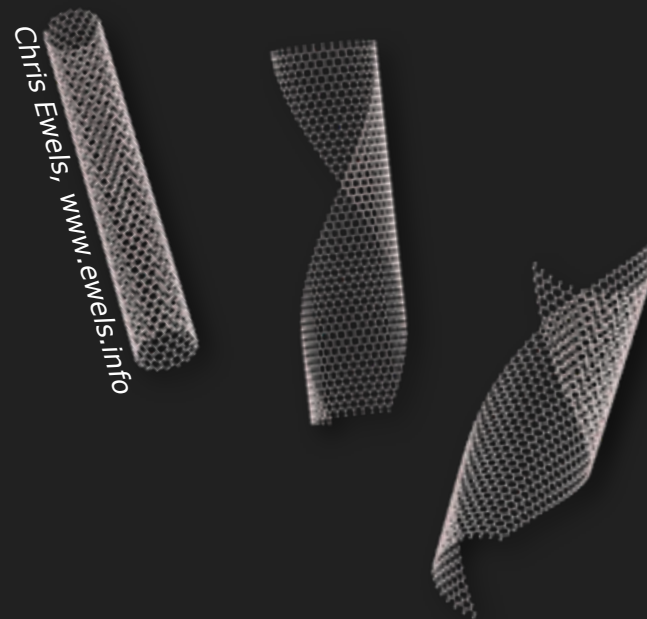


© CSIRO

Medicine

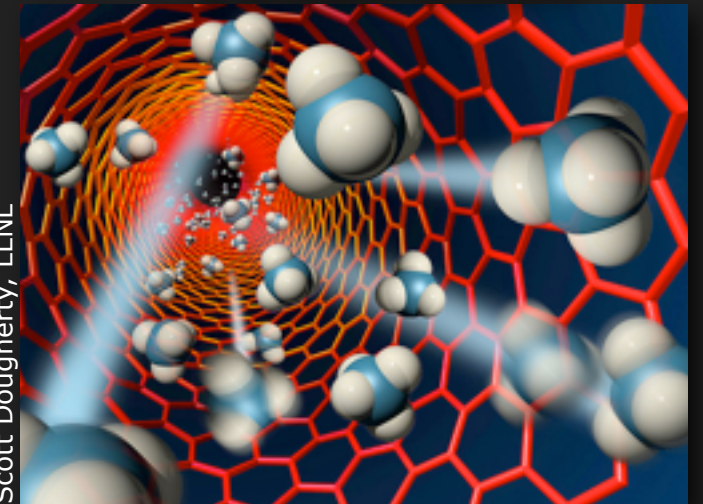


JPL



Chris Ewels, www.ewels.info

