A framework for metaphor.

Bradley Higginson[*§]
[§]*Iniphi ltd., Barrow-in-Furness, UK.*

Metaphor is often used to allow abstract ideas to be comprehended, from Schrödinger's cat to protein channels, the language we use to embody our science both limits and expands our ability to understand and thus build upon our knowledge. Within this poster I aim to highlight a new diagrammatic representation that can be used to think about metaphor in a structured way. It will consider a historically inaccurate representation of the development of organic photochemistry; an example of looking for a new type of protein by adjusting our current framework; and finish with Lakoff's example of the solution to a problem not being a puzzle but rather a bubbling, frothing, *dynamic* chemical solution.

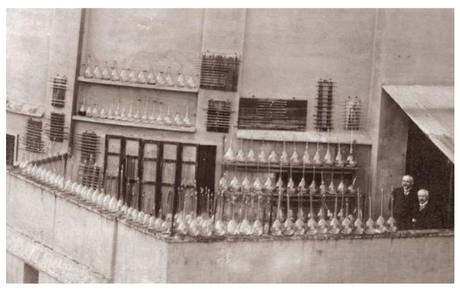
[Abstract ≡ **Known**] → Existing.
[Abstract ≡ *New*] → Implication?

The generalised framework that can allow you to see how we currently think about something. The abstract concept has a known counterpart; this leads to our existing way of thinking about something. If you now equate the abstract concept to your new way of thinking, what is its implication? Does it improve it? Unlock a new direction for study?

[energy source ≡ **heat**] → Classic Reactivity.
[energy source ≡ *light*] → Organic Photochemistry.

For all reactions to proceed, you must overcome certain energy barriers. These energy barriers were typically overcome by heating the reactions. From as early as 1908, Italian chemist Giacomo Ciamician held the idea that light could replace heat because it is an energy source that is much more abundant.

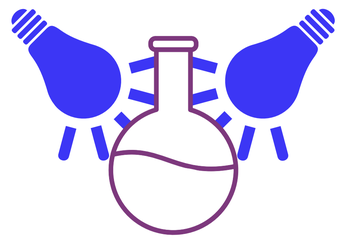
This simple thought, can light replace heat, has spurred chemists on for over a century and in 2007 several studies finally brought this work into workable form. Creating the lively topic of organic photoredox catalysis. I hope it doesn't take your metaphor 100 years to precipitate into the real world.



[energy source ≡ heat]

Classic Reactivity

[energy source ≡ *light*]



Organic Photochemistry

[ion transport ≡ **channel**] → Current understanding of a cell
[ion transport ≡ *canal*] → Lock Protein?

An illustrative example of how far science can be pushed by a "simple" metaphor is the conceptualisation of the ion transport system as a channel. This metaphor has led to a wealth of understanding, largely by giving us a target to aim for.

Using the framework we can start to explore different ideas, it's easy if you start with a simple step. The current channel idea is extremely rich; we want to retain a lot of the ideas represented in the **channel** as this will help us to transfer our current knowledge. Being able to build on something rather than rebuild can be very helpful. If we take a similar waterway – the **canal** – we can easily map our understanding onto this idea.

The canal has several ideas we that we could borrow. One I want to focus on is the idea of a *lock*, a ship moves into a confined space, waits for the water level to change and then exits on the other side. Mapping this onto a **lock protein**, a molecule moves into the protein lock, waits for a change in the protein and is then released on the opposite side of the membrane. Of course, I'm nearly 80 years too late with this suggestion as it describes a carrier protein.

- Width of channel restricts size.
- Directional flow.
- Fully open.

- Lock can prevent larger molecules.
- Neutral flow.
- Must wait for a change.

[Solution ≡ **puzzle**] → Only one answer (permanently solved)
[Solution ≡ *chemical*] → Problems are solvated (temporary)

In Lakoff and Johnson's account, an Iranian student in Berkeley kept hearing people speak of the "solution to our problems." To him, this was a beautifully chemical metaphor: a large beaker of liquid, bubbling and smoking, with problems either dissolved or sitting as precipitates.
The task, he imagined, was not to find one perfect answer, but to discover catalysts or changes that would dissolve certain problems, at least for a while, without causing others to crystallise out.
From here we can change our mindset to "problems never vanish completely; they shift states, and our job is to keep them in solution as best we can".

A clear benefit for diversity of thought during problem solving.
New ways of seeing, New ways of doing.

[Time ≡ **River**] → Flows from A to B.
[Time ≡ *Lake*] → A boat that we float on.

[Love ≡ **War**] → An aggressive act with fighting.
[Love ≡ *Dance*] → Partners *in step* with each other?

[Abstract ≡ **Known**] → Existing.
[Abstract ≡ *New..*] → Implication?

[_____ ≡ _____] → _____.
[_____ ≡ _____] → _____?

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Selected references:
1. Lakoff, G., & Johnson, M. (1980). *Metaphors we live by*. University of Chicago Press.
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3. Bohm, D., & Peat, F. D. (1987). *Science, order, and creativity*. Bantam.

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