# How to judge how good a scientist is ?

Excerpted From Prof. J. P Sumpter of Brunel University London, UK, What makes a good scientist? Karl Fent as an example in Journal of Hazardous Materials，376 (2019)，233–238 with some supplements
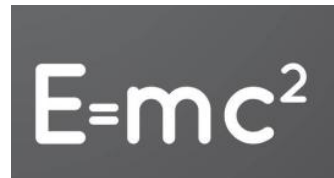
Edited by Hong LIU

March 2020,
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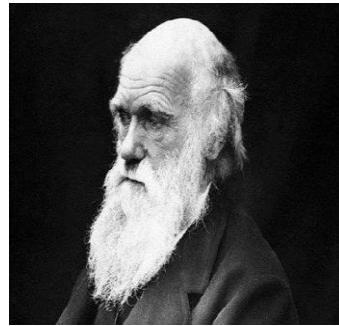
Some exceptional scientists in public eyes
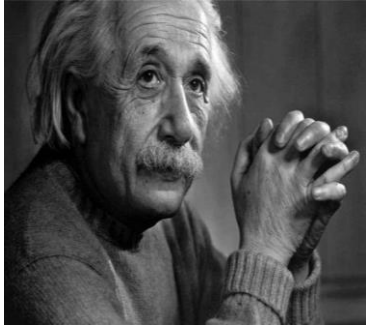
Albert Einstein (1879-1955)
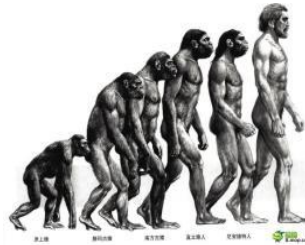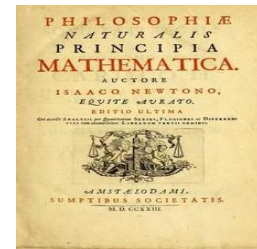
Marie Curie (1867-1934)

Charles R. Darwin (1809-1882)

Isaac Newton (1643-1727)

Galileo Galilei (1564-1642)

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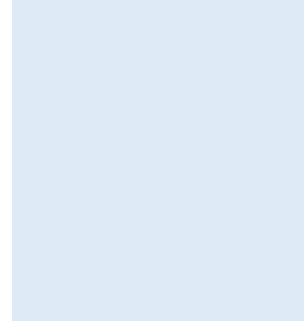
Because their discoveries changed the world and human's life

How can we judge how good a scientist is currently?

(1) Subjective opinions: made by the academic peers

Bias likely arises as we suffer so frequently in real life, as these were just opinions, not facts supported by evidence.

This situation was radically transformed in the 1970's: citation analysis was born

(2) The use of metrics: amount of papers, citations, h-index, ⋯⋯

Who is the best research scientist? These are possible, not actual, metrics, but they are probably representative of productive scientists at different stages of their careers.

Position	Age (years)	Length of publishing career (years)	Number of papers	Number of citations	Average number of citations per paper	H-Index
PhD student	28	2	2	6	3	2
Post – doctoral fellow	34	8	9	54	6	4
Assistant Professor	38	12	15	225	15	11
Associate Professor	52	26	48	1,152	24	20
Full Professor	58	32	150	3,000	20	30
Retired Professor	66	40	220	8,360	38	46

听说隔壁实验室
又发了三篇SCI

不就是写论文吗
我写我写

论文格式还是不对，
拿回去改吧

(3) Research impact

- To lead to a major beneficial change in society is better than the esoteric research appeared to be of very little interest or relevance to anyone.

