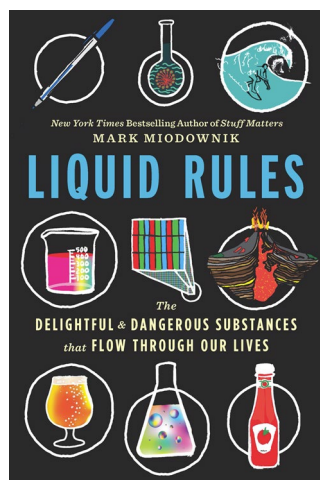


Fluid friends and foes



Liquid Rules

Mark Miodownik

Houghton Mifflin Harcourt, 2019, 256pp, \$26.00

In *Liquid Rules*, Mark Miodownik describes the enjoyment, dangers and protection we experience from liquids in our everyday lives.

Miodownik uses his plane journey from London to San Francisco to describe historical and scientific facts about liquids, both inside and outside the plane. From taxiing to the runway to arriving at his hotel, the chapters hint at the type of liquid and its use — including the deep Atlantic Ocean, the cleansing liquid soap and the indelible pen used to fill in the visa form. With the aid of a fellow passenger, Susan, selected liquids are brought to life with plenty of facts to fascinate the inner geek in you.

In this sequel to *Stuff Matters*, Miodownik's philosophical introduction to liquids offers an indication of their diversity in composition and application. While solids maintain their form and structure — like a trusted friend — liquids flow, gush, drip, mix and flood. Although liquids can be contained within an appropriate vessel, their behaviour is more unpredictable. Clearly, their flowing nature is crucial in many instances: the existence of water on the surface of the Earth, which is the crux for life on the planet, and the blood flowing around our bodies. However, the untameable behaviour of liquids causes life-threatening

situations that are described in relation to natural and nuclear disasters to the home-brewing of moonshine.

Liquid Rules gives a real behind-the-scenes perspective of the liquids by depicting their molecular structures and intermolecular forces, enabling the reactivity and mechanics of the liquids to be probed in more depth. This perspective explains the impact that viscosity can have on the eventual application of a liquid. From the highly viscous tar on the roads, with its ability to mend cracks, to the free-flowing colourless but unfathomably powerful jet fuel, kerosene. In each case, the practical knowledge we have about a particular liquid is described, including its behaviour at extremes; for example, tar on the roads cannot mend as easily at low temperatures, leading to the formation of potholes in the winter months.

From the sticky to the free-flowing, from the deadly to the delectable, the range of liquids we interact with, and that surround us, is endless. Miodownik's narrative is humorous and filled with affection and admiration for our flowing friends. Whether liquids are naturally occurring or synthetic, or found in pure form or in mixtures, there is usually a feat of chemical knowledge or engineering capability required to harness the full potential of the liquids.

Despite advances in our knowledge of liquids, our inability to detect the presence of certain liquids — and hence determine if a liquid is an explosive or not — remains problematic. As a prologue to the flight, Miodownik lists some of the many liquids, for example, peanut butter, pesto and, regrettably, single-malt whiskey, that are susceptible to confiscation at airport security. In some cases, such as peanut butter, these liquids seem more solid-like than liquid-like — and, indeed, the molecular composition of peanut butter is similar to the explosive, nitroglycerin. The destructive detail is in the arrangement of the nitrogen, carbon and oxygen atoms whereas in peanut butter the atoms are arranged in such a way that it is “just, well, delicious”.

Susan is the heroine of the book. She is polite and patient, with well-honed non-verbal communication skills. She speaks only once to

Miodownik during the flight, replying to his conversation starter “It would be great to jump out now, wouldn't it, and dive into those big, fluffy, warm clouds.” Her reply: “They are not warm.” If the book had been written from her perspective, the drivel (or dribble) from Miodownik as he voices some of his thoughts aloud would be a different story.

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The book has a warmth in its tone and the descriptions are thought provoking. Indeed, you may feel an affinity to certain situations; for example, if you have experienced an invigorating swim in the Irish Sea or if you have a preference for pouring milk into your mug before or after adding tea.

By the end of the book, you can't help but feel humbled by the life-giving effect that liquids have on our existence and the awesome power behind their ability to destruct. It is also fascinating how humans have harnessed the properties of liquids to provide lighting (using olive oil or whale oil) or the surfer's pleasure of catching a wave.

As well as recounting how our relationship with liquids has evolved over the centuries, *Liquid Rules* is forward-looking in its analysis of our fluid friends and foes. For example, Miodownik discusses the melting of ice at the poles and how regional variations in sea levels may be affected. From a technological standpoint, the innovation that liquids may give to biomedical uses or even the fabrication of a liquid computer promises an exciting future.

Whether you're a materials scientist or an interested onlooker, there is much to learn from *Liquid Rules*. And like every good story, there's a twist that just may make you smile.

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<https://doi.org/10.1038/s41578-019-0088-1>