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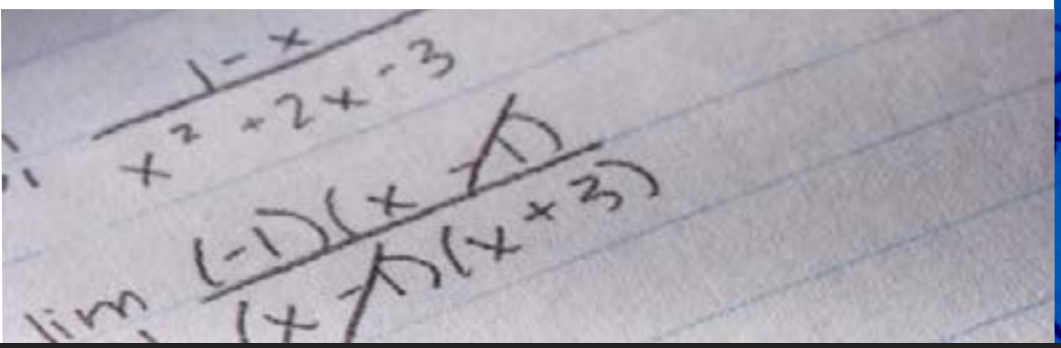
Internet-Based Problem Sets Have Been Helping Students with Their Math for over Twenty Years

In 1994, two professors in the UR Mathematics Department discussed a concern they were having about traditional methods of instruction: if a student struggled with an assignment, by the time the homework was checked, graded, and returned, a week or more had passed and the problem was no longer fresh in the student's mind. It was, therefore, unlikely that the student would return to that assignment and work with the concept until it was fully digested. The professors wondered if the burgeoning Internet might provide a solution.

Arnold Pizer, Ph.D., now Professor Emeritus, and **Michael Gage, Ph.D.**, Professor of Mathematics, took their idea to then-Chair, **Douglas Ravenal, Ph.D.**, and began assembling a collection of problems. Pizer and Gage launched their prototype in the fall of 1996 to a test class of 29 calculus students. Within two years, 750 students per semester were using WeBWork for calculus, pre-calculus, and physics classes. The students were thrilled by the instant feedback they were receiving, and TAs reported that more than 80% of them were sticking with every problem until they arrived at the correct answers.

In 1999, Pizer, Gage, and Ravenal filed an invention disclosure with the Office of Technology Transfer in which they mentioned other institutions that were enthusiastically testing WeBWork with their students, including Johns Hopkins, Purdue, Kansas State, and the National Taiwan University.

Today, WeBWork is an internationally recognized, individualized open-source online homework system containing over 20,000 problem sets for math and science courses, used at more than 700 colleges, universities, and high schools on five continents. WeBWork supports algebra, differential equations, discrete mathematics, single- and multi-variable calculus, probability and statistics, and complex analysis.



WELCOME TO THE UR VENTURES TECHNOLOGY REVIEW

YOUR GUIDE TO WHAT'S HAPPENING AT UR VENTURES AND AT THE UNIVERSITY OF ROCHESTER

The UR Ventures Technology Review is your monthly look at innovation and technology commercialization at the University of Rochester. In this issue, you will learn about a UR invention that's been helping students with their homework for twenty years, how URV helps researchers get the data and services necessary to advance their discoveries, and where Rochester ranks in U.S. patents received in 2015. Meliora!

UR Ventures and the Center for Business Engagement will be hosting an informational get-together on the Friday of Meliora Weekend (7 October 2016). We will be in the Havens Lounge of Wilson Commons (third floor -- over the bridge). Stop by between 1:00 and 5:30 pm to meet us, enjoy some refreshments, and have your mind blown by demonstrations of some of the amazing projects arising from Rochester research. Stay tuned for more details.

The National Academy of Inventors Releases List of Top 100 Recipients of U.S. Patents for 2015

Once again, the **University of Rochester** made the global list of top patenting universities. At 48 issued patents, Rochester placed 41st in the world, tied with Duke University. It is no surprise that larger universities with bigger research budgets ranked higher on this list. Schools like UNC (35th), U Penn (19th), Harvard (11th), Michigan (10th), Johns Hopkins (8th), Stanford (3rd), and MIT (2nd) have research enterprises spending two, three, four, and even five times as much as Rochester. Some unfamiliar with Rochester might find it surprising that we ranked higher than USC (45th), Vanderbilt (52nd), Princeton (54th), Yale (71st), and Emory (91st). **See the complete list here.**

When the number of patents earned is normalized across these institutions based on research expenditures, the University of Rochester surges up in the rankings[1]. Traditional research and technology transfer powerhouses, such as Stanford (2.31 patents earned per $10M spent in research), MIT (1.83) remain ahead of Rochester, but at (1.39) we surpass Harvard (1.31), UNC (0.71), Johns Hopkins and Michigan (0.89 each), U Penn (1.05), and even the entire State of California system (0.97), which led the NAI list with 489 patents.

An issued patent, on its own, has limited intrinsic value without the technology it covers being developed and marketed. It is the mission of the universities' technology transfer operations to license the intellectual property contained in those patents to entities capable of bringing the scientific advancement to the public. At UR Ventures, we seek to file patents with commercial potential. Then we spend the vast majority of our resources and efforts in developing the underlying technology to increase our chances of finding and attracting the right business partner(s) (startups and/or established companies) to carry it forward to market.

For a sample of U**niversity of Rochester patents currently available for licensing**, see here.

The NAI released its annual list of top patent earners.

UR Ventures Connects Researchers with CROs to Advance UR Technologies

Life sciences breakthroughs made at basic research universities often stop at the point of defining a biological mechanism or potential drug target. This is usually too early in the discovery process to catch the interest of potential biotech/pharma industry partners. Hence, additional efforts are necessary to enable scientific discoveries from universities to be adopted by biotech and pharma companies. A competent drug development program is often the missing step or catalyst we need to bridge this gap. When a technology becomes stuck at this point, there are typically four options:

1. The inventor(s) can work with colleagues at other institutions with the right expertise, the necessary resources, and the time to perform the drug screening. This is often not the best option due to limited resources and experience, resulting in inefficient progress;
2. The inventors can work with a Contract Research Organi-zation (CRO) on a pay-for-services basis;
3. We can license the discovery to a startup company capable of carrying the development forward, but often this pre-drug candidate stage is too early to attract enough investments to advance the project; or
4. We can abandon the project due to lack of in-house resources.

At **UR Ventures**, our goal is to locate those resources in order to get each and every technology closer to the finish line. Toward that end, we have entered into a relationship with Albany Molecular Research, Inc. (AMRI), a CRO located in Albany, New York. AMRI is an NIH-designated CRO, and possesses the infrastructure and the expertise in drug development to work with our researchers to identify the desirable lead chemical compounds. These services are not without cost, however, and it is not always possible for research laboratories to raise enough discretionary funds to pay for drug discovery. We encourage researchers in this situation to apply to the **Technology Development Fund**.

One of the recent projects we have asked AMRI for help with comes from the laboratory of **Richard Phipps, Ph.D.**, the Wright Family Research Professor in the Department of Environmental Medicine. Dr. Phipps has been investigating a novel pathway to inhibit scar formation, and he has screened several generic compounds that have shown certain anti-scarring properties. He needed access to someone with medicinal chemistry expertise and the resources to design new and more potent anti-scarring compounds. UR Ventures put Dr. Phipps in touch with AMRI, and they are now investigating potential novel compounds with better specificity and efficacy in preventing and treating tissue scarring.

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