

How Is New Mathematics Changing  
**YOUR** Life Today  
and In the Future?

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**IUPUI**

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February 10, 2014

Do You Know **ALL** of Mathematics??

**ALMOST**

Do You Know / **ALL** of Mathematics???

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Do You Know *ABOUT* / **ALL** of Mathematics????

Is the phrase “**NEW Mathematics**” an oxymoron???

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That is, is Next Year’s Math

any different from This Year’s Math?

or Last Year’s Math?

or even Last Century’s Math?

Is the phrase “**NEW Mathematics**” an oxymoron??? **NO!!!**

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any different from **This Year’s Math**?

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Even if you haven’t experienced it yet, **YES!!! They are Different**

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Graduate students must create new statistics or mathematics to get their PhDs!

And undergraduates(!) at **Bellarmino University** and **IUPUI**  
are engaged in the creation of new mathematics!

## Some Old Mathematics you've heard of:

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and some maybe you haven't

- Number Theory 400 BC-500 AD
- Differential Equations 1670-1750 AD
- Graph Theory 1736 AD
- Group Theory 1830 AD

## Some 'Modern' or 'New' Mathematics:

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- Mathematical Biology 1970
- Dynamical Systems & Chaos 1970
- Computational Algebraic Geometry 1979
- Tropical Geometry 1998/2003

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magnetic resonance imaging (MRI) and ultrasound imaging

computed axial tomography (CAT) scans

positron emission tomography (PET) scans

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Hopper is credited with first using the word "BUG" to refer to a glitch in the work of a computer after a MOTH short circuited an early computer and stopped the machine!

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The RSA cryptosystem, and related ideas, are the basis for much of the work done now on data and communications security worldwide.

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**INFORMATION**, not just data!

Information based on data, yes, but not *just data!*

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**Actuarial Mathematics & Statistics** is used by insurance

companies to predict claims and set premiums.

**Homeowner's insurance** depends on sophisticated catastrophe

modeling so companies can insure homes against earthquakes,

hurricanes, tornados; rare but financially devastating events!

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produce tsunamis that approach terrifyingly and splash

and break over the landscape

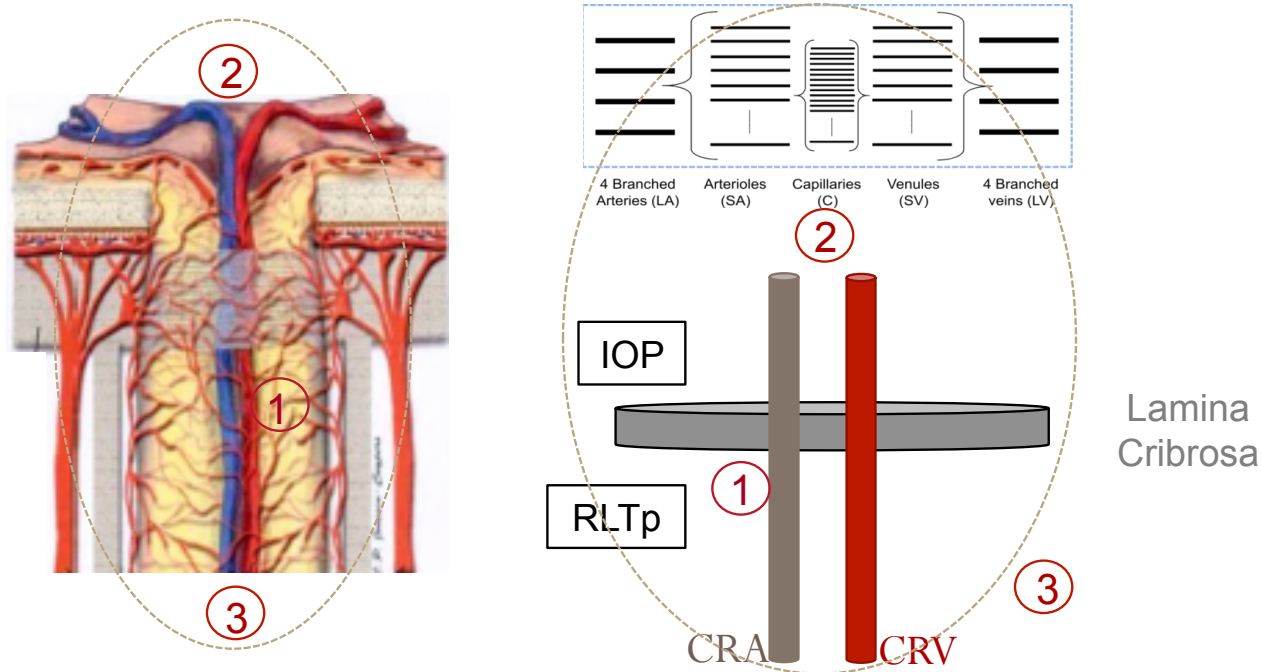
**Mathematical Modeling** is important in your everyday life!

Goal: Use clinical studies & math models to study glaucoma

How do mechanical forces affect flow in central retinal artery?

What mechanisms important to get autoregulation?

What are effects of varying MAP & IOP on retinal blood flow?



Thanks to Prof. Julia Arciero, math biologist at IUPUI

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Don't mistake not knowing about these things  
to be evidence they don't exist!



Clay Mathematics Institute **Millennium Prize Problems** are a challenge to the mathematical community!!

Solution of any will yield \$1,000,000 to the solver:

1. P versus NP problem
2. Hodge Conjecture
3. Poincaré Conjecture (**Solved!!**)
4. Riemann Hypothesis
5. Yang Mills existence and mass gap
6. Navier Stokes existence and smoothness
7. The Birch and Swinnerton-Dye Conjecture

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For example, we have catalogued the human genome but cannot yet connect a gene to the protein it encodes: it is expected that such a connection would enable personalization of cancer and other medical treatments.

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A credit card company processes millions of transactions each day; many of these are fraudulent! It is impossible to check every transaction! How can the company identify the 5 to 10 thousand transactions each day that are ‘most suspicious’??

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Brain function clearly depends on interactions of the smallest scale, also interactions of various middle sized collections, and on the interactions of large collections. How can we model interactions among all sizes of the collections of neurons?



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The same problem occurs in weather forecasting: we can make very good short term predictions of Louisville weather and very good long term predictions of global air flow. How can we make better medium term predictions (a week or two) for regional weather?

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**NEW** Mathematics will be **REQUIRED!!**

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**NEW** Mathematics will be **REQUIRED!!**

You should prepare with an eye to YOUR future!

## Links:

[www.math.iupui.edu/~ccowen/Careers.html](http://www.math.iupui.edu/~ccowen/Careers.html)

[www.math.iupui.edu/~ccowen/CoolMathLinks.html](http://www.math.iupui.edu/~ccowen/CoolMathLinks.html)

**THANK YOU!!**



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