

Small Teams Generate New Directions in Science and Technology; Large teams Develop Them



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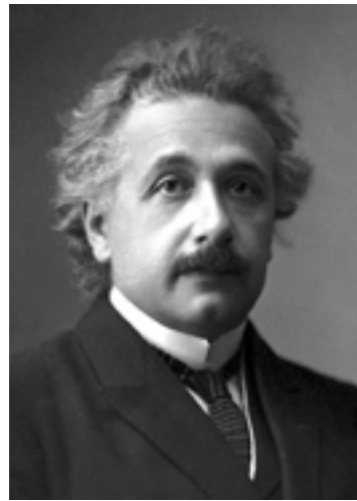
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Different *Roles* in knowledge production

It takes **1** scientist to **ask**

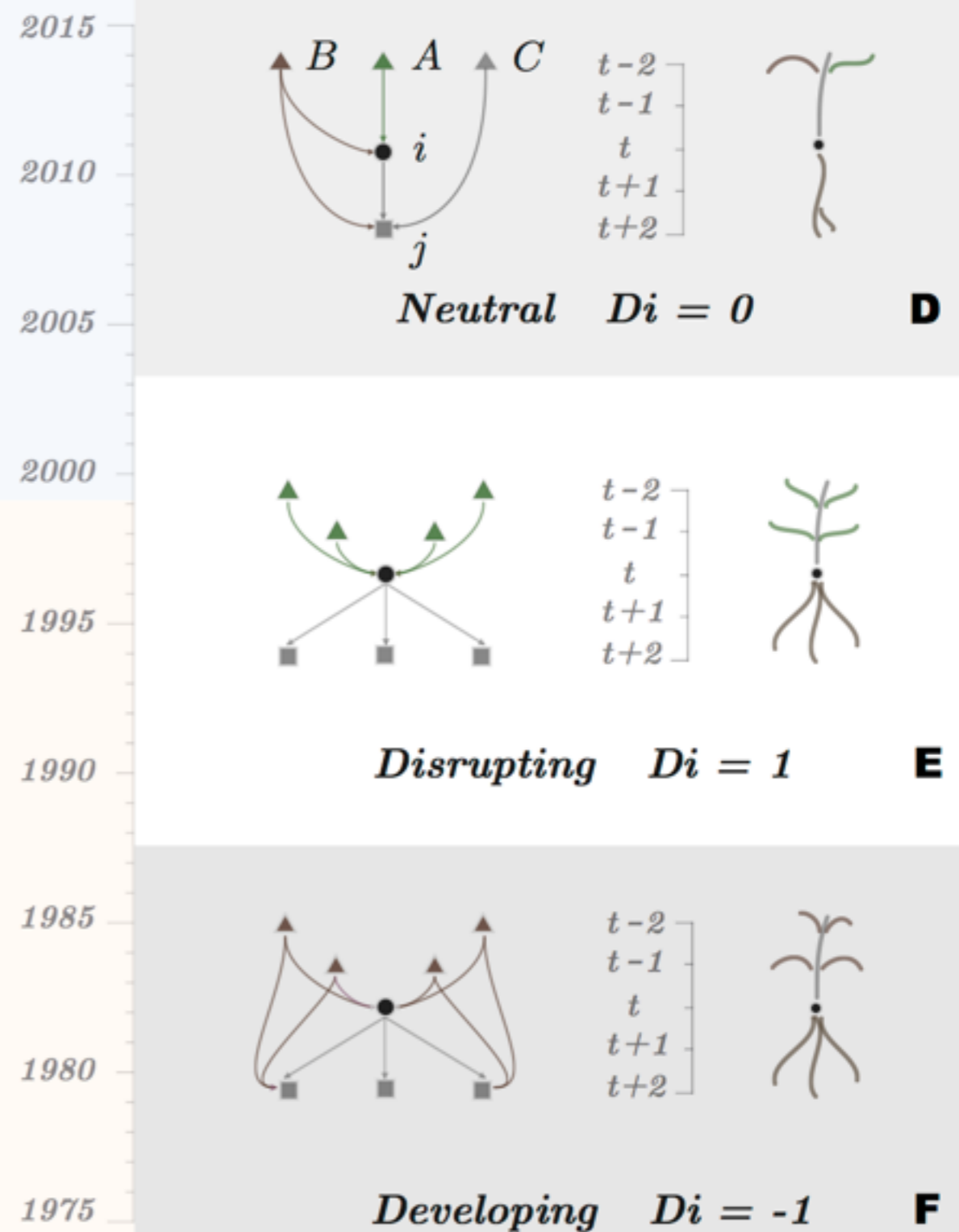
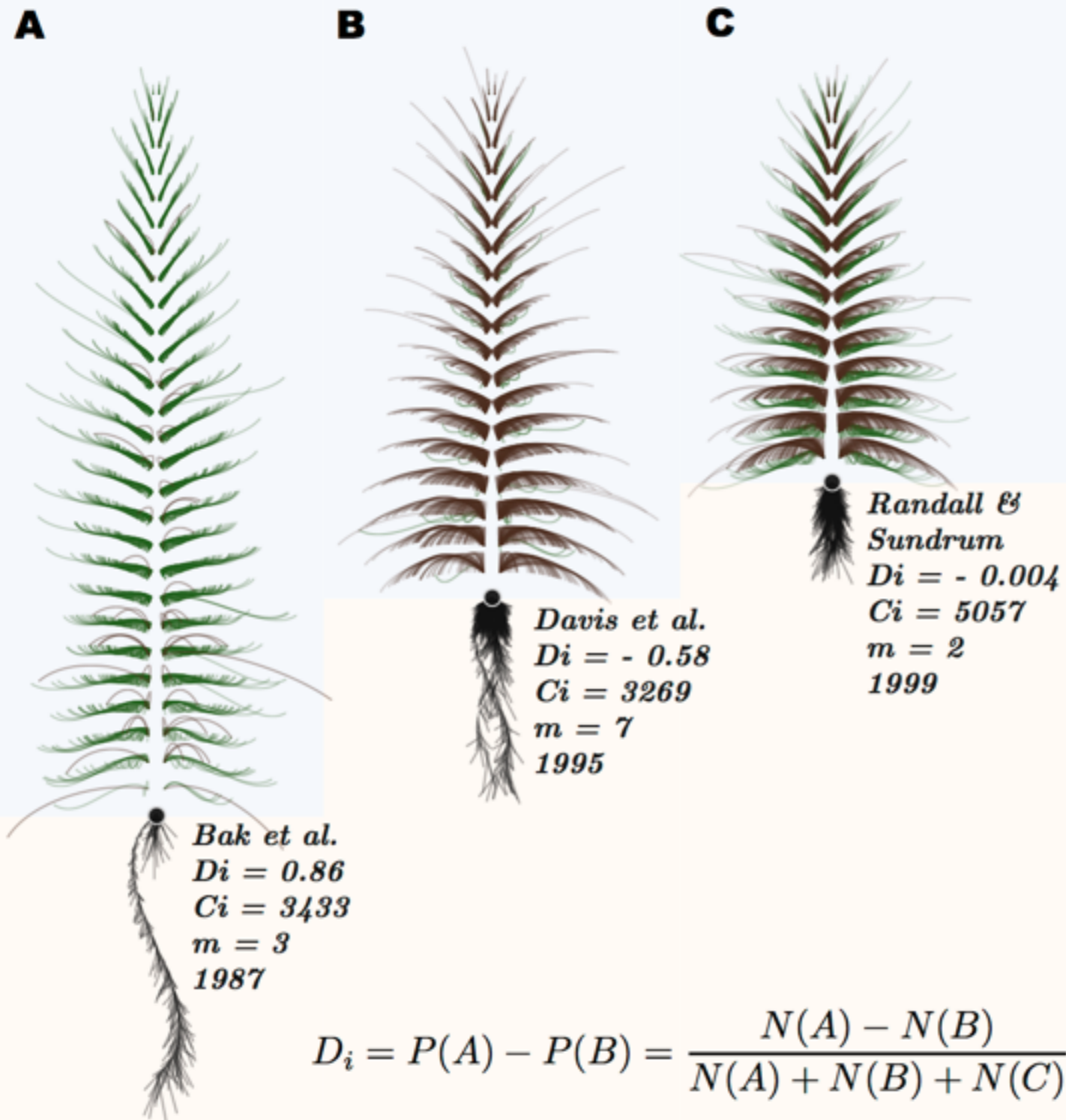
100 years and **10000** scientists to **answer**



