

# The known knowns, known unknowns, and unknown unknowns of COVID-19 | Bulletin of the Atomic Scientists

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In 2002, while making the case for the US invasion of Iraq to those who asked for evidence of what we now know to be nonexistent weapons of mass destruction, Donald Rumsfeld referred to known knowns, known unknowns, and unknown unknowns. Nearly two decades later, we are in similar territory in discussing the origin of SARS-CoV-2, the virus that causes COVID-19. Then, as now, we should be wary that incomplete data and strong opinions not determine high-impact decisions.

The known knowns are that SARS-CoV-2 is a new, highly transmissible virus that has the capacity to evolve rapidly. Genetic analyses indicate that closely related viruses existed in wildlife before human disease was detected in the Chinese city of Wuhan in 2019. We also know that despite promises to shut down wild animal markets in the aftermath of the first SARS outbreak in 2003, thousands of animals were sold in such markets in Wuhan. Many of these species are known to be infected and/or infectable with SARS-like coronaviruses. These animals could have been vectors for carrying SARS-CoV-2 to humans and for adaptation to growth in humans.

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