COVID-19 AND THE WORLD FOOD SYSTEM

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On 31 December 2019, a Chinese government website announced the detection of a pneumonia of unknown cause that was, in the original reports, believed to have had its origin in a wet market in Wuhan, Hubei province, China. In large part it was traced back to the wet market because 27 of the first 41 patients admitted to hospital with the unknown pneumonia had an association with the market. However, by that time the virus was already well-established; the first recorded identification of the SARS-CoV-2 virus has been traced to a patient treated on 17 November in Hubei who had no connection to the market, and France's first case was treated on 27 December in a Parisian suburb.

In this light, it is not surprising that the transmission vectors for the COVID-19 pandemic have not been definitively traced. While the scientific consensus in the spring of 2020 was that it most likely originated in bats (Readfearn 2020), the commonly-held belief that the virus emerged in a Wuhan wet market as a result of an interaction between an animal and a human is just that: a belief. It is likely that the virus passed through an intermediary animal but, unlike Steven Soderbergh's *Contagion*, it is highly unlikely that the Wuhan market will ever be identified as the definitive ground zero of both the SARS-CoV-2 virus and COVID-19. It is, at best, a hypothesis.

The role of bats as vectors of transmission, however, points to the importance of understanding the critical links between the emergence of new zoonotic diseases and the world food system. Zoonotic diseases are human bacterial and viral infections that originate in animals and which cross the species barrier. Something on the order of 60 percent of new human pathogens cross from animals to humans (Molyneux *et al.* 2011).

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And, over the course of the 21st century, the process of transiting across the species barrier appears to have accelerated as a succession of new diseases have emerged. Since 2000 there have been three pandemics: severe acute respiratory syndrome, or SARS, in 2003; H1N1, commonly known as swine flu, in 2009; and now COVID-19. However, there have also been regional outbreaks of zoonotics: avian flu from poultry; the Middle East respiratory syndrome from camels; Ebola from monkeys and pigs; Rift Valley fever from livestock; West Nile fever from birds; Zika from monkeys; and Nipah from bats.

Indeed, these may just be the tip of the iceberg, given that many novel human pathogens may emerge in regions where weak health systems prevent their detection as novel.[1] The success of these diseases lie in them entering human immune systems that do not have the antibodies to resist infection precisely because they have recently crossed from animals to humans.

The world food system has laid the structural foundations to facilitate the expanded spread of zoonotics in the 21st century. The reasons for this are many, but here I want to focus upon two dimensions: the ongoing marginalisation of small-scale petty commodity producers; and the ever-expanding remit of industrial agriculture.

At the point of production, the dominant model of the world food system is the fossil-fuel driven, large-scale, linear-flow-through capital-intensive industrial agriculture megafarm (Qualman *et al.* 2018). This produces, through enclosures of land and multiple other resources as well as the market imperative of cost competitiveness, an agrarian crisis for many small-scale petty commodity producing peasant farmers around the developing world. As Harriet Friedmann so cogently reminds us:

> Transnational agrifood capitals disconnect production from consumption and relink them through buying and selling [...]

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1 Here, we owe a huge debt to the pivotal work of Rob Wallace in identifying the rapid proliferation of food system-sourced pathogens in the 21st century. As Wallace writes, 'This century we've already trainspotted novel strains of African swine fever, *Campylobacter*, *Cryptosporidium*, *Cyclospora*, Ebola, E. coli O157:H7, foot-and-mouth disease, hepatitis E, Listeria, Nipah virus, Q fever, Salmonella, Vibrio, Yersinia, Zika, and a variety of novel influenza A variants, including H1N1 (2009), H1N2v, H3N2v, H5N1, H5N2, H5Nx, H6N1, H7N1, H7N3, H7N7, H7N9, and H9N2' (Wallace 2020). That Wallace has largely gone unrenumerated for his work is a shocking, if unremarkable, indictment of the 21st century academy.

> Suppress[ing] [...] particularities of time and place in both agriculture and diets ... [t]hey have created an integrated productive sector of the world economy, and peoples of the Third World have been incorporated or marginalized—often both simultaneously—as consumers and producers (Friedmann, quoted in Bello and Baviera 2010: 45).

Such peasant producers face a 'simple reproduction squeeze' because the world market prices that they face fail to cover the costs of production at the farmgate (Akram-Lodhi and Kay 2010).

As a result, hundreds of millions of small-scale farmers around the world have been marginalised, which has in turn laid the foundations for the global expansion of industrial agriculture. Worldwide, there are more than 570 million farms, most of which are small and family-operated. Small farms of 2 hectares or less operate about 12 percent of the world's agricultural land, and family farms more generally operate about 75 percent of the world's agricultural land (Lowder *et al.* 2016). Faced with a simple reproduction squeeze, some small-scale farmers have coped by moving to less cultivable, often forested, areas, where they encroach on wilder habitats, putting in place a possible channel through which animal viruses can be transmitted to humans as 'forest disease dynamics' (Wallace *et al.* 2020) enter peri-urban settings.