A. Einstein, Sitzungsber. K. Preuss. Akad. Wiss. 1, 688(1916).



Different *Roles* in Knowledge production: the limitation of citation counts

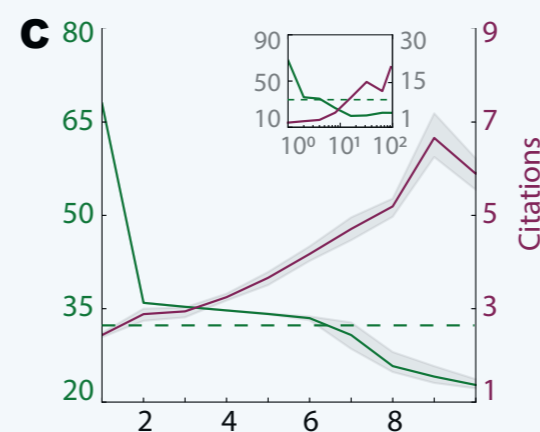
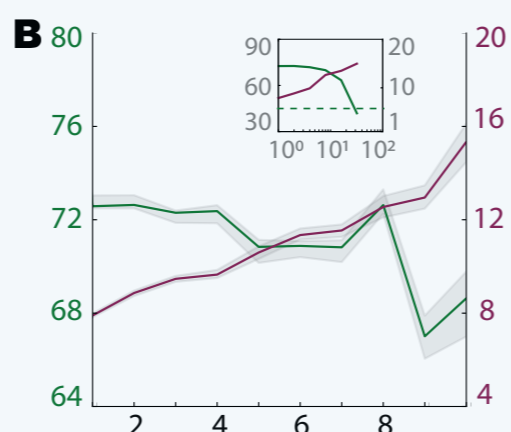
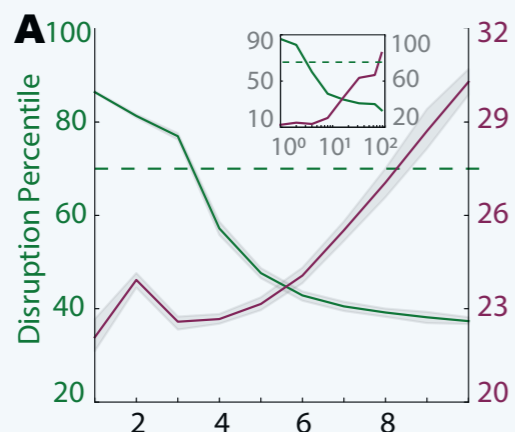


Articles

Patents

Software

Average
teamwork

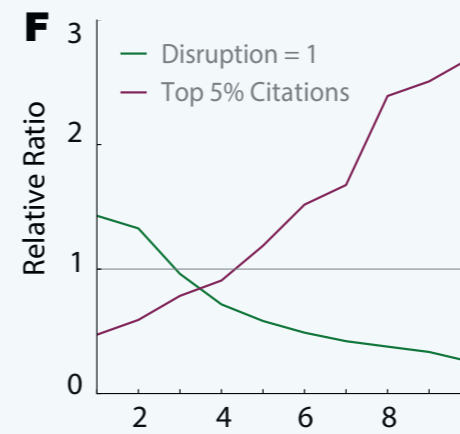
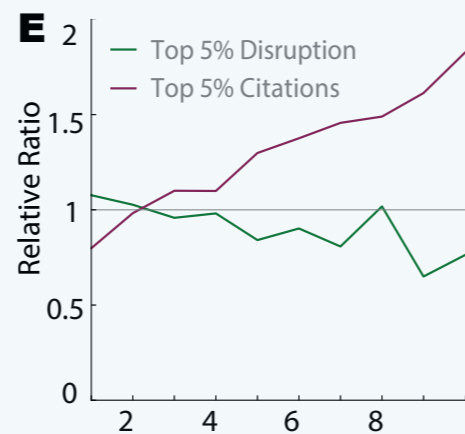
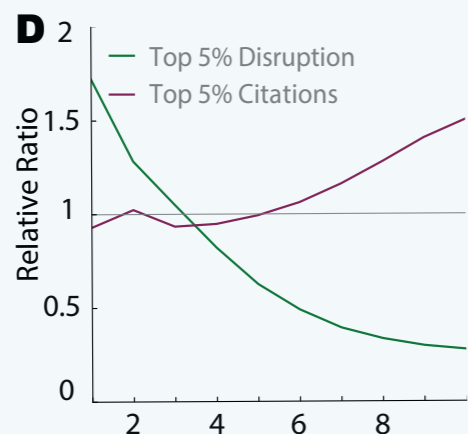


