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Chemistry Papers Rank High Among Once-Obscure Studies That Recently Racked Up Citations

Research: So-called sleeping beauties are more common than previously thought

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It's the dream of the underappreciated scientist. A research paper that barely made a blip soon after its publication is rediscovered decades later and recognized with citations in thousands of other published science studies.

A new analysis of these so-called sleeping beauty publications by researchers at Indiana University, Bloomington, has found that they are not as rare as once thought (*Proc. Natl. Acad. Sci. USA* 2015, DOI: [10.1073/pnas.1424329112](#)). And chemistry is a top producer of this type of paper. Seven of the top 15 sleeping beauty studies identified were published in chemistry journals.

The number of citations a paper gets has risen in importance as research institutions, individuals, and publishers increasingly use them to appraise the quality of science. They rarely look for citations beyond the first few years after a paper's publication, however.

In contrast, sleeping beauties go decades with little recognition before they are "awakened" with a wave of citations. The phenomenon of a long-dormant paper reemerging has long been considered rare.

The Indiana researchers were the first to search for sleeping beauties in a wide swath of papers, examining 22 million citations across all science disciplines, explains Mark Newman of the University of Michigan, who peer reviewed the paper for *PNAS*. They found that most research papers follow a standard course: They are cited the most in the years immediately following publication, then citations gradually fade away.

But some papers emerge with a spike in citations decades later. For example, a 1906 *Zeitschrift für Physikalische Chemie* paper that modeled adsorption now helps clean up metals and pharmaceuticals from drinking water; it started getting numerous citations in 2002.

The scientists still don't know exactly what wakes a sleeping beauty or how to predict which papers will rise from obscurity. A paper could contain a novel idea that takes a while to become accepted, says Peter J. Stang, editor-in-chief of the *Journal of the American Chemical Society*, which published two of the top 15 sleeping beauties identified in the new study. Or perhaps a method or idea that is old hat in one discipline suddenly rises to prominence in a new field, he suggests.

Chemistry's prominence among sleeping beauties "speaks well for the breadth and depth of chemistry," Stang says. "Chemistry has a lot of paradigm-shifting ideas. It has impact and implications for a lot of different disciplines."

RESEARCH AWAKENING

Seven chemistry papers are among the top 15 science papers not heavily cited until decades after publication

RANK IN TOP 15	DESCRIPTION/MODERN-DAY APPLICATION	AUTHOR(S)	REFERENCE	PUBLICATION YEAR	"AWAKENING" YEAR	NO. OF CITATIONS
	Models adsorption of molecules from	H.				

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1	solution/removal of metals and drugs from drinking water	Freundlich	<i>Z. Phys. Chem.</i> 57, 385	1906	2002	2,685
2	Synthesis of graphitic oxide/produce precursor to graphene	W. S. Hummers, R. E. Offeman	<i>J. Am. Chem. Soc.</i> DOI: 10.1021/ja01539a017	1958	2007	8,379
4	Describes wetting on porous surfaces/theory behind superhydrophobic surfaces	A. B. D. Cassie, S. Baxter	<i>Trans. Faraday Soc.</i> DOI: 10.1039/tf9444000546	1944	2002	4,523
5	Study of growth of gold colloids/design of gold nanoparticles	J. Turkevich, P. C. Stevenson, J. Hillier	<i>Discuss. Faraday Soc.</i> DOI: 10.1039/DF9511100055	1951	1997	2,477
8	Study of various emulsifiers/preparation of surfactant-free emulsions	S. U. Pickering	<i>J. Chem. Soc. Trans.</i> DOI: 10.1039/ct9079102001	1907	1998	1,083
9	Describes wetting of solid surfaces/theory behind superhydrophobic surfaces	R. N. Wenzel	<i>Ind. Eng. Chem.</i> DOI: 10.1021/ie50320a024	1936	2003	4,427
11	Reviews theory of solid and liquid evaporation and condensation/theory behind adsorption of solutes such as drugs and proteins	I. Langmuir	<i>J. Am. Chem. Soc.</i> DOI: 10.1021/ja02268a002	1958	2003	2,813

NOTE: Papers as ranked by a "beauty" factor, a measure of the rate at which a paper rose from obscurity. Citations as of May 26, 2015. **SOURCES:** *Proc. Natl. Acad. Sci. U.S.A.*, Web of Science

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David Dodds (June 3, 2015 2:03 PM)

More than just well-deserved rewards for under-appreciated individuals, this shows the value of research beyond the short-term perspective of corporate decision-making and government funding. It should be sent to all members of Congress.

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