

Universidade Federal de Alfenas
Programa de Pós-graduação em Estatística Aplicada e Biometria
English Proficiency Exam

Registration number: _____

Read the text carefully and answer the questions. Don't forget, you must answer only in Portuguese! Answers in English will not be considered.

Reference: HORGAN, J. **Is Science Hitting a Wall?, Part 1** - Economists show increased research efforts are yielding decreasing returns. 2018. Available in: <https://goo.gl/Jskxiw>. Access in: April 20th 2018.

Is Science Hitting a Wall?, Part 1

Economists show increased research efforts are yielding decreasing returns

Once again, I'm brooding over science's limits. I recently posted [...] with three physicists with strong opinions on the topic - David Deutsch, Marcelo Gleiser and Martin Rees - as well as this column: "Is Science Infinite?" Then in March I attended a two-day brainstorming session - which I'll call "The Session" - with 20 or so science-y folks over whether science is slowing down and what we can do about it.

The Session was inspired in part by research suggesting that scientific progress is stagnating. In "Are Ideas Getting Harder to Find?", four economists claim that "a wide range of evidence from various industries, products, and firms show[s] that research effort is rising substantially while research productivity is declining sharply." The economists are Nicholas Bloom, Charles Jones and Michael Webb of Stanford and John Van Reenen of MIT.

As an counter-intuitive example, they cite Moore's Law, noting that the "number of researchers required today to achieve the famous doubling every two years of the density of computer chips is more than 18 times larger than the number required in the early 1970s." The researchers found similar trends in research related to agriculture and medicine. More and more research on cancer and other illnesses has produced fewer and fewer lives saved.

These findings corroborate analyses presented by economists Robert Gordon in "The Rise and Fall of American Growth" and Tyler Cowen in "The Great Stagnation". Bloom, Jones, Webb and Van Reenen also cite "The Burden of Knowledge and the 'Death of the Renaissance Man': Is Innovation Getting Harder?", a 2009 paper by Benjamin Jones. He presents evidence that would-be innovators require more training and specialization to reach the frontier of a given field. Research teams are also getting bigger, and the number of patents per researcher has declined.

The economists are concerned primarily with what I would call applied science, the kind that fuels economic growth and increases wealth, health and living standards. Advances in medicine, transportation, agriculture, communication, manufacturing and so on. But their findings resonate with my claim in *The End of Science* that "pure" science - the effort simply to understand rather than manipulate nature - is bumping into limits. And in fact I was invited to The Session because an organizer had read my gloomy tract, which was recently republished. [...]

Question 1: Who wrote the column “Is Science Infinite?”? _____

Question 2: How many people attended to “The Session”? _____

Question 3: What did four economists say in “Are Ideas Getting Harder to Find”? _____

Question 4: Who are such economists? _____

Question 5: What does Moore’s Law say? _____

Question 6: Researches on cancer and other illnesses are saving more and more lives? _____

Question 7: Benjamin Jones, in his 2009 paper presents evidence of what? _____

Question 8: What are the economists concerned primarily with? _____

Question 9: What the author means with “pure” science? _____

Question 10: Why the author was invited for “The Session”? _____