- Impact evaluation methodology itself has become an active and dynamic field of study.
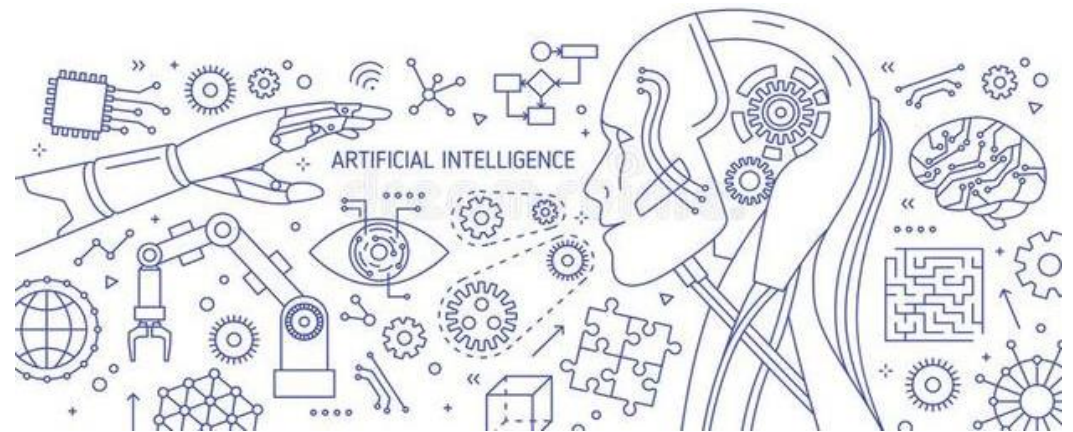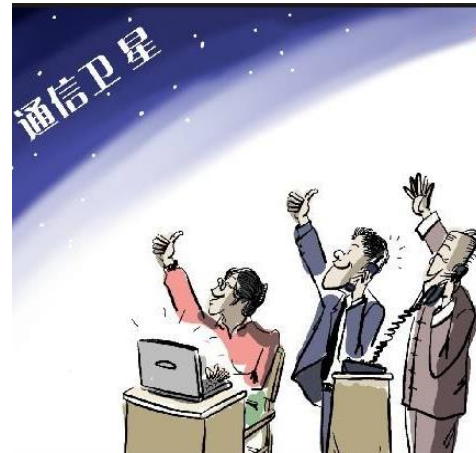
However, this impact can take years, or even decades,to become apparent
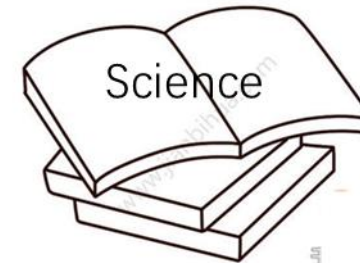
Let the bullet fly for a while

(4) Other outputs

- Articles in newspapers and magazines, and appearing on television and radio.
- Blog, tweets on Twitter
- Books

However, an outrageous scientific claim might cause asocial media 'storm', but be based on fabricate devidence, or no evidence at all.

Also the topics are unrelated to science, or the audience may be of uninterest, even misled.

(5) Teaching

- Scientists based in universities are likely to do considerable amounts of formal teaching.
- Teaching sometimes contributed more to the legacy than the research and articles.
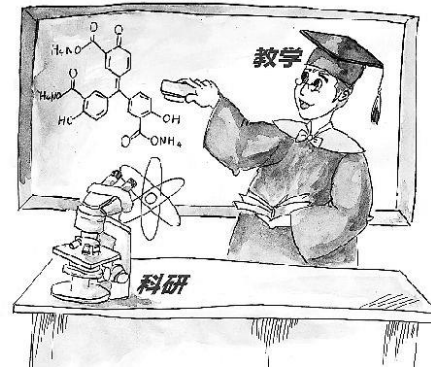
Unfortunately no simple–or even complex–metric has been developed yet that can identify and quantify the importance of teaching.

(6) Supervision and mentoring of juniors cientists

- One-to-one activities

- To ensures that the next generation of scientists will be well trained, from Ph.D. students.

- Some excellent research scientists are not particularly good supervisors

  Some excellent supervisors are not particularly good research scientists.

  The best scientists are both.

(7) Leadership

- Individual's research is conducted within a team or an organization devoted to a particular topic.
- Someone, almost always another scientist, very definitely a good scientist, lead the team or organization.

- Leadership, very demanding and time-consuming.
- A good administrator, likely having little or even no time for their own research, protects other scientists from non-scientific issues, so that the latter can concentrate on their research.
- Leaders contribute in a more indirect manner, and contribution should not be underestimated.

However, quantifying this aspect of the contribution to the discipline is only possible subjectively; no metric available for scientific leadership.