Desalination



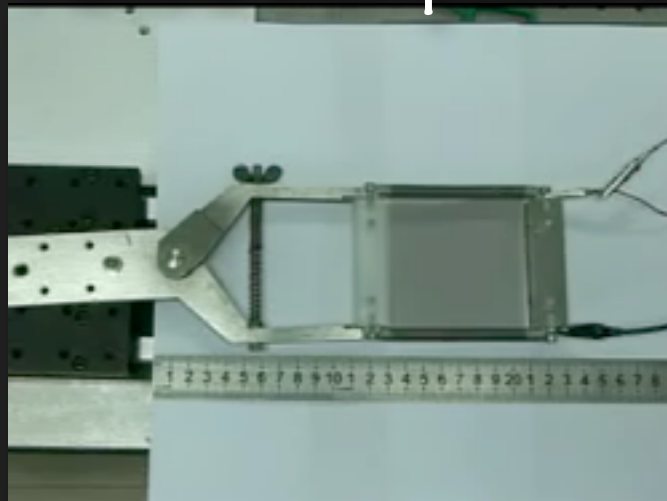
Scott Dougherty, LLNL

Strong materials



Easton

Flexible loudspeakers



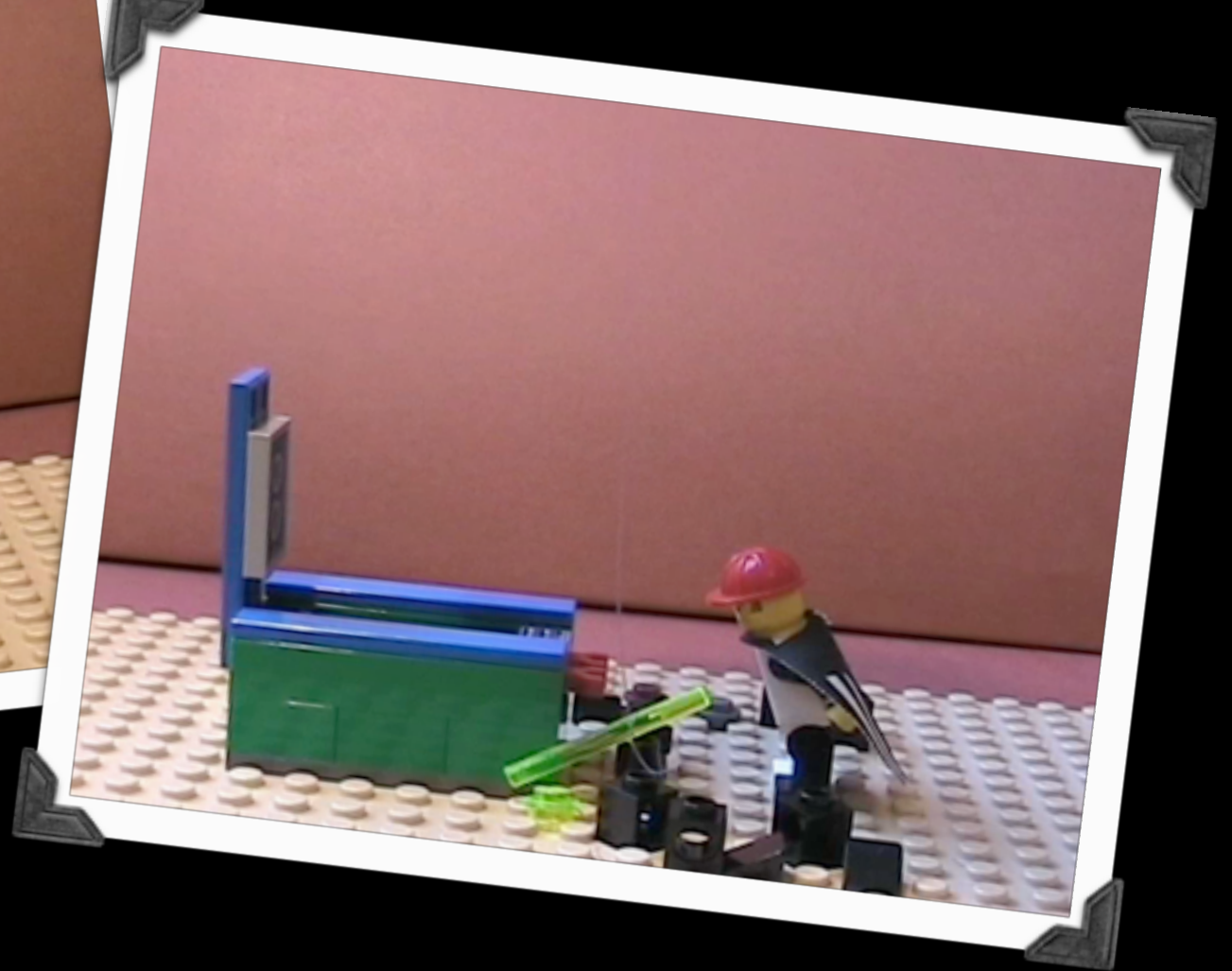
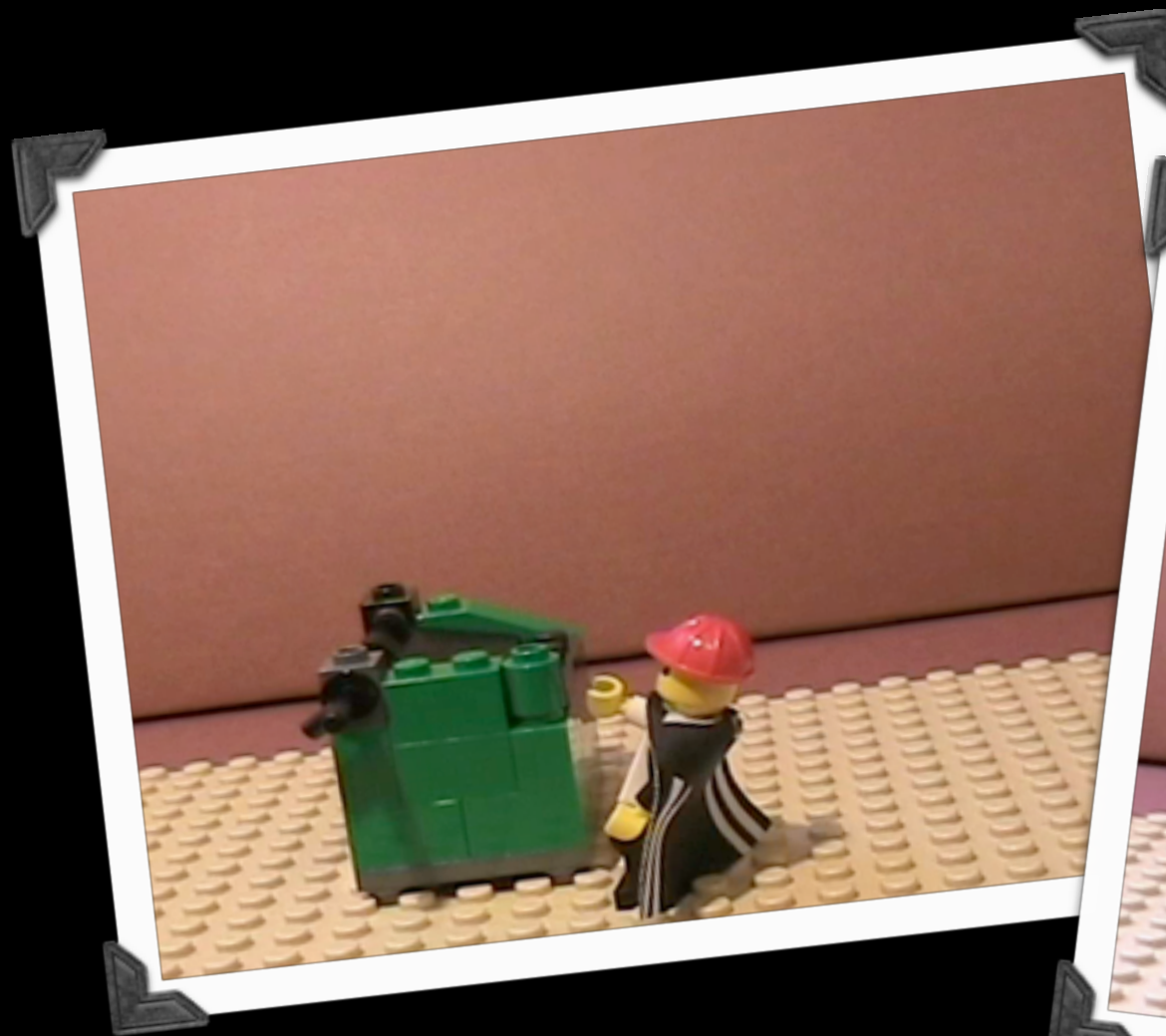
Kaili Jiang, Tsinghua University

