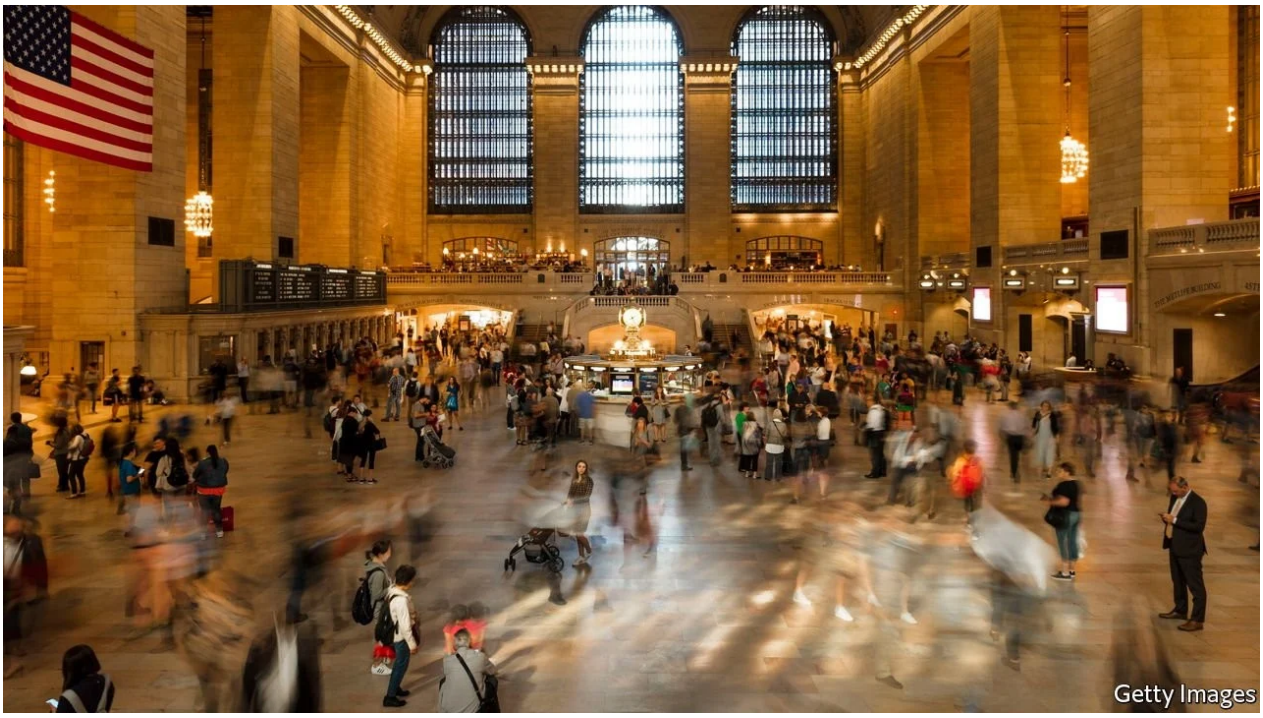
Science & technology

Jun 19th 2021 edition

Microecology

A midsummer bug hunt

Every June 21st sees a census of the world's urban microbes



DEPENDING ON WHERE you live, June 21st is either the summer or the winter solstice. For some, this is a moment of celebration, accompanied by strange rituals. And among the celebrants are members of the International Metagenomics and Metadesign of Subways and Urban Biomes Consortium (MetaSUB). If, in Bogotá, Doha, Kuala Lumpur, London, Minneapolis or any other of some 60 cities around the world, you see on that day someone furtively swabbing a ticket counter, handrail, turnstile or seat in your local underground-railway station, be not afraid. It is just one of MetaSUB's volunteers gathering samples of the local microbes.

