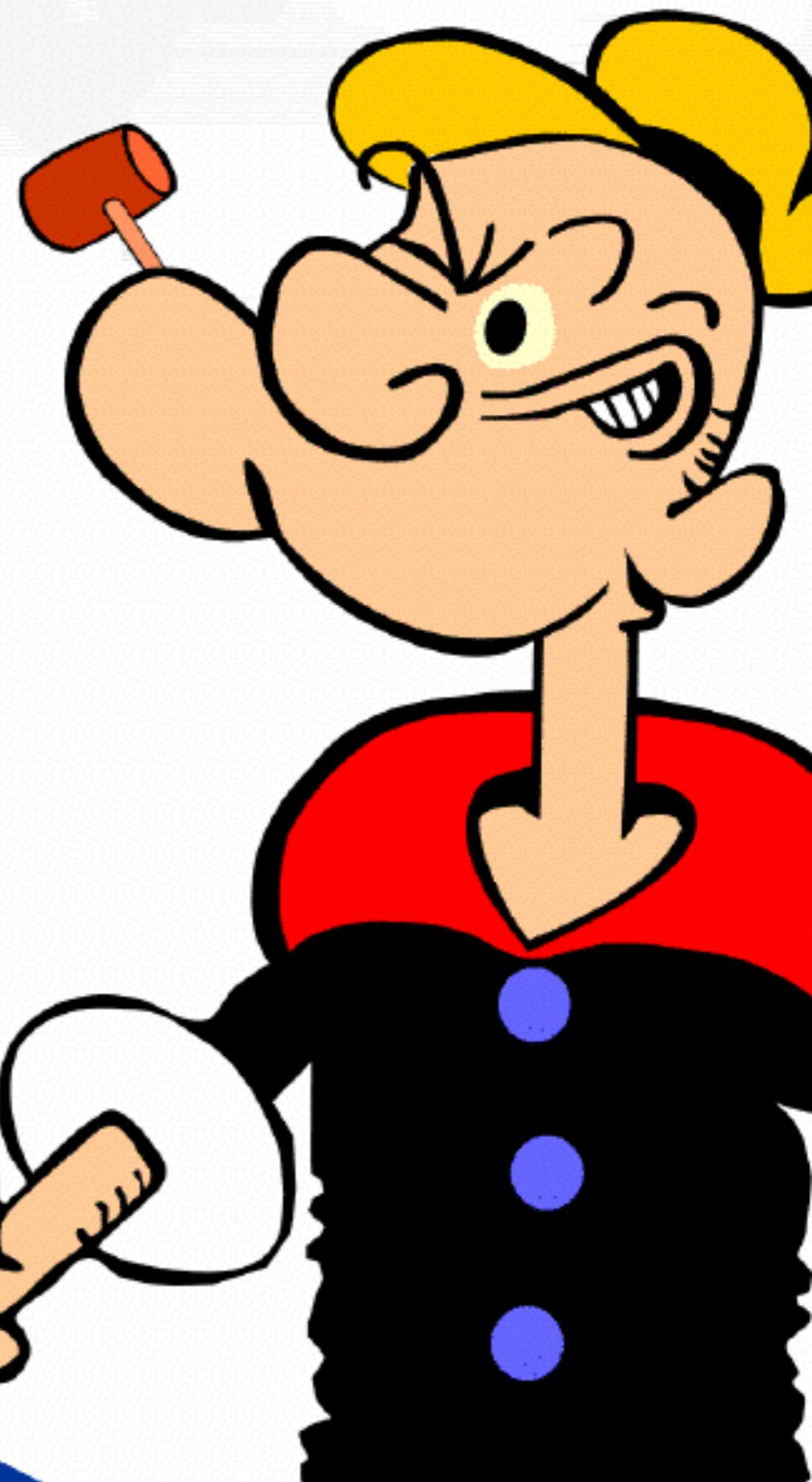




Scary Science



Spinach is rich in iron, right?



Sorry Popeye, spinach DOESN'T make your muscles big: Expert reveals sailor's love of the food was due to a misplaced decimal point

- The iron content of spinach was miscalculated by a German chemist when he misplaced a decimal point
- While there are just 3.5 milligrams of iron in a 100g serving of spinach, the accepted number became 35 milligrams thanks to his mistake
- This caused the popular misconception that spinach is exceptionally high in iron, which makes the body stronger
- The connection between the incorrect calculation and popular cartoon character has been made in a book by scientist Samuel Arbesman

By SARAH GRIFFITHS

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Popeye's love of spinach is born out of one of history's easiest mathematical errors.

