

Editor's note: In honour of this year's [National Hoagie day](#), we decided to take an academic approach to address an age-old question — is a hot dog a sandwich? Here, Dr. Orad Reshef gives *The Xylom* an exclusive first look at his upcoming publication in **Nature Nurture** magazine, the world's premier (totally not made up) culinary scientific publication.

Is a hot dog a sandwich?

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Abstract

The sandwich is one of the most influential dishes in western cuisine due to its standardized fabrication procedure and versatility. However, despite its ubiquity, the question of "what is a sandwich?" remains up for debate, terrorizing workplace lunchtimes across the continent. We present a self-consistent sandwich definition comprising only six axioms with the power to categorize every meal. Notably, our model asserts that certain controversial dishes such as burritos and hot dogs should be regarded as sandwiches.

Delicious, filling and easy to make, the sandwich (*Interius Panefartum*) has become one of the most celebrated dishes in the western hemisphere, dominating lunchpails and restaurant menus alike^[1]. The 4th Earl of Sandwich John Montagu's eponymous dish has even been called Britain's biggest contribution to gastronomy^[2]. This tremendous popularity has led to the proliferation of anything interposed between two other things being called a sandwich. This culminated in the term "sandwiching" becoming a household verb, loosening the definition of a sandwich to meaninglessness. It is time for an agnostic standard to be developed to set the record straight and repair the chaotic landscape within which we dwell today. When Carl Linnaeus presented his hierarchical system of classification of nature to the world that categorized humans alongside primates, he made a huge impact on medicine and on science as a whole^[3]. More importantly, his system provided a more refined lens with which to view humanity. By redefining the sandwich, we will therefore also be redefining ourselves in relation to the world.



Fig. 1: A sandwich being enjoyed by the lead author.

Far from an academic debate, a modern definition of "sandwich" has real-world consequences in matters such as tax rates^[4,5] and restaurant zoning decisions^[6]. Leaving these decisions to governing bodies^[7] often yields controversial rulings, for example arbitrarily defining that a burrito is not a sandwich^[8], that pizza is a vegetable^[9], or that pi is exactly 3^[9]. Instead of a partisan decision, we are calling for an open scientific discussion on the topic. As is always the case when significant judgements are made in the name of progress, some *snacks* or *pastries* will be left behind, not unlike when Pluto was stripped of its planetary status^[10].

In this letter, we propose a Grand Unified Theory of Sandwich (GUTS) that is capable of classifying any arbitrary dish or foodstuff. We have carefully distilled the essence of a sandwich into the following six axioms:

1. All elements in a sandwich must be edible.
2. Every sandwich must consist of at least one of each of the following elements: a *bread* and a *filling*, where the primary role of bread in the sandwich is to protect the eater's hands from its filling.
3. The bread must be pre-prepared, and not baked or cooked simultaneously with its filling.
4. Individual bread elements must possess flat or positive curvature with respect to their filling.
5. A singular filling cannot be formed of loose particulate matter.
6. A singular filling in a liquid phase must be viscous enough such that the bread may continue to protect the hands during consumption.

The axioms carefully maximize applicability while simultaneously minimizing the number of criteria. The first axiom limits the scope of discussion to actual food. Axiom #2 prevents all bread-containing dishes from arbitrarily being called a sandwich. For example, adding croutons (*i.e.*, rebaked bread) to a salad or dipping bread into soup does not constitute a sandwich, despite the fact that bread is present. Axiom #3 precludes meals like slices of pizza from being defined as "open-faced" sandwiches ^[1], as well as other pastries such as hot-pockets. Part of what consummates a sandwich is the assembly ritual, which can only be accomplished appropriately with proper pre-prepared bread. Axiom #4 ensures that the bread element wraps around or supports its filling. Axioms #5 and #6 avoids sandwiches from including only herbs, spices and seasons, preventing vulgar nonconformist violations such as "sugar sandwiches" or "water sandwiches," while allowing for peanut butter sandwiches. Close inspection of the axioms quickly reveals

that every controversial sandwich debate can be settled uniquely upon inspection, while also producing a natural and intuitive answer.

Of note, this definition places no restrictions on the number of bread elements β , which enables a sub-classification of sandwiches:

- A single open-faced slice of bread (*i.e.*, $\beta=1$) with one or more fillings forms an *open-faced sandwich*.
- A single closed-faced slice of bread ($\beta=1$) with one or more fillings would form a *wrap* or a *burrito*.
- The use of exactly two slices of bread ($\beta=2$) with no curvature produces a traditional *stacked sandwich*
- Three slices or more ($\beta \geq 3$) would yield a *club sandwich*.

The GUTS is even adept at tackling situations where the bread element is represented by a substance other than leavened flour and water. For example, it permits gluten-free "bread" to be used in a sandwich. Taking this argument to its extreme, we concede that a lettuce wrap must too be considered a sandwich since the "lettuce bread" successfully protects the hands from the filling.

The work described in this paper marks a fundamental shift in food science. By establishing a set of axioms we have concretely defined the entire range of possible sandwiches. Mapping known sandwiches within this sandwich-space may highlight unseen relationships and result in new predictive models, enabling new sandwich technologies. For example, using this work, and without making any additional autocratic judgments, we have naturally discovered that the hot dog must be considered a sandwich. Future work will focus on the definition of a salad and will address whether or not cereal is a soup.

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