Space elevator



NASA

...but is nano
SAFE?

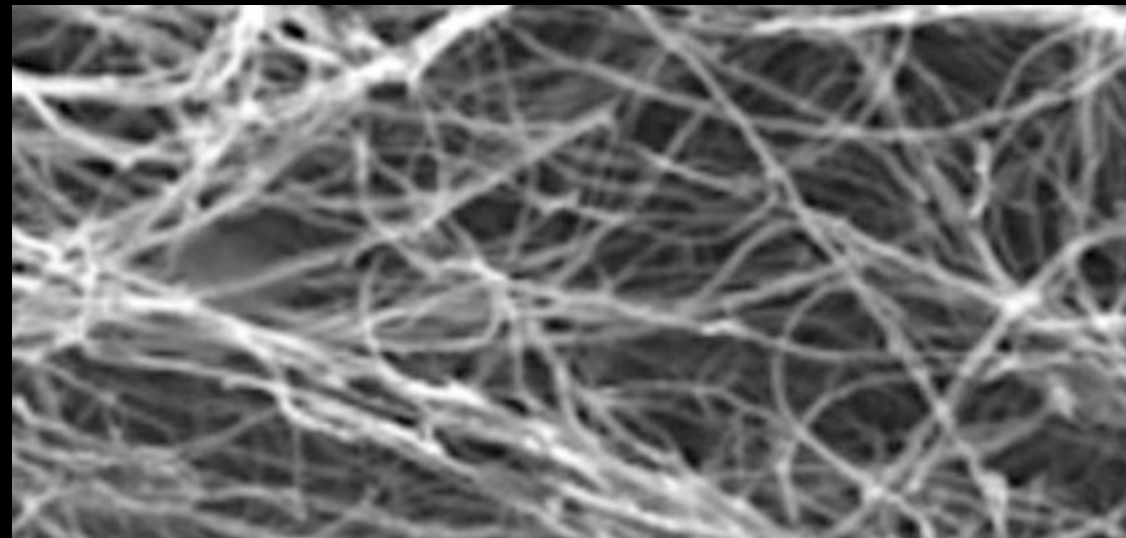
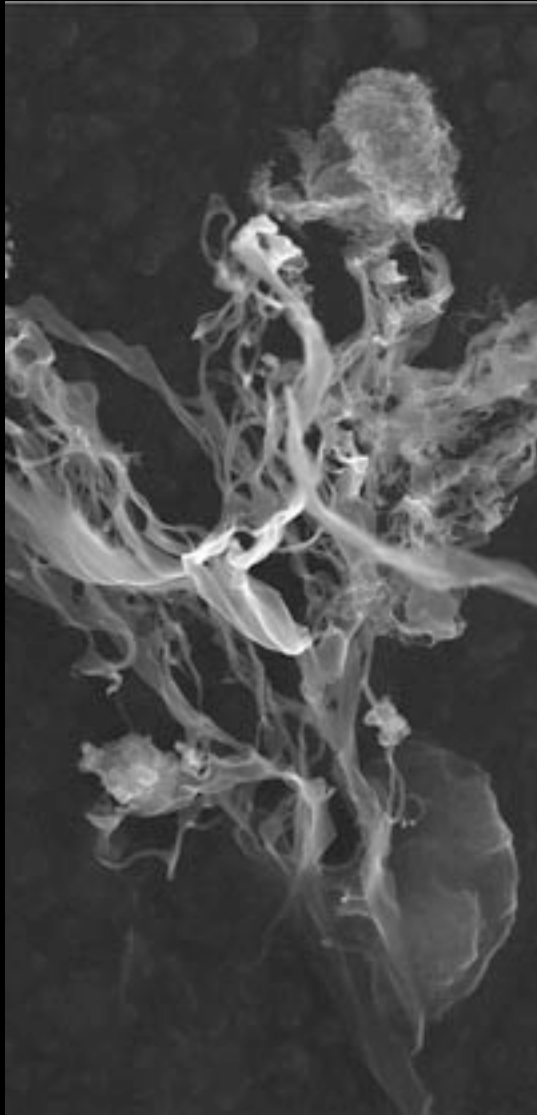
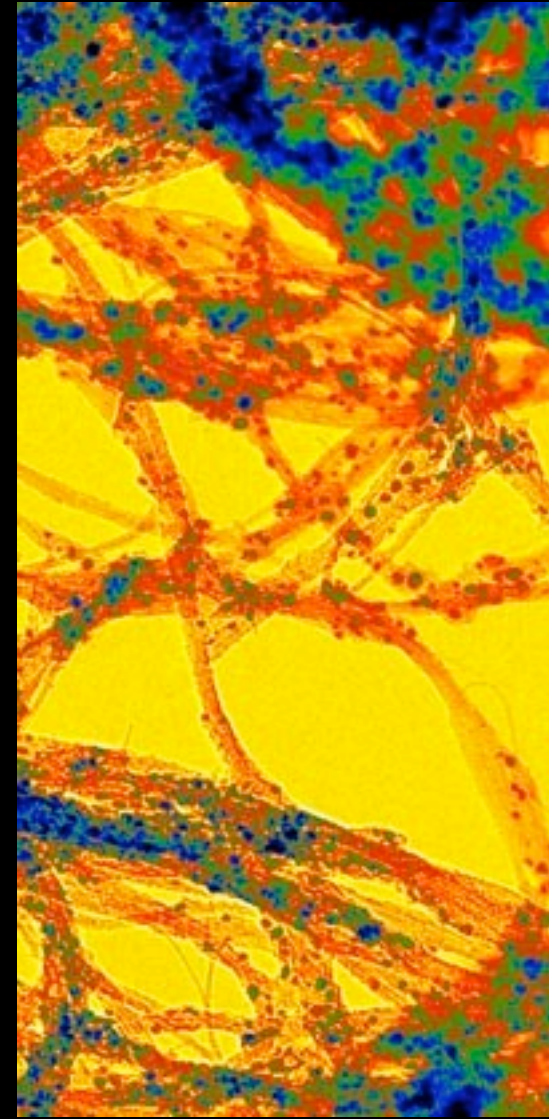
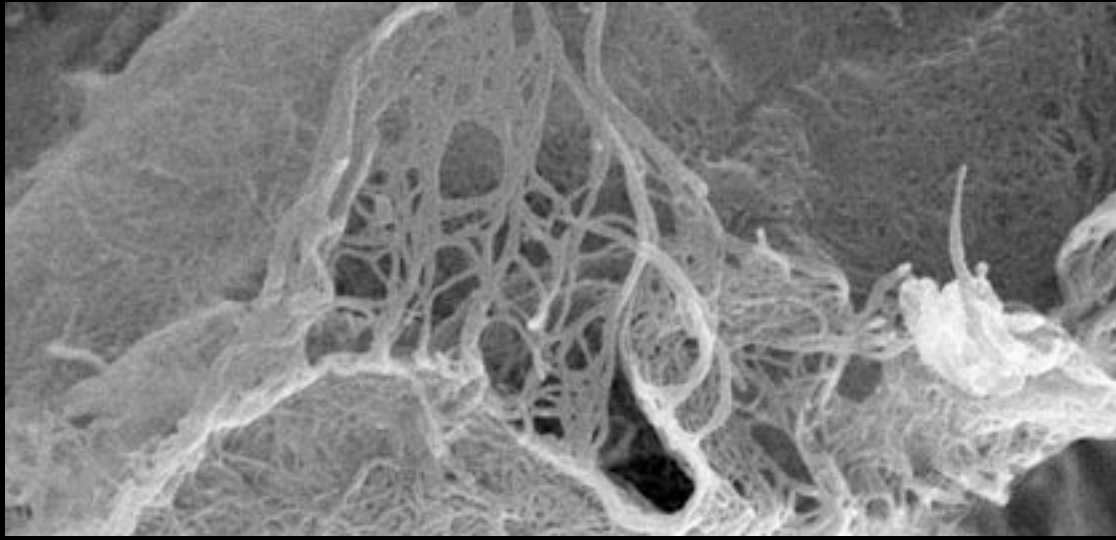


New Questions...

...but is nano
SAFE?

...New Answers





Smallness

Strangeness

Sophistication



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Writing on emerging technologies at:

<http://2020science.org>