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Sunset of the Solo Scientist

By JONAH LEHRER

In recent weeks, President Barack Obama has focused on the importance of innovation for "winning the future." It's our new ideas, he says, that will solve our energy problems, increase exports and create high-paying jobs. "This is our generation's Sputnik moment," he said in the State of the Union speech. "We need to out-innovate the world."

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A brilliant researcher, barely out of his teens and working alone? Scratch that: Today's ideal scientist is close to 40 and working on a team.

The question, of course, is where these new ideas will come from. For centuries, the Western model of innovation has been simple: We've relied on young geniuses. From Da Vinci to Einstein, from Newton to Darwin, our most revolutionary breakthroughs have typically emerged from individuals, working by themselves.

But that model appears to be as old-fashioned as the manual typewriter. In recent years, it's become increasingly clear that our best ideas no longer come from solitary researchers. (Here's a quick test: Name a current scientist as influential as Einstein or an inventor as famous as Edison.) If America is going to "out-innovate" the world, it's not because we have more youthful geniuses, toiling away alone in a lab. The age of the great scientific thinker is over.

Why have individual geniuses become less important? Mostly because the nature of our hardest scientific problems has changed. One sign of this comes from data on the "peak age" of creativity, which has been increasing for the last 500 years. Newton may have benefited from tackling the problems of calculus and gravity in his 20s, but the ideal age for most scientists is now closer to 40.

Benjamin Jones, a professor at Northwestern University's Kellogg School of Management, has looked at this shift in detail. He's found, for instance, that the mean age of "great achievement" among Nobel laureates has risen by nearly eight years over the course of the 20th century. (Similar trends also apply to inventors.) The reason is straightforward: Before we can transform a field, we need to master it, to learn the details of the domain. And there's more to learn than ever before.

The complexity of our 21st-century problems has also profoundly influenced the nature of the scientific process. If the old model of innovation revolved around the individual—Einstein had no co-authors on his most important papers and Darwin prized his isolation—modern research is now defined by its collaborations.

Mr. Jones has found, for instance, that scientific teams have become a far more important part of intellectual production. By analyzing 19.9 million peer-reviewed papers and 2.1 million patents, Mr. Jones and his colleagues at Northwestern were able to show that teamwork is a defining trend of modern research. Over the last 50 years, more than 99% of scientific subfields, from computer science to biochemistry, have experienced increased levels of teamwork, with the size of the average team increasing by about 20% per decade.

This shift is even more pronounced among influential papers. While the most cited studies in a field used to be the product of lone geniuses, Mr. Jones has shown that the best research now emerges from groups. It doesn't matter if the scientists are studying particle physics or human genetics. Papers by multiple authors receive more than twice as many citations as those with one author. This trend is even more apparent when it comes to "home run papers"—those publications with at least 1,000 citations —which are more than six times as likely to come from a team.

What's driving this shift toward group problem-solving? Mr. Jones blames it, in part, on the "death of the Renaissance man." Unlike Da Vinci, who made important contributions to such disparate fields as medicine, civil engineering and geology, today's scientists must spend years in graduate school developing an extremely narrow expertise. As a result, they depend on teams to make the crosscutting connections that end up changing the world. All of us are smarter than one of us.

In his State of the Union speech, President Obama listed just a few of the transformative innovations that he hopes to see, from hydrogen fuel cells to a cure for cancer. If we're going to find answers to our hardest questions, we need to begin by rethinking our old assumptions about where these answers will come from. Collaboration is no longer an option—it's a necessity.

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