

Researchers launch innovative, hands-on online tool for science education

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This is the Rosalind logo. Credit: Jacobs School of Engineering at UC San Diego

Computer scientists at the University of California, San Diego and at St. Petersburg Academic University in Russia, have developed a one-of-a-kind, hands-on online learning tool that weaves together for the first time science and programming education—and automatically grades homework too.

"While [modern biology](#) is inundated with computation, biology students at U.S. universities are taught neither programming nor bioinformatics and as a result are unprepared for the challenges that await them in their own discipline," said Pavel Pevzner, a computer science professor at the Jacobs School of Engineering at UC San Diego. "We provide a tool to fill that learning gap."

The new tool, called [Rosalind](#), diverges from large-scale, online open education platforms such as Coursera and Udacity. Instead of listening to a lecture, students are required to complete increasingly difficult

problems at their own pace. Researchers say it's the only online tool using this method to teach science that they know of.

Computer scientists hope to make Rosalind a premier educational resource not only for students lacking access to higher education, but also for universities aiming to update their curricula. The site offers an environment designed for professors that grades homework assignments automatically. This environment promises to help universities offer online courses to a larger student population by creating a "zero-cost teaching assistant." Rosalind also could act as a complement to the lectures offered on Coursera and Udacity.

"In a traditional classroom environment, teaching assistants wind up grading the same homework assignment over and over," said Phillip Compeau, one of Pevzner's graduate students at UC San Diego, who created Rosalind with Nikolay Vyahhi, a graduate student in St. Petersburg. "By automating grading, we hope to foster individualized instruction and fuel the transition from traditional textbook exercises to a programming-driven homework environment."

Rosalind primarily targets biologists who want to learn bioinformatics, and is also helpful for biology or computer science professionals who want to learn more about bioinformatics. The platform has already attracted more than 1,600 beta testers from more than 50 countries. "Rosalind is already helping students who are brave enough to dive into bioinformatics without waiting for their universities to update their curricula, and it's only a matter of time before this model spreads to other disciplines," Pevzner said.

The beta version of Rosalind became available only six weeks ago, but students from six different countries have already solved all the problems in the platform, said Vyahhi. "To keep up with them, the Rosalind team aims to add 100 new problems by the end of the year."

Rosalind begins with a simple computational problem: given a strand of DNA, count the number of times that each of the four nucleotides appears in the strand. Subsequent exercises steadily grow in complexity, creating a problem tree in which the students' biological and computational knowledge is constructed simultaneously. After solving only a few dozen problems, students will possess a wide arsenal of bioinformatics algorithms and will be prepared to tackle advanced problems that even graduate students may find challenging.

"The way in which Rosalind problems build on each other ensures that students are continuing to process the material instead of simply regurgitating notes for a test," said Pevzner. "Completing Rosalind problems constitutes mastery of the subject, which is difficult to achieve with traditional courses online. I am happy to give top Rosalind [students](#) an A even though they have not attended my class."

Provided by University of California - San Diego

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