

## Out of Hours

# Nature works: why don't we?

How living systems can inform the design of effective primary care

### WINNER OF THE KIERAN SWEENEY PRIZE 2016\*

I have always found denial an excellent strategy. For years I had listened with scepticism to reports of a crisis in UK general practice. In my surgery things were ticking over reasonably well. Then in May 2015 I had a bit of a crisis of my own. In transition to a new partnership structure I faced a few months of relentless on-call. I noticed myself become less caring towards my patients, less diagnostically curious, and less assiduous with my clinical records. My partners confronted the issue in a supportive way, the staffing issues resolved, and I regained my equilibrium, and with it a keener sense that all is far from well in UK primary care.

Doran *et al's* paper in the *BJGP* gives a sobering account of why so many GPs are getting the hell out of practice, citing impossible workloads, degradation of the doctor-patient relationship, and negative media portrayals.<sup>1</sup> These troubles are the cause and the effect of a recruitment crisis. A friend is a rural GP. With one partner down and a second due to retire, he simply cannot recruit. A dynamic training practice is on the brink of closure. In his patch, only three out of 15 GP training posts are filled. Now *that* is a crisis.

Our quandary has elicited a valiant response from the RCGP and research is underway to anatomise the nature of GPs' occupational stress. Initiatives are aimed at emphasising the good bits, supporting ailing GPs, and campaigning for better funding. But might there be things so fundamentally wrong with general medical care that no amount of good money or good will can fix it? And in the face of such anomalies, is now a time for some fresh thinking?

This essay seeks inspiration from a system that works blisteringly well. And so it should because the system in question has been evolving for 3.8 billion years. I am referring of course to life itself. The human imprint on life is confined to what geologists term the Anthropocene — a minute episode in the vastness of geological time through which living systems have used low-intensity chemical reactions to build the natural world in all its efficiency, productivity, diversity, and beauty.

### LOW PRESSURE, HIGH EFFECTIVENESS

I once took a group of medical students to an olanzapine factory in Avonmouth. It was like

stumbling onto the set of a Bond movie: the cavernous warehouse lined with corrosive solvents, the pristine innards of convoluted pipework, the absence of living souls beyond the all-seeing control room, the daily cubic metre of white crystalline product. Nature on the other hand has created sequoia, blue whales, and termite colonies (q.v.) at room temperature, atmospheric pressure, and using water as the only solvent. The Slow Medicine movement, starting, like the Slow Food movement, in Italy, challenges us to be less industrial, to achieve more by doing less.<sup>2</sup>

### TRUSTING SELF-ORGANISATION

One way of doing less in primary care is to trust patients more than we do. Once patients came to us when they felt ill; now we go knocking on the doors of the well. Despite the billions invested in them, wiser people than me are not convinced that screening does more good than harm, spawning further unnecessary tests and ineffective treatments.<sup>3</sup> Every test is in a sense a statement of mistrust in the inherent capacity of organism to organise its own affairs, and this is something that living systems do to a truly remarkable extent. Amputate the leg of a newt and it will grow a new one; dissect a flatworm and each segment will regenerate the whole original organism. Disturb an entire ecosystem with unanticipated carbon dioxide and mitigations pop up across the piste (the oceans for instance absorb at least a third of greenhouse gases).

In his ethology classic *The Soul of the White Ant*, Eugène Marais describes how, with no one obviously in charge, termite colonies emerge with air-conditioning, maternity units, and aqueducts.<sup>4</sup> Should the termitary be disturbed, the workers immediately start to restore it. The same process is continually at work in the human system — biologically and psychologically. We get a glimpse of it through the placebo effect, as in an early RCT of mammary artery ligation for angina where one of the recipients of sham surgery

experienced a complete resolution of their angina with normalisation of a previously positive exercise ECG.<sup>5</sup>

One way into this puzzle is to look at how we deal with feedback. Feedback loops are basically how life works. Amplificatory loops enhance desirable attributes. Normative loops maintain equilibria in the face of disturbance. The same principles that maintain plasma glucose are maintaining macro-equilibria such as atmospheric O<sub>2</sub> and oceanic salinity. So good is the earth at keeping its house in order that it is increasingly recognised, like the termitary, as a super-organism.<sup>6</sup>

