You can help medical science just by playing a new Borderlands mini-game



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- This terminal is your entry point to helping biomedical research through gaming.
- Line up those colors and close those gaps… for science!
- The team at DNA Puzzles outlines how the “puzzles-for-science” process works.
- Help your in-game numbers go up as you help the cause of science.
- Scientific research looks cooler with a bit of *Borderlands* polish.

Players can help biomedical research by playing a new color-

matching mini-game introduced in *Borderlands 3* this week. “Borderlands Science” basically tricks human players into solving complex genetic alignment problems that can be intuitive for humans but difficult for computer algorithms.

The mini-game is a joint effort between *Borderlands* maker Gearbox and scientists at McGill University, UC San Diego’s Microsetta Initiative, and the Massively Multiplayer Online Science group. “The first time I met with [Gearbox founder] Randy Pitchford and [Producer] Aaron Thibault to discuss this crazy idea was 5 years ago at GDC,” MMOS founder Attila Szantner said in a blog post. “Since then we have been working together with the Gearbox team to realize this project.”

How does it work?

The process starts with DNA sequences from some of the trillions of microbes in the human gut. Researchers want to arrange those sequences to figure out which of these microbes are genetically similar to each other. That can help indicate which genetic lines of microbes are associated with certain diseases.

Finding the optimal alignment between two related genomes can be difficult, though, because evolutionary distance leads to gaps and mismatches in those DNA sequences. When heuristic computer algorithms try to account for these issues, they tend to get stuck at suboptimal solutions. In these computer-fooling cases, a single alignment shift in any direction will only make things worse, even if a few moves to one side or another might make things much better.

Enter humans, with brains that have evolved over millennia to become efficient pattern-matching machines. By converting DNA sequences to lines of colored blocks, “Borderlands Science” asks players to find their own optimal base pair alignments, minimizing gaps and maximizing matches according to a scoring algorithm (gaps are worse than mismatches, generally). As

competitive players find new “high scores” in these patterns, they’re also training a machine-learning AI in new principles for finding optimal solutions on its own.

Using gamers for medical research in this way isn’t an entirely new concept: McGill University’s *Phylo*, which has been free to play online since 2010, uses the same basic premise to get thousand of players to help sequence viruses. But Gearbox’s *Borderlands Science* implementation adds a bit of game industry polish and interface refinement to the idea. It also incentivizes millions of *Borderlands* players to take part in the research by giving them free in-game items and rewards just for playing.

“Combined with classical algorithms, crowd computing techniques can be successfully used to help improving the accuracy of [multiple-sequence alignment],” McGill University researchers wrote in a 2012 paper on *Phylo*. “Our results show that solutions submitted contributed to improving the accuracy of up to 70% of the alignment blocks considered… This suggests that citizen science approaches can be used to exploit the billions of ‘human-brain peta-flops’ of computation that are spent every day playing games.”

[embedded content]
Mayim Bialik gives a simple introduction to how “Borderland Science” works.
John Timmer contributed to this report

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