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How Many Scientists Does It Take to Write a Paper? Apparently, Thousands

Scientific journals see a spike in number of contributors; 24 pages of alphabetized co-authors

Scientists who regularly share co-author credit on physics papers gathered at the Large Hadron Collider in Switzerland in 2012. *PHOTO: CLAUDIA MARCELLONI/CERN*

By **ROBERT LEE HOTZ**
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A Frenchman named Georges Aad may have the most prominent name in particle physics.

Galadriel Mirkwood.

In less than a decade, Dr. Aad, who lives in Marseilles, France, has appeared as the lead author on 458 scientific papers. Nobody knows just how many scientists it may take to screw in a light bulb, but it took 5,154 researchers to write one physics paper earlier this year—likely a record—and Dr. Aad led the list.

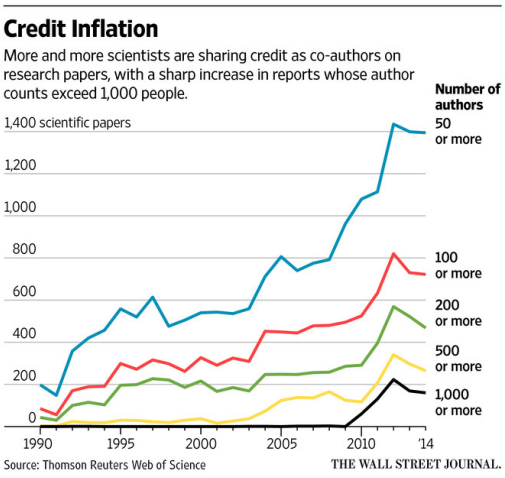
His scientific renown is a tribute to alphabetical order.

Almost every paper by "G. Aad et al." involves so many researchers that they decided to always list themselves in alphabetical order. Their recent paper, published in the journal Physical Review Letters, features 24 pages of alphabetized co-authors led by Dr. Aad. There is no way to tell how important each contributor might be.

"Basically, this guy has won the academic lottery," said Vincent Lariviere, a professor of information science at the University of Montreal who studies scholarly communications.

From Aad to Zoccoli, these physicists, who conduct experiments at the Large Hadron Collider in Switzerland, are a measure of an accelerating trend in science—the growth in the number of people who get credits.

In fact, there has been a notable spike since 2009 in the number of technical reports whose author counts exceeded 1,000 people, according to the Thomson Reuters Web of Science, which analyzed citation data. In the ever-expanding universe of credit where credit is apparently due, the practice has become so widespread that some scientists now joke that they measure their collaborators in bulk—by the "kilo-author."



Earlier this year, a paper on rare particle decay published in Nature listed so many co-authors—about 2,700—that the journal announced it wouldn't have room for them all in its print editions. And it isn't just physics. In 2003, it took 272 scientists to write up the findings of the first complete human genome—a milestone in biology—but this past June, it took 1,014 co-authors to document a minor gene sequence called the Muller F element in the fruit fly.

"There was a joke that anyone who had ever seen a fruit fly got to be an author," said neuroethologist Zen Faulkes at the University of Texas Rio Grande Valley, who tracks the spiraling number of scientific co-authors.

The exponential growth has a number of causes, one of which is that experiments have gotten more complicated. But scientists say that mass authorship makes it harder to tell who did what and who deserves the real credit for a breakthrough—or blame for misconduct.

More than vanity is at stake. Credit on a peer-reviewed research article weighs heavily in hiring, promotion and tenure decisions. "Authorship has become such a big issue because evaluations are performed based on the number of papers people have authored," said Dr. Larivière.

Usually, the position of first author confers the most prestige, identifying the person who contributes the most to a research enterprise. The last author is usually the senior scientist who oversees the experiment.

Even before Dr. Aad and his fellow physicists adopted their alphabetical order, there have been unorthodox approaches to ranking co-authors. The co-authors of a 1974 paper in the Journal of Animal Ecology ranked themselves by playing a croquet tournament, according to a footnote. The authors of a 1998 paper in the journal Molecular Ecology arranged the order of co-authors "by proximity to tenure decisions," according to their acknowledgments.

But now the sheer numbers are prompting scientists to come up with new ways to keep track. Some researchers are developing computer software to decipher the taxonomy of

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scientific credit. "The challenges are quite substantial," said Marica McNutt, editor in chief of the journal Science. "The average number of authors even on a typical paper has doubled."

Among the 24,000 or so scholarly journals that publish peer-reviewed research, many now require that all authors read and approve a manuscript, and explain their contribution. Most important, they ought "to be accountable for all aspects of the work," according to standards developed by the International Committee of Medical Journal Editors. Some insist on a designated "guarantor" who takes formal responsibility for the veracity of the work.

Some scientists do their best to subvert the process.

Michigan State University mathematician Jack Hetherington published a paper in 1975 on low temperature physics in Physical Review Letters with F.D.C. Willard. His colleagues only discovered that his co-author was a siamese cat several years later when Dr. Hetherington started handing out copies of the paper signed with a paw print.

In the same spirit, Shalosh B. Ekhad at Rutgers University so far has published 32 peer-reviewed papers in scientific journals with his co-author Doron Zeilberger. It turns out that Shalosh B. Ekhad is Hebrew for the model number of a personal computer used by Dr. Zeilberger. "The computer helps so much and so often," Dr. Zeilberger said.

French physicist Georges Aad is often named first in scientific papers because co-authors are listed alphabetically. *PHOTO: GEORGES AAD*

Not everyone takes such pranks lightly.

Immunologist Polly Matzinger at the National Institute of Allergy and Infectious Diseases named her dog, Galadriel Mirkwood, as a co-author on a paper she submitted to the Journal of Experimental Medicine. "What amazed me was that the paper went through the entire editorial process and nobody noticed," Dr. Matzinger said. When the

journal editor realized he had published work crediting an Afghan hound, he was furious, she recalled.

Physicists may be more open-minded. Sir Andre Geim, winner of the 2010 Nobel Prize in Physics, credited H.A.M.S. ter Tisha as his co-author of a 2001 paper published in the journal Physica B. Those journal editors didn't bat an eye when his co-author was unmasked as a pet hamster. "Not a harmful joke," said Physica editor Reyer Jochemsen at the Leiden University in the Netherlands.

"Physicists apparently, even journal editors, have a better sense of humor than the life sciences," said Dr. Geim at the U.K.'s University of Manchester.

In fact, some scientists speculate that "Aad" isn't a real person. He is listed among a group of thousands of researchers from 38 countries who use the ATLAS particle detector at the Large Hadron Collider. Some speculate that the ATLAS group picked the name to avoid disputes over who most deserves to be named first author on each new research paper.

Aad would always appear first in their alphabetical listing.

Google searches turn up little information about someone so well published. In a field notable for seeking the "God particle," the pronunciation of the name as it usually appears in technical citations—G. Aad—has stoked suspicions.

"People ask me," said Dr. Aad. "Do you exist?"

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