Alternatively, some small-scale farmers have diversified production into more lucrative higher-value products that,when commodified, can be easily sold in nearby markets. For livestock farmers marginalised by industrial livestock production, one group of these higher-value products are animals that were once caught in the wild and eaten for subsistence and which have not been traditionally bred in captivity to be sold as food – snakes, turtles and mallard ducks, among others. For these small-scale livestock farmers, economic marginalisation has forced them to produce such commodities for niche markets in which they can realise more revenue against costs of production; such commodities can be supplemented by higher-value domesticated animals that are not traditionally eaten as food but for which a food market exists – dogs and cats, to name two. In some instances, the commodification of so-called 'wild' animals raised in captivity can create the opportunity for pathogens to cross from non-traditional farmed animals to livestock and from there into humans.

Indeed, when farmers raising non-traditional farmed animals are successful in exploiting the opportunities afforded by markets, this creates incentives to increase the scale of their activity. This has been a well-established route by which small-scale farmers unable to compete with Chinese industrial livestock production have crafted livelihood strategies (Lynteris and Fearnley 2020). However, it also amplifies and magnifies the possibility of zoonotic spread. In a commodity economy one way of dealing with the market imperative is to commodify that which was not previously widely commodified. This has been the route of some small-scale petty commodity producers marginalised by industrial agriculture, and this can create pathways through which new pathogens emerge.

In the second dimension, as industrial agriculture has grown across the developing countries, including China, its expanded control and operation of better farming land has not only forced the exit of many small-scale farmers but it has also created fertile breeding grounds for new infections as industrial livestock production increases. Industrial livestock breeds its own diseases, like swine flu and avian flu, in concentrated animal feeding operations and on factory farms.[2]

Moreover, these 'modern' industrial farming methods significantly enhance the virulence of those viruses that do emerge from farmed pigs and poultry, among others, before they cross from animal to human. This is because modern animal farming significantly weakens the resistance of animals to pathogens even as the massive application of antibiotics to combat pathogens contributes to antibiotic resistance, cumulatively exacerbating the problem of new pathogens. As Rob Wallace (2016) eloquently puts it, 'big farms make big flu'. This is why enhanced virulence has been documented in the US, Canada, Europe and Australia

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2 Wallace *et al.* (2020) have a remarkably succinct paragraph that highlights the virulent risk of concentrated animal feeding operations: 'However unintended, the entirety of the production line is organized around practices that accelerate the evolution of pathogen virulence and subsequent transmission. Growing genetic monocultures—food animals and plants with nearly identical genomes—removes immune firebreaks that in more diverse populations slow down transmission. Pathogens now can just quickly evolve around the commonplace host immune genotypes. Meanwhile, crowded conditions depress immune response. Larger farm animal population sizes and densities of factory farms facilitate greater transmission and recurrent infection, High throughput, a part of any industrial production, provides a continually renewed supply of susceptibles at barn, farm, and regional levels, removing the cap on the evolution of pathogen deadliness. Housing a lot of animals together rewards those strains that can burn through them best. Decreasing the age of slaughter—to six weeks in chickens—is likely to select for pathogens able to survive more robust immune systems. Lengthening the geographic extent of live animal trade and export has increased the diversity of genomic segments that their associated pathogens exchange, increasing the rate at which disease agents explore their evolutionary possibilities.'

rather than developing countries: these are the heartlands of industrial agriculture, and the principal driver of contemporary zoonotic disease has been industrial livestock production, most notably pig production.

COVID-19 may not have emerged in industrial agriculture; but the market imperatives of industrial agriculture were imposed on small-scale farms, who responded by producing commodities with which industrial agriculture could not compete: non-traditional farmed animals for niche markets. The central issue at the source of the COVID-19 pandemic is not some people's taste for seemingly strange or exotic food, which in any event is culturally constructed, but rather the market imperatives of the world food system.

Clearly, the COVID-19 pandemic demonstrates that there is a critical need in contemporary agriculture to manage the interactions between animal and human. However, these interactions are central to the production process of the world food system, which is itself a principal cause of the crisis. Industrial agriculture and the survival strategies of marginalised small-scale petty commodity-producing farmers lay the groundwork from which new, virulent pathogens can emerge. Clearly, the terms and conditions by which the world food system operates serves to deepen threats to global health. In other words, there is a co-morbidity between COVID-19 and the world food system.

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