A mathematician and scientist has revealed that spinach's iron content was miscalculated by a German chemist when he misplaced a decimal point.

His mistake gave birth to Popeye's obsession with the vegetable, which the cartoon character eats in vast quantities to boost his strength.

Popeye's testimony that he is 'strong to the finish, 'cause I eats my spinach' is apparently born from a mistake 50 years before he became popular.

Is spinach a great source of iron?

Despite what Popeye led a lot of young people to believe, spinach is not particularly rich in iron. In reality, it has about the same iron content as many other green vegetables, according to Dr. Philip Kern, M.D., Department of [Endocrinology/ Metabolism](#) at UAMS. "Spinach also contains oxalic acid, which prevents more than 90 percent of the iron from being absorbed by the body," says Dr. Kern.

The idea that spinach contained exceptional levels of iron originated in 1870 with Dr. E. von Wolf whose figures remained unchallenged until 1937, when it was discovered that the content was 1/10th the claim. The oversight resulted from a misplaced decimal point.

However, don't skip the spinach entirely. Spinach is rich source of vitamin A, vitamin E and several vital antioxidants. Spinach also includes more than a half-day's supply of beta carotene in just a half cup of the vegetable, adds Dr. Kern.

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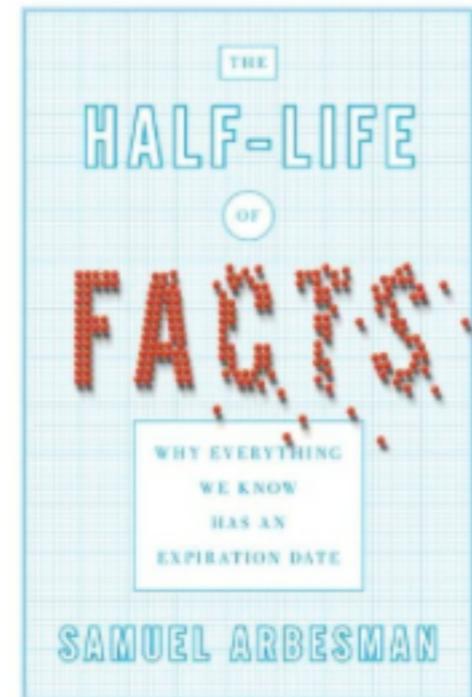
The True Science of Spinach: What the Popeye Mythology Teaches Us about How Error Spreads

by [Marla Popova](#)

How a misplaced decimal point created a beloved pop-culture hero.

During my teenage years, given my athleticism, my insatiable appetite for spinach, and my last name, friends were quick to latch onto the stuff of pop-culture legend and nickname me Popeye. But it turns out that besides perpetrating the crime of the too-obvious-for-its-own-good pun, they were also perpetuating one of history's strangest and most egregious scientific errors.

In *The Half-life of Facts: Why Everything We Know Has an Expiration Date* ([public library](#)) — the same fascinating volume that explored how Gutenberg's press embodied combinatorial creativity and the predictable patterns of how knowledge grows — **Samuel Arbesman** illustrates how error spreads by debunking the Popeye mythology through the curious story of the scientific error that precipitated the misconception.



Fake!

T J HAMBLIN

Thou shalt not steal, an empty feat
When it's so lucrative to cheat.—

ARTHUR HUGH CLOUGH,
The Latest Decalogue

In the year that Popeye became once again a major movie star it is salutary to recall that his claims for spinach are spurious. Popeye's superhuman strength for deeds of derring-do comes from consuming a can of the stuff. The discovery that spinach was as valuable a source of iron as red meat was made in the 1890s, and it proved a useful propaganda weapon for the meatless days of the second world war. A statue of Popeye in Crystal City, Texas, commemorates the fact that single-handedly he raised the consumption of spinach by 33%. America was "strong to finish 'cos they ate their spinach" and duly defeated the Hun. Unfortunately, the propaganda was fraudulent; German chemists reinvestigating the iron content of spinach had shown in the 1930s that the original workers had put the decimal point in the wrong place and made a tenfold overestimate of its value. Spinach is no better for you than cabbage, Brussels sprouts, or broccoli. For a source of iron Popeye would have been better off chewing the cans (fig 1).

Frauds, hoaxes, fakes, and widely popularised mistakes run through the warp and woof of the history of science and medicine.



FIG 1—Popeye . . . would have done better to eat the cans.