44 million articles

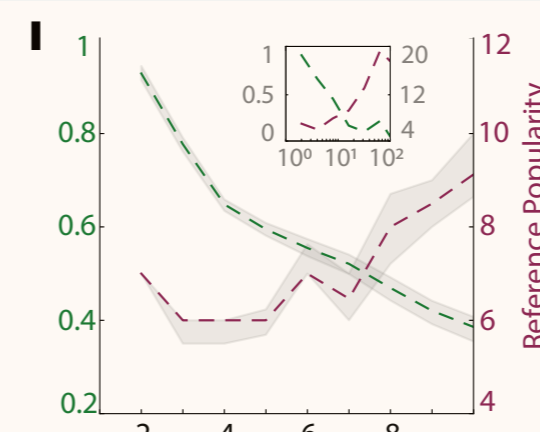
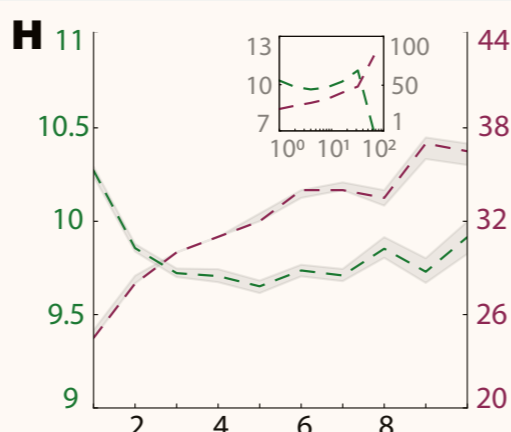
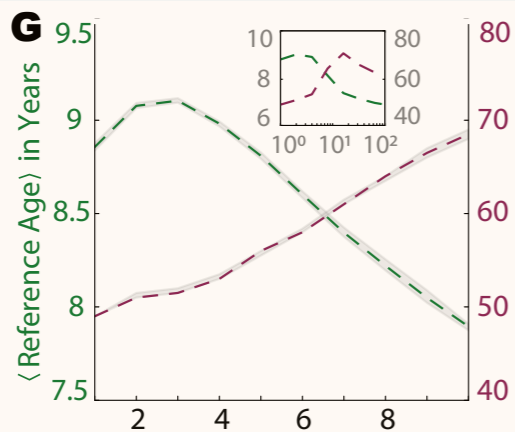
5 million patents

16 million software

Top
teamwork

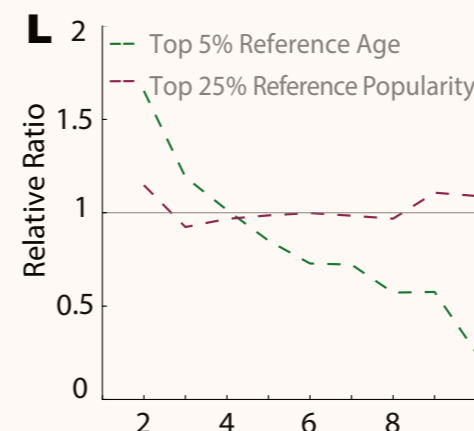
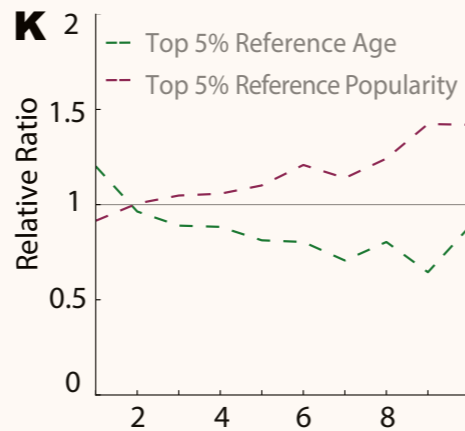
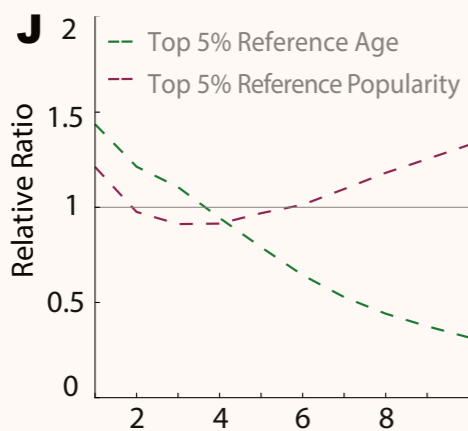


