

Books & arts

vulnerable this makes our economies and societies to pandemics and other disasters.

Now, Mazzucato brings these strands together to advocate a ‘mission’ approach to address society’s complex challenges and to transform capitalism, enabling a more just and sustainable trajectory. *Mission Economy* is a bold and persuasive call to action, reflecting an influence already felt in many policy areas. For example, the €95.5-billion (US\$117-billion) Horizon Europe programme targets five missions: adaptation to climate change; climate-neutral and smart cities; soil health and food systems; healthy oceans and other waters; and cancer.

The template for Mazzucato’s vision is the US Apollo astronaut programme of the 1960s, which resulted from president John F. Kennedy’s desire to outdo the Soviet Union in the race to space during the cold war. Apollo had the clearly defined goal of landing humans on the Moon within a decade. It required massive expenditure – US\$26 billion between 1960 and 1973, equivalent to more than \$200 billion in 2020. (Many Americans questioned this use of public resources for the space race rather than for addressing the needs of poor citizens back home.) It involved large numbers of people (around 400,000 workers) with various skills from different organizations. It was fraught with risk, physical as well as financial: three astronauts died in one early test. It required unprecedented coordination across government departments in a range of policy fields, as well as private actors; silos had to be broken and chains of command reorganized.

All of this was achieved because of political support from the top and because the goal captured the public imagination. Despite hiccups, the agencies involved gained sustained financial support, relative autonomy and organizational flexibility. The mission was successful not just in achieving its stated goal of landing men on the Moon. It also generated many spill-over technologies, including camera phones, magnetic resonance imaging, solar panels and water-purification systems.

Missions inspire because of their wider societal relevance, and they catalyse collaboration between sectors. Apollo demonstrated the need to encourage multiple solutions instead of focusing on one development path or technology. Today, many challenges would fit the mission approach. Think of those identified in the United Nations Sustainable Development Goals (which come with 159 specific targets). Others include the digital divide, access to health care and, most of all, climate change.

These ‘Earthshots’ are much harder to accomplish than literal Moonshots (see *Nature* 571, 145; 2019). Why? Because their goals are harder to define; they involve global commons such as air and water; and they are affected by social and political complexities within nations and in international collaboration,

as well as competing interests and concerns about inequality and justice. These offer different kinds of hurdles, not all of which are considered in the book. Therefore, they require even greater public ambition and commitment.

Missions need a new approach to governance, Mazzucato argues. “It is not about fixing markets but creating markets,” she writes. Public–private partnerships have focused on

“These ‘Earthshots’ are much harder to accomplish than literal Moonshots. Why?”

de-risking investment through guarantees, subsidies and assistance. Instead, they should emphasize sharing both risks and rewards. For example, the US government’s investment in Elon Musk’s aerospace company SpaceX should get it a slice of the profits, to be used for the welfare of its citizens. This would link creation of value to its distribution – what Mazzucato calls “predistribution” rather than redistribution. Successful examples include efforts in Sweden and the United Kingdom to make vibrant and healthy common urban spaces, and the Sustainable Europe Investment Plan that is part of the European Green Deal.

Consider how a mission approach would have changed global public-health interventions for COVID-19 vaccines and drugs. Could products developed by pharmaceutical companies with government financial assistance have

been freely available to all, rather than paid for again by taxpayers and restricted by profit-making considerations? The public research and development subsidies provided to US companies Pfizer and Moderna could have resulted in lower prices for their vaccines, as with the AstraZeneca shot developed in collaboration with the University of Oxford, UK. And all vaccines could have been subject to compulsory patent licensing, enhancing production and making distribution easier across the world.

Power imbalances can determine the viability and success of the mission approach, and this requires explicit recognition at the national level. International cooperation must ensure that the global legal and institutional architecture (such as the World Trade Organization, the International Monetary Fund and treaties and agreements) do not continue to shrink the national policy space and privilege the rights of corporations over people. This is implicit in *Mission Economy*, but it would need another book to unpack.

Mazzucato presents her arguments so simply and clearly that they can seem obvious. In fact, they are revolutionary. Rethinking the role of government nationally and in the international economy – to put public purpose first and solve the problems that matter to people – are now the central questions for humanity.

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The grisly trials that gave poison to prisoners

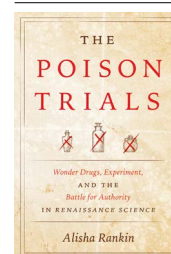
Hair-raising reports of experiments emphasize control arms and societal benefit. **By Alison Abbott**

It was a time of contagion and quacks. A Machiavellian power-broker keen to protect his position defied tradition to sponsor controlled experiments on the most marginalized of people.