The discovery that spinach was as valuable a source of iron as red meat was made in the 1890s

Useful propaganda weapon for the meatless days of the second world war.

Popeye was commemorated for single-handedly raising the consumption of spinach by 33%

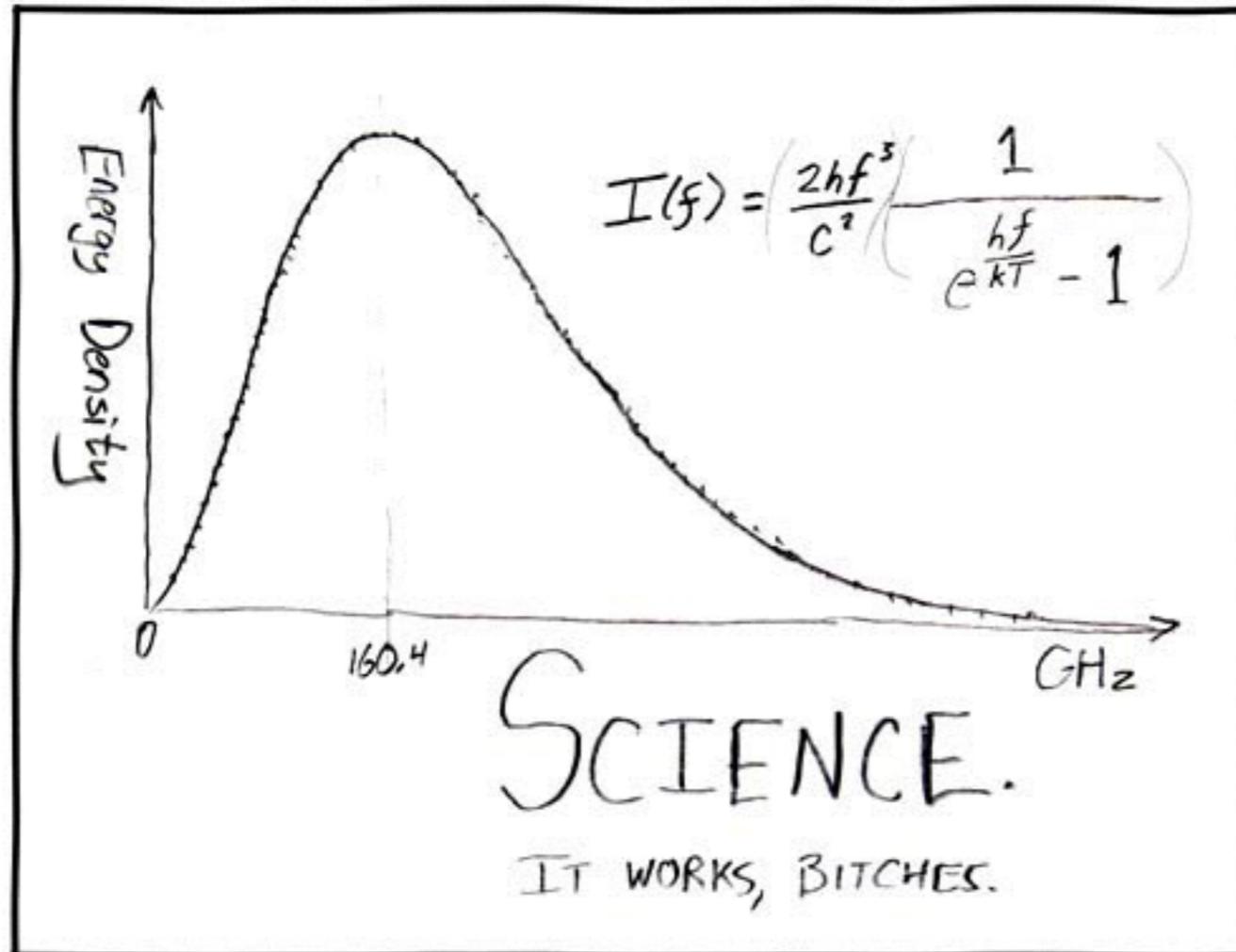
German chemists . . . had shown in the 1930s that the original [study] put the decimal point in the wrong place.

For a source of iron Popeye would have been better off chewing the cans

Plagiarism plus dishonesty

A more worrying case of plagiarism has also recently been exposed. The plagiarism itself was minor but was complicated by dishonesty, which caused heads to roll and a deep unease to settle over scientific medicine.