Average
teamwork

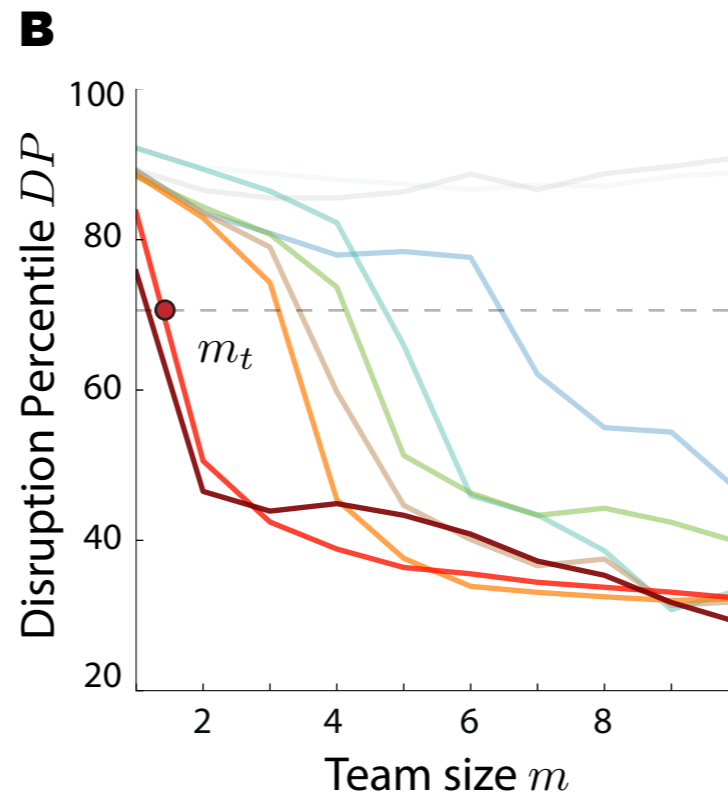
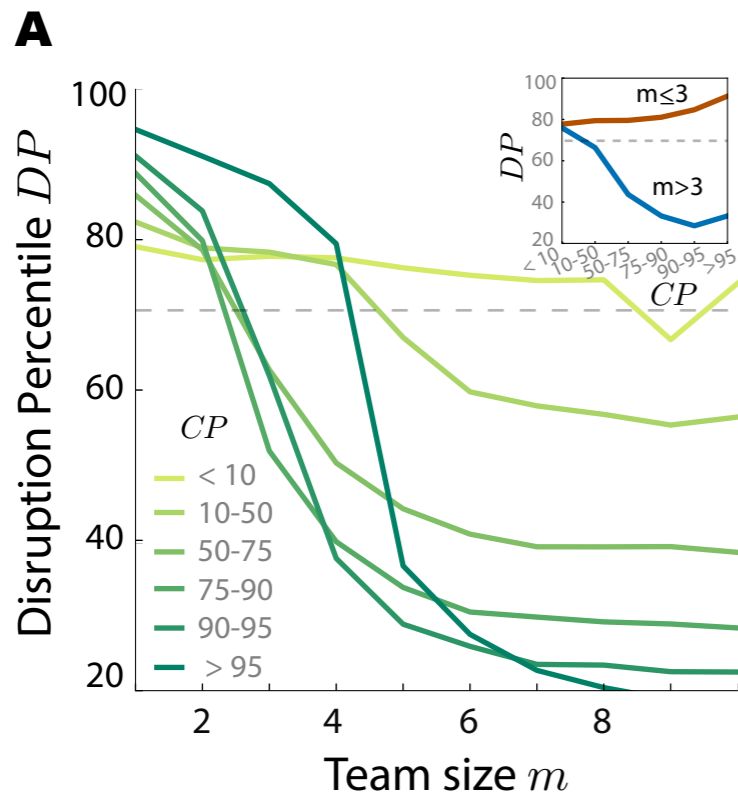