### SYMPTOMS AS SIGNALS

There is one category of feedback that we especially underserve — and that is symptoms. Headache, indigestion, low mood, palpitations, fatigue — those lights on the dashboard of life. Mostly these remain stubbornly unexplained from a biomedical perspective. Though they mystify us, our clinical instinct is to annihilate them with analgesics, antacids, antidepressants, and other antithetics. This provides relief but somehow frustrates the intent of our 'complex adaptive system',<sup>7</sup> which responds by developing tolerance, side effects, and new problems.

So what's to be done? Guidance exists for unexplained symptoms,<sup>8</sup> but what if we viewed them less like 'annoying things to be got rid of' and more like 'useful pointers to issues in the wider system'? I can't recall a case of dyspepsia, insomnia, or chronic headache where a deeper engagement with the predicament did not yield insight, and insight breeds resilience. Though such consultations take longer they have the potential to transform demand — with so many patients currently attending with trivial and self-limiting (self-healing) complaints.

### DESIGNING FOR DIVERSITY

One of the hallmarks of a resilient system is diversity. There are around 9 million

---

*"I can't recall a case of dyspepsia, insomnia, or chronic headache where a deeper engagement with the predicament did not yield insight, and insight breeds resilience."*

---

*“What if we reversed this trend away from generalism in generalism? My hunch is that job satisfaction levels would climb, practices would be less derailed by staffing issues, and patients would enjoy the benefits of a more comprehensive service.”*

unique eukaryotic species. There are an estimated 10 000–50 000 bacterial species in every 1 g of soil, with different soils having markedly different biota. Such diversity feels instinctively good but what is its value to us as a design principle? Bacteria provide a possible answer. When scientists used genetic markers to study the human microbiome they were surprised to find many species represented in perishingly small numbers. These ‘contingency species’ lurk in the background, deploying their particular biochemical genius to bloom when a unique source of nutrient enters the food supply.<sup>9</sup> Diversity therefore provides systems with options for bouncing back from unexpected changes in their external environment.

As with agrarian monocultures, like the potato in 19th century Ireland, any low-diversity system is, by contrast, vulnerable. On the run from workload, GPs have reduced the diversity of their roles through delegation to midwives, drug addiction counsellors, physios, pharmacists, psychologists, travel clinics, minor illness nurses, and chronic disease services. When did you last take a blood test or change a dressing, let alone deliver a baby? What if we reversed this trend away from generalism in generalism? My hunch is that job satisfaction levels would climb, practices would be less derailed by staffing issues, and patients would enjoy the benefits of a more comprehensive service.

Diversity is also a vital element of good therapeutics. I love GPs who collect ‘contingency interventions’ like tips for the best side to sleep on if you get reflux (that’s the left), the best way to open the bowel (squatting or with feet raised on a stool),<sup>10</sup> breathing practice for hyperventilators (install the BreathPacer app), or naturopathic cures for constipation (linseeds crushed over muesli). Every GP has their private collection. These are just like the rare bacteria in our guts, mostly inactive but priceless in that therapeutic niche where all else has failed.

### THE FUTURE IS ... SYMBIOTIC

The metaphor of nature as a ruthlessly competitive enterprise arose with industrial capitalism. It is at variance with most

cultural traditions, which emphasise the interdependence of species, and field observations, which highlight cooperativity. Aphids are an interesting example. They can live on sugary sap because they are the (only) home to a species of bacteria called *Buchnera aphidicola*, which produces large amounts of amino acids used by the aphid for making proteins. The two species have co-evolved over 150 million years. The future of general practice in the UK hinges on our ability to foster such symbioses: between practices in federations, between primary and secondary care, between health, social care, and third-sector organisations. We need to quit thinking of ourselves as a distinct species and more as nodes within a web.