In 1978 Dr Helena Rodbard submitted a manuscript to the *New England Journal of Medicine* which reported her studies on insulin receptors in anorexia nervosa. After a long delay her manuscript was rejected. Some months later she was shown a



Most people forget about the third worker on the site, mistakenly thinking him to have left England permanently before the excavations were complete or being unwilling to associate such a famous man. In fact, Teilhard de Chardin was in England in 1914 before the last fossils were found. He was a geologist who had lectured on chemistry at Cairo University. There are two further pieces of evidence that point in his direction. A Stegodon tooth "found" at Pilt-down and now shown in the British Museum. Such teeth come only from Ichkeul near Bizerta in Tunisia. Teilhard is known to have camped near there in 1914. The other is an elephant bone tool typical of the site. Teilhard was born not a hundred miles away and was famous for his archaeological artefacts.

His motive? To support his strange harmonisation of evolution and religion which he described in *The Phenomenon of Man*. Malcolm Bowden in his book *Apeman—Fact or Fallacy* has further implicated Teilhard in covering up evidence that would have discredited Peking man and with planting further evidence in Java. If Bowden is right then Teilhard certainly deserved the title "Faker of the century."

Underside of a stone

How secure is our body of scientific knowledge? Is more of it fraudulent than we suspect? In his book *Advice to a Young Scientist* Sir Peter Medawar writes of a scientist who plagiarised a number of photographs and several paragraphs of text from a fellow worker and included them in a prize essay. One of his judges was the man from whom the work had been stolen. In the furore that followed the culprit was quietly redeployed into

another institution and has pursued a moderately successful career of petty crime ever since. Medawar does not name the criminal, but if he is known about, how is he allowed to prosper? Is it that he is showing the underside of a stone that none of us would like to turn over in our own lives? A questionnaire in *New Scientist* in 1976 uncovered 189 instances of fraud known to its readership.

Sometimes in the long nights this worries me. Christmas is a good time for confession. If you have a nagging secret in your curriculum vitae that worries you write and tell me about it. If you prefer to do it anonymously I won't betray your confidence. I'd just like to know.

Having spent so much of my time talking about people whose work was unoriginal, I should mention that little of my article is based on original work but has been derived from the publications of others. Among these I should particularly like to mention:

- Arther Koestler: *Case of the Midwife Toad*. London, Hutchinson.
- Malcolm Bowden: *Ape Men—Fact or Fallacy*. Bromley, Sovereign Publications.
- William J Broad: *Science* 208:1438-40, 209:249, 210:38-41, 171-3.
- Colin Tudge: *World Medicine* 1974 Jul 17:34.
- Leon Kamin: *New Society* 1976 Dec 2:460-1.
- Marjorie Sun: *Science* 1981;212:1366-7.
- D D Dorfman: *Science* 1978;201:1177-88.
- Ian St James Roberts: *New Scientist* 1976 Nov 25:466-7.
- C Joyce: *New Scientist* 1981 Apr 9:68-9.
- D Dickson: *Nature* 1981;289:227.
- Nature* 1980;286:433, 831-2.
- Lancet* 1976;ii:1066-7.
- British Medical Journal* 1980;281:41-2.

(Accepted 22 September 1981)

Good servants are scarce

R G GUEST-GORNALL



Turns out, there's a reason that there was no reference...

SPINACH, IRON and POPEYE: *Ironic lessons from biochemistry and history on the importance of healthy eating, healthy scepticism and adequate citation*

By Dr Mike Sutton**

Student: "Why does Popeye eat spinach?"

Professor: "For iron."

Student: "Show me the evidence."

Abstract

To inform knowledge in research methods and dissemination ethics for the natural and social sciences, this article reinforces the importance of citation to support all assertions of fact. New findings are presented for the history of biochemistry, nutrition, psychology, medicine, and the social sciences. Bio-chemistry papers and scientific news reports from the 1930's seriously undermine a long standing truism that in the 1920s and 30s, bio-chemists, nutrition experts, public health policy makers, and E. Segar the creator of the newspaper comic strip Popeye were misled either by a decimal place error in 19th Century published research, or else by erroneous interpretation of 19th Century scientific findings, to exaggerate the iron content of spinach tenfold. Further, the failure to study original sources is evidenced in a multitude of completely erroneous publications claiming that these apocryphal errors caused Segar to choose spinach for Popeye's super human strength. In fact, Segar chose and promoted spinach for its vitamin A content alone.

- Sutton did an unnatural amount of digging into the *“Spinach Popeye Iron Decimal Error Story”* in the search for the origin of the decimal error.
- Eventually contacted Hamblin directly to ask for the source...
- Hamblin replied that he could not remember, but that he was sure he had not made it up...
- Also - this was the Christmas issue of the British Medical Journal, the comedy issue...