Small teams are more
disruptive
and less *impactful*

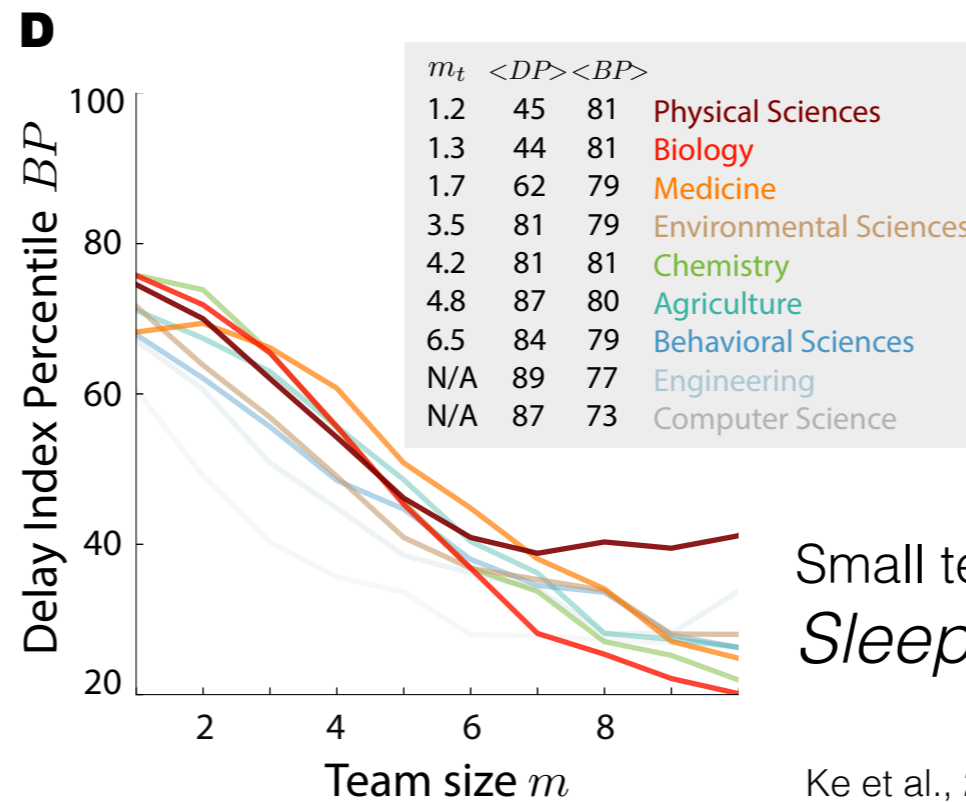
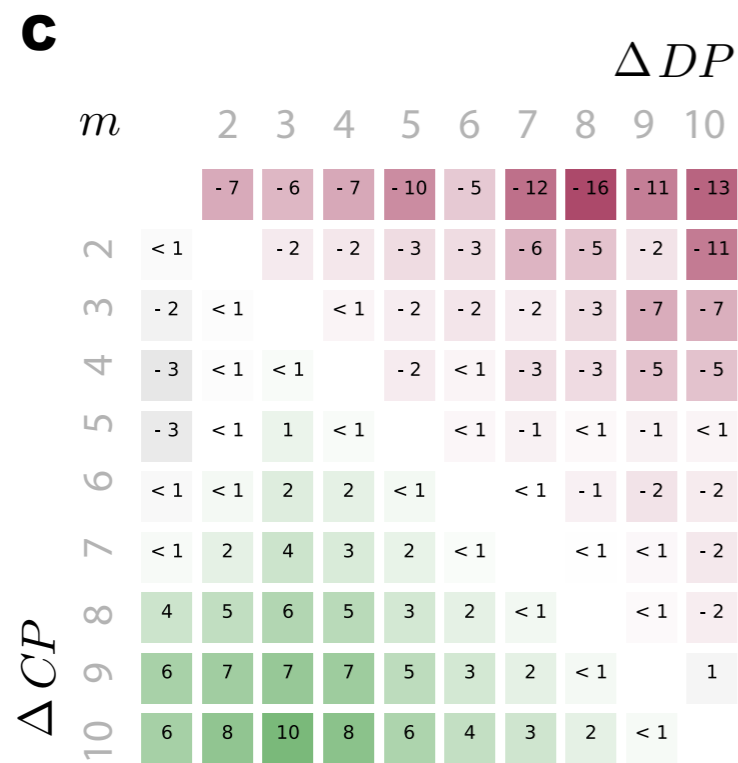
Top
teamwork



Small teams draw