It was 1524. The Italian surgeon Gregorio Caravita offered Pope Clement VII a medicinal oil he had prepared as an antidote to poison. There were good reasons for the pope to fear poisoning. So, instead of dismissing Caravita’s unlikely claim, he decided to have the concoction tested – on condemned prisoners.

Two Corsicans – convicted of theft and

murder – were chosen. Doctors fed them marzipan cakes laced with deadly aconite. When they started to writhe and scream in agony,



The Poison Trials
Alisha Rankin
Univ. Chicago Press
(2021)



The plague in fourteenth-century Florence, Italy, was widely thought to be caused by poison.

Caravita anointed one of them with his oil. The treated prisoner survived. As a reward for his services, the prisoner had his death sentence commuted to life as a galley slave. The untreated prisoner? It took four hours of torment for him to die.

The next trial of Caravita's oil was carried out by the papal physician, the papal pharmacist and a Roman senator. The officials wanted to check that they had not been tricked, and to see whether the antidote worked against other poisons. They administered a mixture of raw eggs, sugar and arsenic to a man from Mantua who had been condemned for murder. He, too, survived to live out his days as a galley slave.

Two weeks later, the experimenters published a four-page report of the trials, describing effects of the poisons and emphasizing the presence of "pious men" who prayed on the convicts' behalf. (Without knowing the exact content of the oil, and the exact doses of the poisons, it is impossible today to speculate on whether the antidote could really have worked.)

Rush to justify

These were the first of a series of poison trials conducted on condemned prisoners across Europe in the sixteenth century. Historian Alisha Rankin describes the cruel human experiments in grisly detail in her book *The Poison Trials*. Her research uncovered more than a dozen documented trials (some alluded to others that went undocumented). Half were carried out between 1560 and 1580 in France, Italy and the Holy Roman Empire, and the last by the end of the century.

Although the concept of human rights did

not then exist, those running the trials felt pressure to justify themselves to society, Rankin finds. And their decidedly scholarly methodology prefigured the era of experimentation by a good century.

In sixteenth-century Europe, poisons were everywhere. A snakebite or unfortunate choice of herb or mushroom could be deadly. Regulations were lax; poisons were easily accessible to anyone who wanted to control a rat

"Their decidedly scholarly methodology prefigured the era of experimentation by a good century."

infestation, or assassinate a political leader.

The Black Death, which swept in devastating waves over Renaissance Europe, was generally thought to be caused by some sort of transmissible poison (now we know it to have been the result of the bacterium *Yersinia pestis*). So, for Clement, proving that he commanded a general antidote would demonstrate both his power to defend himself from his enemies and his power to protect his flock from the plague.

Clement was the first person since the time of the ancient Greeks to be recorded carrying out poison trials on humans. The practice was taboo in the classical world by the second century AD – in Rome, the physician Galen studied cockerels instead. Galen's experiments famously included control arms: he divided his birds into two groups, poisoned them all, then gave one group the antidote.

Rankin describes how Clement's trial with Caravita's oil revived, and extended, this scholarly approach. The studies recorded in hair-raising detail the physiological consequences of the poisonings over time.

Subsequent poison trials tended to follow the same pattern of design and sober documentation in their attempts to offer convincing proof of efficacy. The respected doctors and intellectuals who conducted them, Rankin explains, were keen to differentiate themselves from charlatans who hawked their own antidotes with much show in marketplaces.

Still, she writes, qualms about the practice were high from the start. That unease applied also to dissections of human corpses, which had become relatively common in the scholarly circles of sixteenth-century Europe. Contrary to popular belief, dissections were never actually banned by the Catholic church, but there was enough queasiness about them for Clement to issue, in 1531, rules for their approval and oversight by both church and civic authorities. Aware that he was entering dangerous territory, Clement made it clear that he had followed these rules in his trials with Caravita's oil, writes Rankin.

Primitive medical ethics

Reports of poison trials always underscored their societal benefit. As the decades progressed, they began to include statements that the condemned had consented to participate without coercion. The participants selected, Rankin notes, were usually foreigners.

Rankin widens her story to encompass the sometimes overlapping claims for panaceas – universal cures – in the same period. At times, her text becomes repetitive and confusing. Still, her anecdotes are riveting. For example, we learn that popular antidotes tended to be exotic mixtures of ingredients, including herbs, spices, special clays, opium, and animal parts and products of varying levels of weirdness. Particularly valued were bezoars – hardened masses found in the gastrointestinal systems of some animals – and the horns of unicorns, whose existence was widely discussed in Renaissance times, but not yet dismissed.

But the book's fascination lies in its exposure of the early attempts at an approach to medicine that we would now call scientific – along with the revelation of how quickly and seemingly instinctively these attempts became enmeshed in a primitive version of what we would now call medical ethics. These tensions, like contagions, have always been with us.

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