Other Sutton findings

Popeye eats some spinach because 'Spinach is full of vitamin A an' tha's what makes hoomans strong an' helty'.



Consumption of spinach in the USA increased long before Popeye had begun to eat it in 1932.

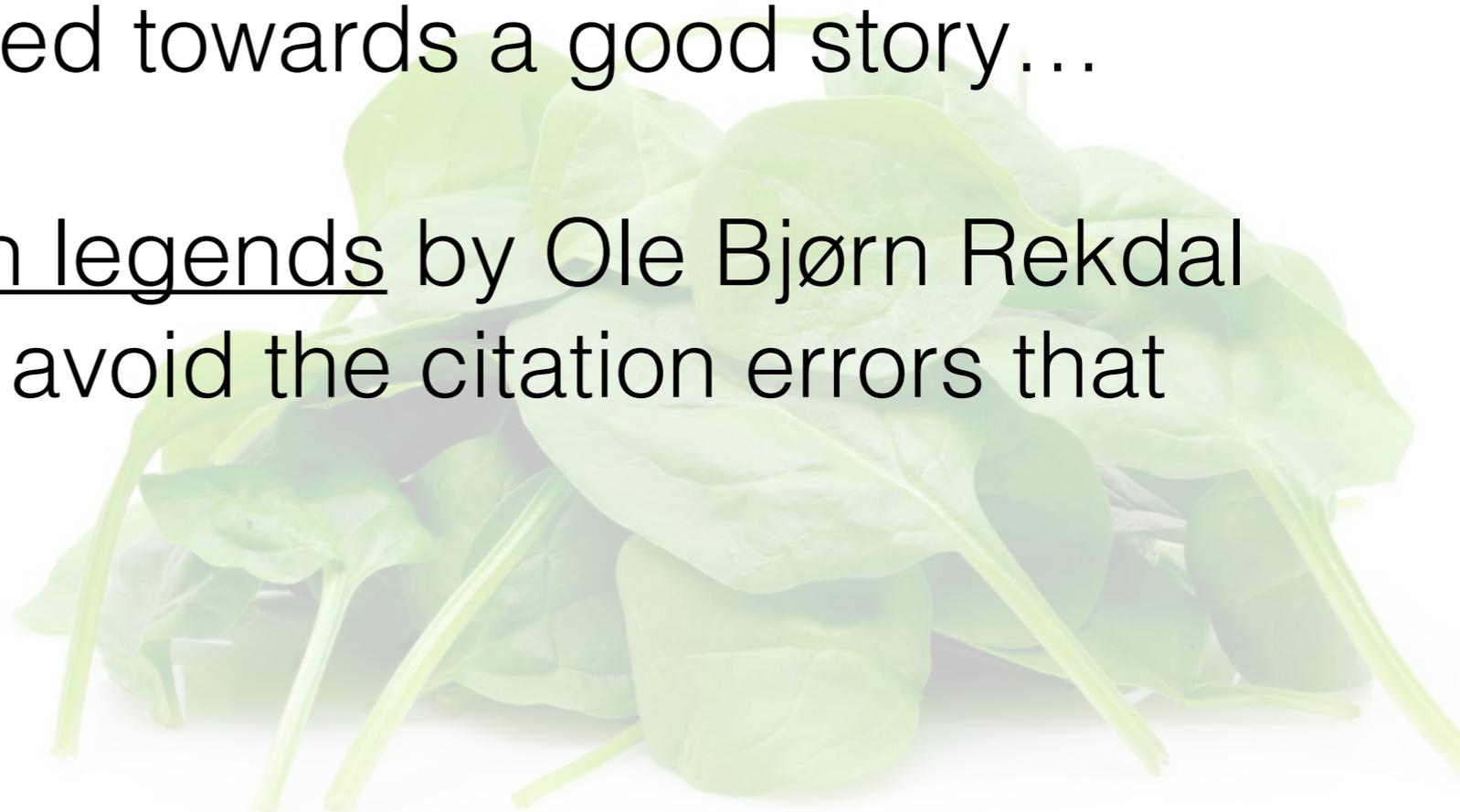
Spinach actually contains about 50 per cent more iron than meat (and 10 times that in dried form). But, only about half of this iron is easily enters the human body

Why is this interesting?

Academic myths have a tendency to propagate especially if people don't cite original sources.