on *earlier* and *less*
popular ideas



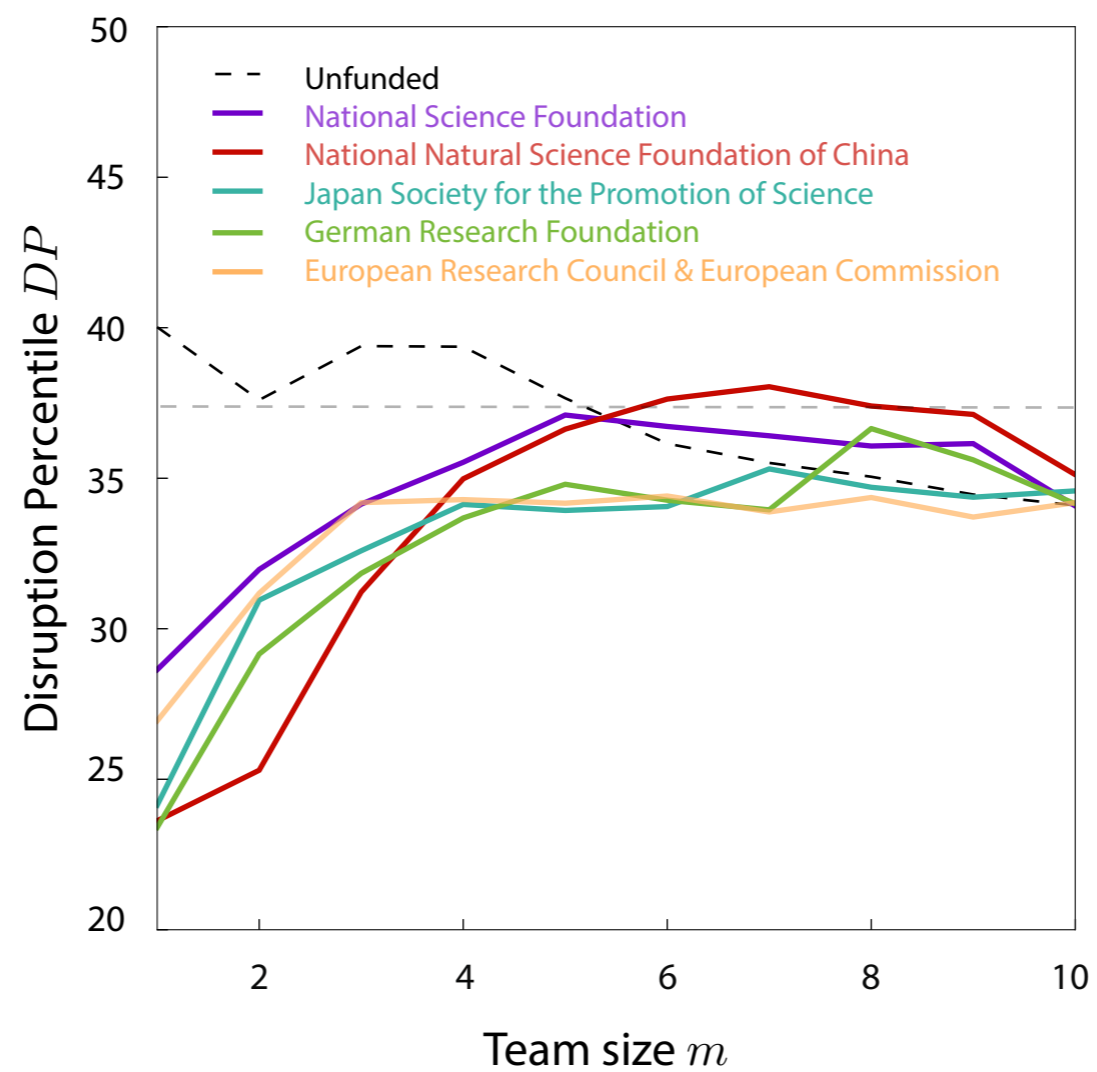
Small teams are more *disruptive* across *fields*, *impact levels*, & *individuals*



