

Scientific Evidence for the Origin of COVID-19

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A complete laboratory fabrication of the COVID-19 pathogen is not credible. Rather, consider the possibility that a natural bat coronavirus was altered in a lab using gene splicing and gain-of-function methods, and then escaped from the lab. This is the “lab leak” hypothesis. The alternative, that the pathogen jumped from animal to human, is the “zoonotic” hypothesis.

A. Scientific evidence that favors lab leak

A vast amount of scientific data has been collected and analyzed over the past 18 months that testifies to the origin of the COVID-19 epidemic and of the responsible pathogen, SARS-CoV-2. My testimony today was developed in conjunction with Dr. Steven Quay, who will give more details than I do. In this section **A**, I have selected five sets of scientific evidence, each one of which leads to a compelling conclusion in favor of the lab leak hypothesis. In our Wall St. Journal OpEd we included only evidence **A4** and **A5** below.

A1. Pre-epidemic infections. Previous coronavirus epidemics, SARS1 (2003) and MERS (2013) showed extensive human infection prior to developing human-to-human transmission. 9522 stored hospital records were expected to show 100 to 400 pre-infections, based on SARS1 and MERS experiences. 0 were found.

Conclusion: Lab leak highly favored over zoonotic

A2. Host animal identification. Over 80,000 animals were examined for medical evidence that they had carried the disease. None were found; unprecedented, c.f. SARS1 and MERS.

Conclusion: Lab leak highly favored over zoonotic

A3. Genetic purity. Based on SARS1 and MERS, we expect many jumps from animal to human, leading to a wide range of early clads, viruses with significant genetic difference. The absence of genetic diversity evidence points to a single entry into humans.

Conclusion: Lab leak highly favored over zoonotic

A4. Spike mutation. No coronavirus in the sub-genus Sarbecovirus (capable of recombination gene transfer with CoV-2) had a furin cleavage site. Moreover, no CGG-CGG doublet anywhere in the subgenus. There is no plausible natural origin for this critical component.

Conclusion: Lab leak highly favored over zoonotic

A5. Optimization. Based on SARS1 and MERS, when the virus becomes capable of human-to-human jumps, it takes weeks to optimize this process by additional mutations. Laboratory gain-of-function leaves a virus pre-optimized. No early changes have been observed. A study of the effect of added mutations shows it is 99.5% optimized.

Conclusion: Lab leak highly favored over zoonotic

B. Evidence that favors zoonotic origin

In the literature and in talking to virologists, they refer to the following evidence to favor the zoonotic hypothesis.

B1. Zoonotic is common. COVID-19 “looks like” a zoonotic pandemic. Zoonotic examples include swine flu, avian flu, SARS1 (2003) and MERS (2012). But laboratory leaks are also common. The 1977 world-wide flu epidemic was traced to a laboratory flu preserved since 1950. Anthrax deaths at Sverdlovsk in 1979 came from a lab leak. The last 6 deaths from SARS1 in 2003 were caused by laboratory leaks in Beijing, Taipei, and Singapore. According to USA Today, there were over 11,000 laboratory “incidents” reported in the US in the period 2008-2012.

Conclusion: neither lab origin nor zoonotic favored by this evidence

B2. The Lancet (Feb 2020). 27 health care professionals say in this non-refereed letter that Zoonotic was firmly established. Their reasons: China had done an investigation and had located the source animal (a horseshoe bat) and the epicenter of the outbreak (the Wuhan wet market). To challenge their work would be to insult China. But a study of clads (minor mutations) shows that the earliest cases of COVID-19 occurred in people who had not visited that market. And there is no evidence for a jump from horseshoe bats to humans (see **A2** above). The praise the authors give China for transparency is undeserved, as subsequent events have shown.

Conclusion: neither lab origin nor zoonotic favored by this evidence

B3. Nature Medicine. (K. Andersen et al., March 2020) Very highly quoted non-refereed “Correspondence” that claims to rule out laboratory origin. The evidence put forth has two parts: (1) The spike protein was not optimized, and if human-designed it would have been. But **A.5** above shows it was 99.5% optimized, contradicting the Andersen et. al claim. (2) There was no “backbone” on which a lab manipulation could work. But both hypotheses require a backbone. Andersen et al. refer to a 2014 paper. But the Wuhan lab had collected thousands of samples since then. Their records were all taken off-line in September 2019.

Conclusion: neither lab origin nor zoonotic favored by this evidence

B4. 77 Novel Laureates open letter. This non-refereed letter is often misquoted as being in support of the zoonotic hypothesis; it actually takes no stand, but pleads for the de-politicization of scientific funding. I personally called two of the signers and asked them their opinion of “gain of function” research. Neither had ever heard of it. Whomever organized the letter did not inform the signers about this central issue.

Conclusion: neither lab origin nor zoonotic favored by this evidence

B5. Numerous papers supporting zoonotic origin. We have read many of these, but found none which actually offers evidence. Typically they argue for a plausible pathway that CoV-2 could have developed in nature. None that we have found address the 5 issues that we cited in Section **A**.

Conclusion: neither lab origin nor zoonotic favored by these publications

C. Other evidence

There is a great deal of additional evidence that is adduced to address the origin. This includes the location of the outbreak in the only city in China with a biosafety level 4 laboratory, and that it has been conducting horseshoe bat coronavirus studies; incidents of early illnesses at the Wuhan laboratory; and the failure of China to provide critical data. In my testimony I specifically avoid such evidence because it can be disputed or stigmatized as “circumstantial”. In contrast, the scientific evidence presented here is established and not disputed. We can focus first on the scientific evidence to deduce the origin of the virus. Then we look at additional evidence to help understand better the details of why the pathogen was created and how it spread and what we can do to prevent similar events in the future.

D. Summary of Scientific Evidence

Many tests, and vast amounts of data, have been collected and analyzed in the last 18 months, and much of this is directly relevant to understanding the origin of the COVID-19 pandemic. The results are remarkably consistent. Every scientific test that distinguishes between the zoonotic and lab leak origins gives results that highly favor the lab origin. We have found no credible evidence that favors zoonotic origin.

It is possible that the widespread belief in the zoonotic hypothesis derived from an overemphasis on belief in scientific authority, such as references to papers by eminent health professionals, without the concomitant attention to the data and the analysis that were used to justify their conclusions, and possibly from a desire to avoid insulting China. We present scientific evidence that favors lab leak origin; we ask zoonotic proponents to put forth similar scientific evidence that supports their hypothesis. .

On the basis of scientific evidence alone, we conclude that SARS-CoV-2 was developed from a bat coronavirus by gain-of-function and gene splicing in a laboratory.

Brief biography of Richard A. Muller

Richard Muller, Prof. of Physics at U.C. Berkeley, emeritus, is known for many projects outside the field of his PhD (which was in particle physics). He founded two astrophysics project that led to Nobel Prizes for his former student and post-doc. He invented the standard method now used for archeological age determination. He co-founded Berkeley Earth, a non-profit that studies climate change (he is the NYTimes “Converted Skeptic”) and world-wide air pollution. He holds 14 patents on nuclear waste disposal. He has been awarded the National Science Foundation Alan T. Waterman Award, the MacArthur Prize, the Texas Instruments Founders Prize; he shared the Breakthrough Prize (discovery of dark energy), and many more.