该投谁，我心里有数！
我的工作   我的工作
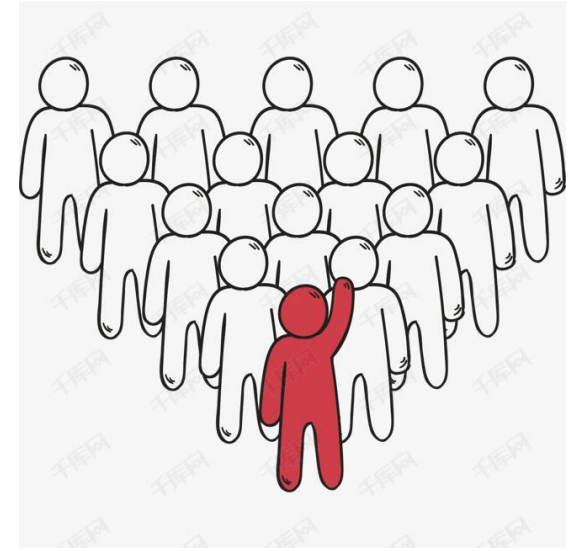
(8) Appropriate mental characteristics （besides intelligence）

- **Objectivity:** open mind instead of letting existing prejudices influence thinking, unbiased
- **Curiosity:** the desire to understand something of interest; to be inquisitive about the world
- **Vision:** the ability to identify important new research topics, rather than follow fashionable topics, and then have the courage to initiate research on those novel topics
- **Finishing something**: knowing when 'enough is enough' on a topic, hence completing that project, then moving on to the next topic
- **Communication skills**: the ability to deliver public talks and publish scientific papers, in order to make others aware of research findings
- **Coping with failure**: persevering while regularly 'failing' is a prerequisite of any scientist
- **Hard work:** passionate about their research

Many have very balanced characters, enabling them to interact well with other scientists and allowing them both to lead scientific projects and collaborate with other scientists successfully.

(9) Integrity

- Not published research of poor quality or irreproducible

- Not publishing negative results and/or exaggerating positive results, or fabrication of results

- Bias in the interpretation of results

- Hype and exaggeration,especially in the title and abstract

- Figures that distort data, or do not display it fully

- Failure to cite relevant papers from other scientists

- To omuch selfcitation

- Failure to mention any limitations to the study

- Conflicting interests not mentioned

- Rawdata not submitted as supplementary information

- Failure to analyse the results appropriately and accurately

Scientific integrity is such a crucial factor in science, then to consider it separately from other personal characteristics often possessed by good scientists.

No metric for integrity! But I don't believe that" or "that paper is very poor", or alternatively positive comments like "he/she doe excellent research" or " that is a very robust study".
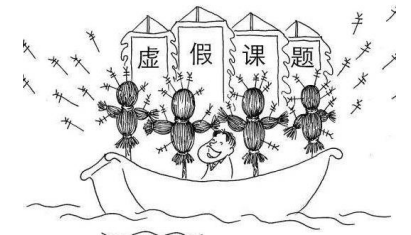
(10) Humanism and patriotism （supplemented by this PPT editor）
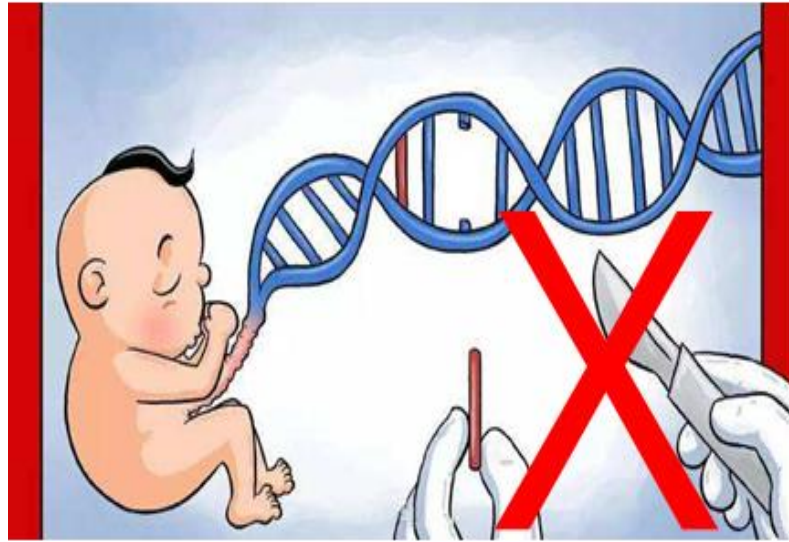
Final thoughts: Most scientists should all aspire to being good research scientists, because only good research is of benefit to society. The advent of scientific metrics applied to the output of scientists has helped to add a degree of objectivity into the judging of scientists, but perversely it has also stimulated a range of poor scientific practices, as scientists try to 'play the game' to satisfy their paymasters, who often utilize metrics uncritically. Probably only further education and training can improve the current situation, and enable as many research scientists as possible to become good researchers.