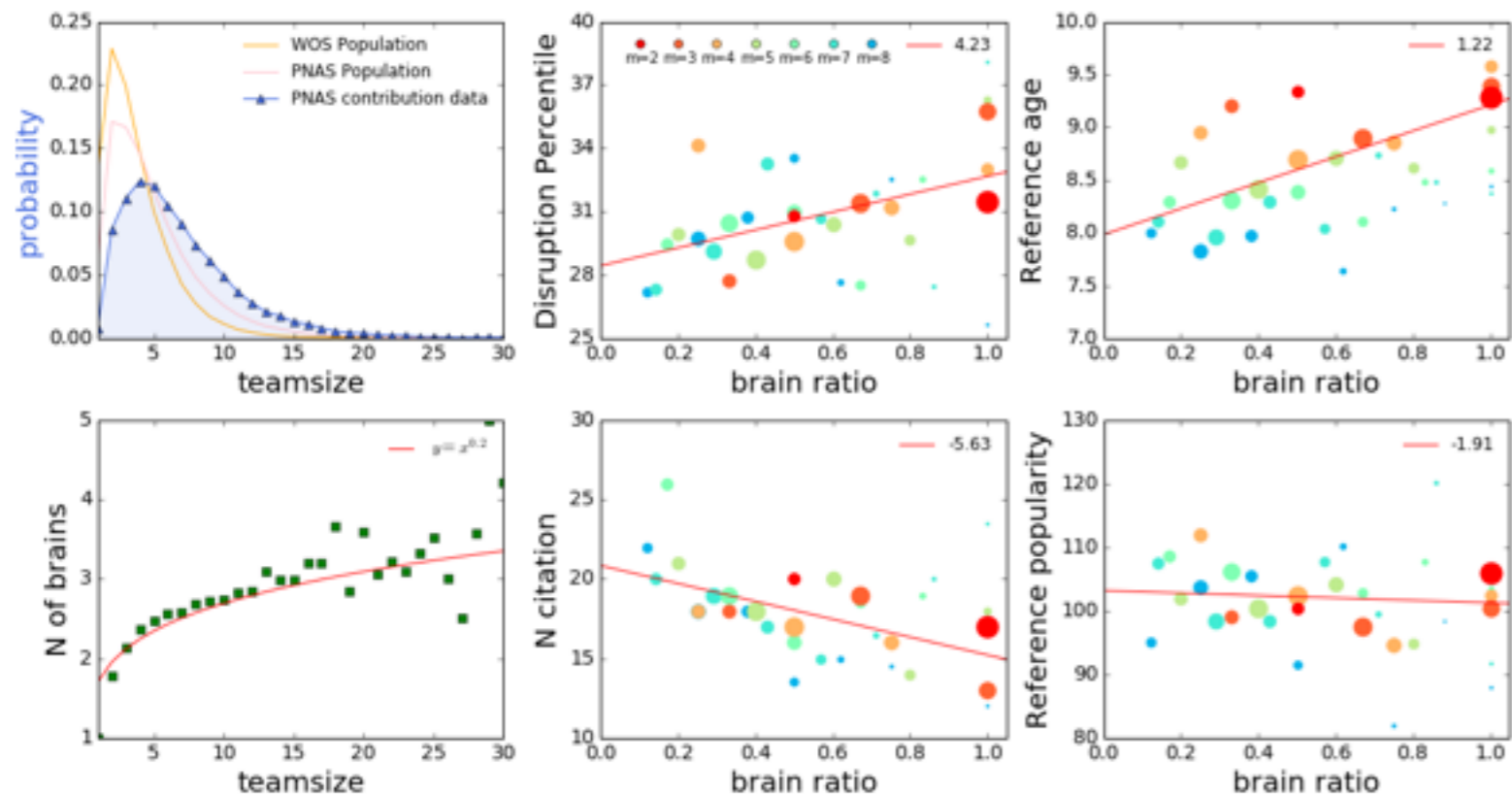
Small teamworks are more likely to be *Sleeping Beauties* in science