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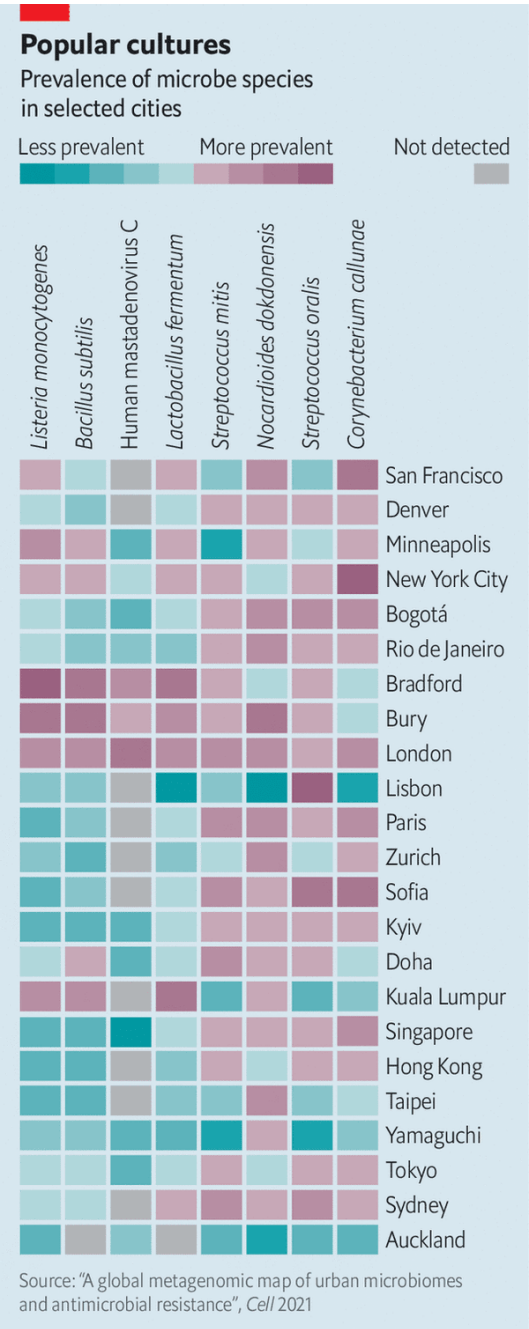

The Economist

MetaSUB's purpose is to understand the invisible complexes of bacteria, archaea, fungi and viruses that are life's smallest representatives. Every year, on June 21st, it co-ordinates an army of small-game hunters who have the task of sampling their city's public transport. The swabs are then tagged with time of collection, local temperature and humidity, and the nature of the sampled surface, and sent off for

samples collected in 2015, 2016 and 2017. These show that each city has a microbial ecosystem distinctive enough (see chart) to serve as a fingerprint. An algorithm trained on the data could identify the origin of a randomly chosen sample 88% of the time. A few species are ubiquitous. Thirty-one (all bacteria) were found on almost every swab, and a further 1,145 (also, bar brewers' yeast, bacteria) turned up in over 70% of samples. The vast majority of the 4,246 identifiable species were, however, much more narrowly distributed.

On top of these identifiable organisms are the unknowns. Around half of the critters sequenced had no match in the world's public genetic databanks, says Daniela Bezdan, a former executive director of MetaSUB who was one of the study's leaders. She estimates that more than 1,000 of the bacteria collected, and 10,000 of the viruses, remain unidentified.

Ill met by moonlight…

Unidentified organisms are common in such microbiological fishing expeditions, for a proper understanding of microbial biodiversity remains a long way off. But, though intriguing, such hidden neighbours are unlikely to be dangerous. "We know there aren't any pathogens because people don't get ridiculously sick," says David Danko, another of the paper's authors.

The identities of this dark microbiome's members are just one of the mysteries that remain to be solved. Another is what regulates a city's microbial ecology. Strikingly, the pattern observed reflects the more familiar ecology of plants and animals in that equatorial cities have richer ecosystems than those nearer the poles (microbial diversity declines at a rate of seven species per degree of latitude). No one knows for sure why this pattern pertains for macroscopic creatures. That it is also true for microbes may add insight.

On top of latitudinal variation, three other patterns stood out. Coastal cities share characteristics that inland ones lack. So do those at high altitude, compared with those which are low-lying. And so do cities with higher human-population densities.

At the moment, MetaSUB is still in the position of the early botanists and zoologists, gathering information about what, exactly, is out there. As the underlying patterns become clearer, though, such surveys could have practical benefits. They should, for example, enable public-health bodies to monitor and map the spread of diseases, and identify harmful new species. They could also permit the monitoring of bacteria carrying genes that confer resistance to antibiotics. MetaSUB has found such genes to be widespread, but unevenly distributed. They were less common in Oceania and the Middle East. Why, is so far impossible to say.

The current paper looks only at DNA from the samples, but MetaSUB has now started surveying RNA as well. This is particularly pertinent to viruses, many of which, such as the coronavirus currently sweeping the world, store their genes as RNA, not DNA. As the team gears up for its next collection day, it hopes the data it gathers will grant a more accurate portrait of the role of viruses in cities, and provide insights into the spread of covid-19. ■

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