### NATURE CYCLES, SO SHOULD WE

Nature is staggeringly efficient in its use of resources. There are literally no waste products in living systems — everything is caught up in some cycle or another. You have heard of the water cycle — but did you know we also have a sulphur cycle, a phosphorous cycle, and even a strontium cycle? This efficiency is one of the main things that draws engineers to the study of biomimicry.<sup>11</sup> The healthcare system is pretty bad at thinking in cycles. Where do we think the medicines we prescribe end up? Consider the Indian vulture. The population has been reduced by 90% through the ingestion of carrion contaminated with diclofenac, used by poor farmers to treat arthritis in beasts of burden. Wild dogs have filled the niche and an excess of 50 000 deaths from rabies reported.<sup>12</sup> Thinking cyclically would transform our engagement with drugs, devices, and death.<sup>13</sup>

In this essay I have looked to living systems for inspiration in the design of primary care in the UK. There are of course some definite limits to this approach. Nature lacks compassion; it is in fact pretty ruthless. You’d never leave it in charge of your ailing mother. Wildfires have raged since the Palaeozoic era, destroying old growth and making way for the new. Perhaps that’s where we are now with primary care. But because of its fabulous longevity, with prolonged opportunity for trial and error, coupled with mysterious creative

turns (such as the Cambrian explosion), life has created systems of awesome efficiency and resilience. Primary care built on such proven principles would look very different from what we have today. In particular, the system would be focused on activating the inherent adaptive capacity of the human organism to care for itself, allowing doctors to get back to their traditional pursuits of golf and sailing.

### Trevor Thompson,

GP, Wellspring Health Living Centre; Reader in Healthcare Education; Head of Teaching and National Teaching Fellow, Centre for Academic Primary Care, School of Social and Community Medicine, University of Bristol, Bristol.

**E-mail:** Trevor.Thompson@bristol.ac.uk

\*This national prize is awarded annually by RCGP Tamar Faculty in memory of Professor Kieran Sweeney, FRCGP (<http://bjgp.org/content/66/648/375>).

DOI: <https://doi.org/10.3399/bjgp17X690281>

### REFERENCES

1. Doran N, Fox F, Rodham K, *et al*. Lost to the NHS: a mixed methods study of why GPs leave practice early in England. *Br J Gen Pract* 2016; DOI: <https://doi.org/10.3399/bjgp16X683425>.
2. Dolara A. [Invitation to ‘slow medicine’]. *Ital Heart J Suppl* 2002; **3(1)**: 100–101.
3. Morgan DJ, Dhruva SS, Wright SM, Korenstein D. Update on medical practices that should be questioned in 2015. *JAMA Intern Med* 2015; **175(12)**: 1960–1964.
4. Marais EN. *The soul of the white ant*. New York, NY: New York University Press, 2009.
5. Cobb LA, Thomas GI, Dillard DH, *et al*. An evaluation of internal-mammary-artery ligation by a double-blind technic. *N Engl J Med* 1959; **260(22)**: 1115–1118.
6. Lovelock JE. *Gaia: a new look at life on earth*. Oxford: Oxford University Press, 2000.
7. Sweeney K. *Complexity in primary care: understanding its value*. Abingdon: CRC Press, 2006.
8. Royal College of Psychiatrists. *Guidance for health professionals on medically unexplained symptoms (MUS)*. 2011. [http://www.rcpsych.ac.uk/pdf/CHECKED%20MUS%20Guidance\\_A4\\_4pp\\_6.pdf](http://www.rcpsych.ac.uk/pdf/CHECKED%20MUS%20Guidance_A4_4pp_6.pdf) (accessed 3 Mar 2017).
9. Blaser M. *Missing microbes: how killing bacteria creates modern plagues*. London: OneWorld Publications, 2015.
10. Enders G. *Gut: the inside story of our body’s most under-rated organ*. London: Scribe Publications, 2016.
11. Benyus JM. *Biomimicry: innovation inspired by nature*. New York, NY: William Morrow & Co., 2002.
12. Cuthbert RJ, Taggart MA, Prakash V, *et al*. Avian scavengers and the threat from veterinary pharmaceuticals. *Philos Trans R Soc Lond B Biol Sci* 2014; **369(1656)**, pii: 20130574.
13. Schroeder K, Thompson T, Frith K, Pencheon D. *Sustainable healthcare*. Chichester: Wiley-Blackwell, 2012.