Ke et al., 2015 *PNAS*

How to fund innovative teamworks ?



Future work: team combination and performance



Data: the contribution text of >15 k PNAS papers

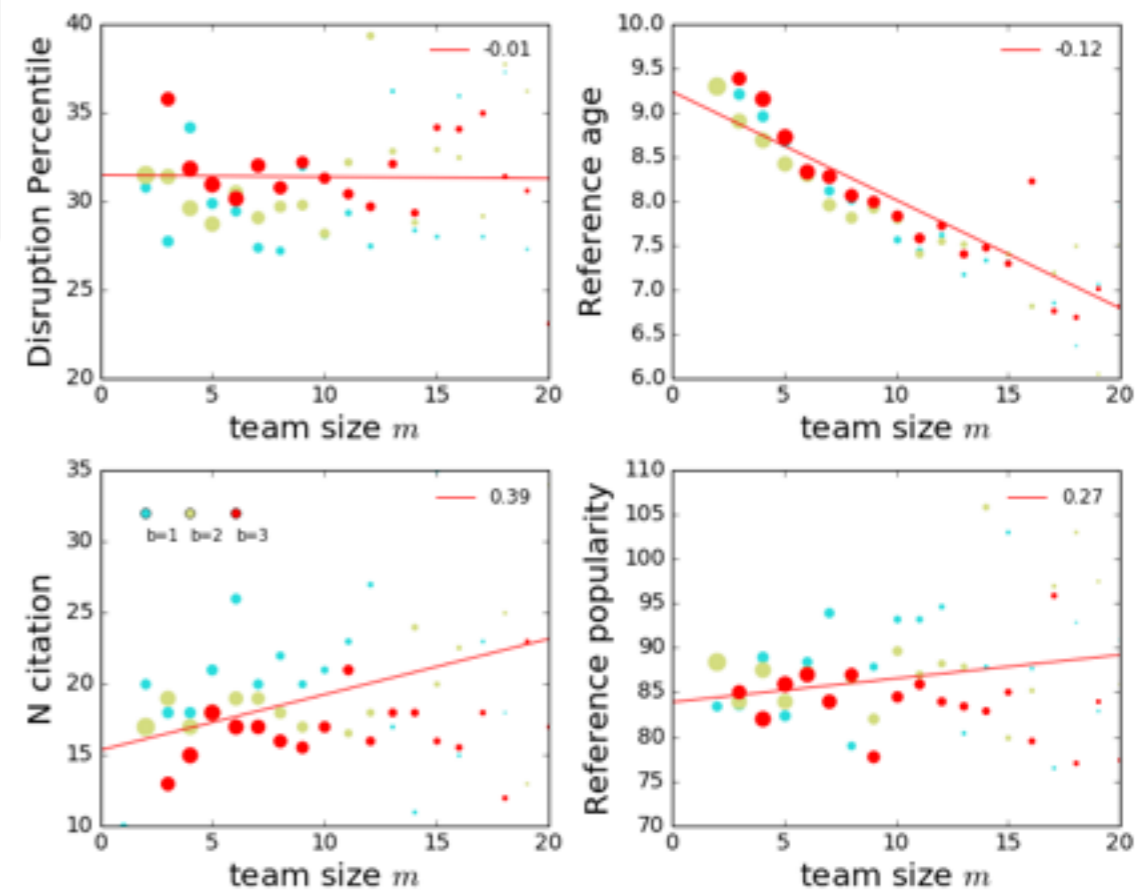
“Brains”: the author(s) both “design research” and “write paper”

“Muscles”: all the other authors

More “brains” more innovative



More “muscles” more conservative



How many “muscles” can a brain mentor? Does it increase over tech development?

What kind of team is needed to address complex problems? Large vs effective?