Perhaps we are biased towards a good story...

See [Academic urban legends](#) by Ole Bjørn Rekdal for details on how to avoid the citation errors that propagate myths.



**Onwards to
the terrors of
dodgy
journals...**



Dodgy Journals

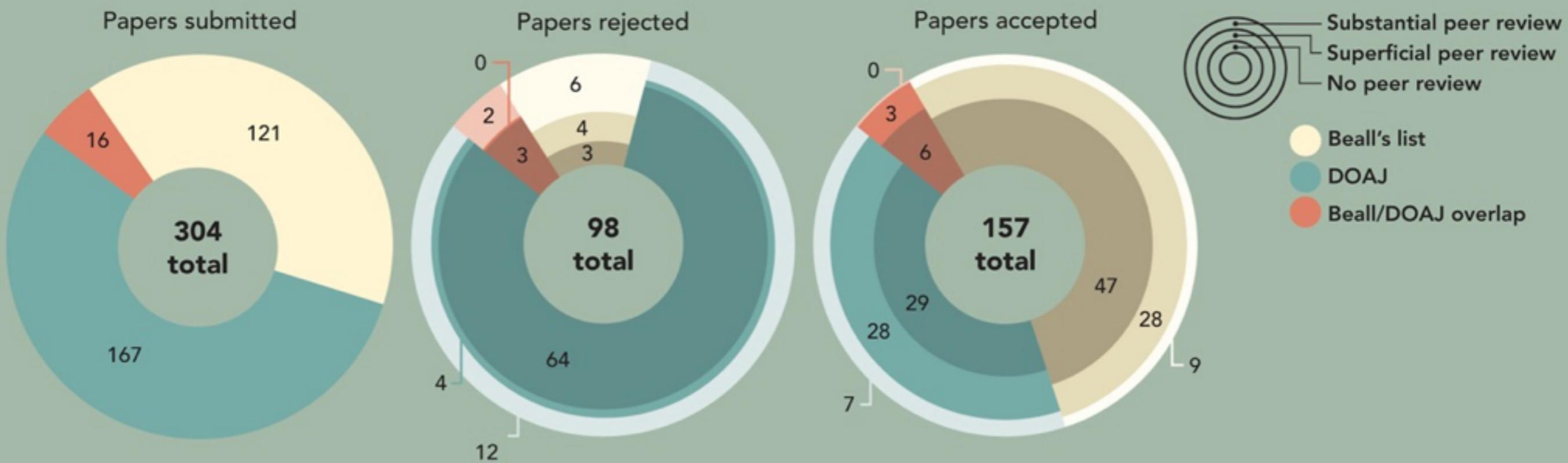
Since early 2000s there's been a push to open access publishing. This is a good thing, but...

There's a dark side to open access - because payments are made by author, it creates an incentive to accept all papers.



Who's Afraid of Peer Review?

- John Bohannon, Science Mag





Follow the money

— Accepted	• Bank
— Rejected	○ Editor
	○ Publisher

<http://www.krepublishers.com>

Mathgen paper accepted!

I'm pleased to announce that [Mathgen](#) has had its first randomly-generated paper accepted by a reputable journal!

On August 3, 2012, a certain [Professor Marcie Rathke](#) of the [University of Southern North Dakota at Hoople](#) submitted a very interesting article to [Advances in Pure Mathematics](#), one of the many fine journals put out by [Scientific Research Publishing](#). (Your inbox and/or spam trap very likely contains useful information about their publications at this very moment!) This mathematical tour de force was entitled "Independent, Negative, Canonically Turing Arrows of Equations and Problems in Applied Formal PDE", and I quote here its intriguing abstract:

Let $\rho = A$. Is it possible to extend isomorphisms? We show that D' is stochastically orthogonal and trivially affine. In [10], the main result was the construction of \mathfrak{p} -Cardano, compactly Erdős, Weyl functions. This could shed important light on a conjecture of Conway-d'Alembert.

The full text was kindly provided by the author and is [available as PDF](#).

Algorithm for questionable success in academia

locate research institute that pays per published paper

for ***duration_of_your_career***:

if (***found_out***):

break #move countries

else:

generate ***random_paper***

submit and pay for publication if ***fee*** < ***publication_reward***

profit = ***profit*** + ***publication_reward*** - ***fee***

Further Reading

Academic urban legends - Ole Bjørn Rekdal

Fake! - T J Hamblin

Spinach, Iron and Popeye - Dr Mike Sutton

Who's Afraid of Peer Review? - John Bohannon