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

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Do You Know ALL of Mathematics??

ALMOST

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

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any different from This Year's Math?

or Last Year's Math?

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Is the phrase "NEW Mathematics" an oxymoron??? NO!!!

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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 Duquesne University and IUPUI are engaged in the creation of new mathematics!

Some Old Mathematics you've heard of:

- **Arithmetic** — **before 3000 BC**
- **Geometry** — **2000-500 BC**
- **Algebra** — **1000 AD**

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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:

- **Complex Analysis** **1850**
- **Set Theory** **1874**
- **Knot Theory** **1877**
- **Topology** **1895**

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• **Functional Analysis**	**1900**
• **Theory of Computability**	**1936**
• **Linear Optimization**	**1939/1947**

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• **Functional Analysis**	**1900**
• **Theory of Computability**	**1936**
• **Linear Optimization**	**1939/1947**
• **Mathematical Biology**	**1970**
• **Dynamical Systems & Chaos**	**1970**
• **Computational Algebraic Geometry**	**1979**
• **Tropical Geometry**	**1998/2003**

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and in Medical imaging techniques like:

- **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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- **help characters and their clothes move 'naturally'**
- **get billowing smoke of an explosion to engulf the screen**
- **show hungry flames licking up and consuming buildings**
- **produce tsunamis that approach terrifyingly and splash and break over the landscape**

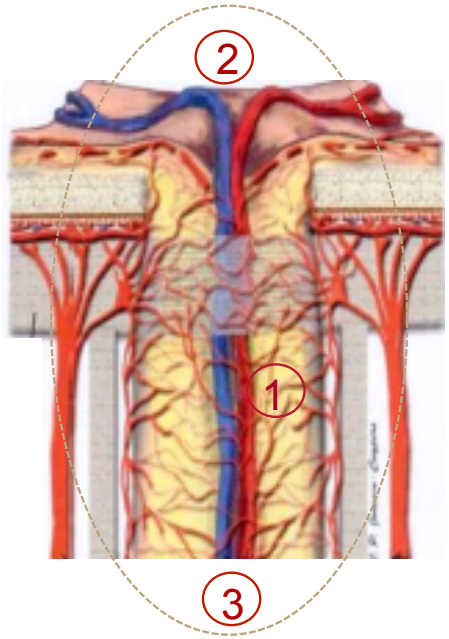
Mathematical Modeling is important in your everyday life!

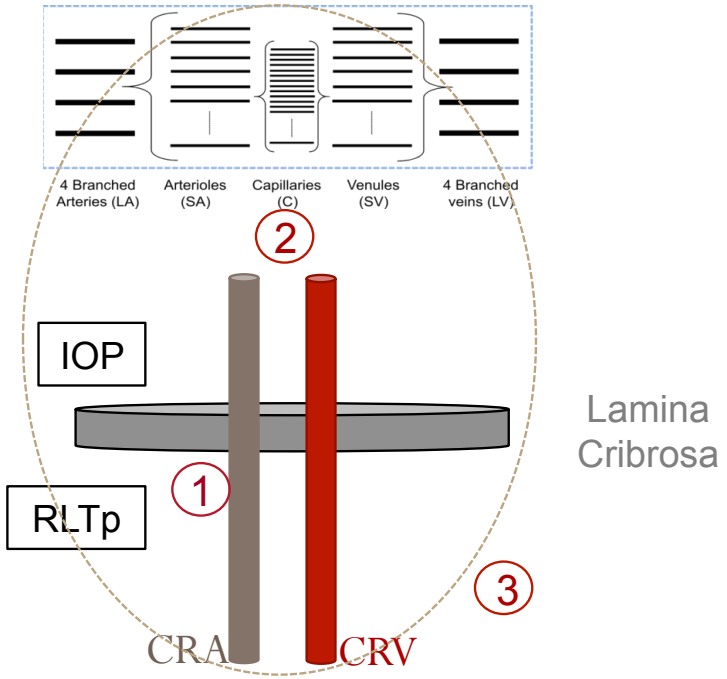
Goal: Use clinical studies & math models to study glaucoma

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 easily connect a gene to the protein it encodes: work is going on now to make such connections to 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 iteractions 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 Pittsburgh 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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You should prepare with an eye to YOUR future!

www.mathaware.org/index.html

Links:

www.math.iupui.edu/~ccowen/Careers.html

www.math.iupui.edu/~ccowen/CoolMathLinks.html

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THANK YOU!!

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In Spring 2010, "Mathematician" had fallen from the top spot —

and the best job in America was Actuary!

Last Spring, the "CareerCast.com" reported that the five best jobs in America are

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4. **Actuary!**
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More importantly,

in all editions of "Jobs Rated Almanac" since the first(1988),

the Mathematical Sciences have been a central part

of more than half of the top ten jobs in their rating!