



## COMMENTARY

# Hybrid Autopsy Virology Laboratory Experimental Platform

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## Abstract

**Background:** The SARS-CoV-2 aerosols' transmission route is not still settled. Along with epidemiology data, there is an urgent necessity for reliable reproducible experimental methods for virus aerosolization studies.

**Methods:** The autopsy table can form part of a hybrid autopsy virology laboratory as an investigative platform equipped with the necessary instruments for SARS-CoV-2 aerosolization studies. Wide open mucosa surfaces COVID-19 deceased can be a field for studying under experimental manipulations of air flow, temperature, and humidity.

**Results:** The hybrid autopsy virology laboratory's goal could be to study the conditions in which containing a viruses droplet nuclei would leave the area of dwelling on/in the cilia respiratory and other mucosa epithelium. The YES result would shed light on the possibility of aerosolization. It could lead to a variety of additional studies on SARS-CoV-2. The NO result would diminish fear of infection inoculation for workers and retract administrative limitations in autopsies performance.

**Conclusion:** This article suggests the principle of a method for SARS-CoV-2 aerosolization studies. The variants of the hybrid virology laboratory design would depend on the specific goals of the experimental platform.

## Keywords

COVID 19, SARS-CoV-2, Aerosolization, Autopsy, Experimental platform, Hybrid autopsy virology laboratory

with contaminated surfaces (fomites) is accepted with some reservations. Unsettled is the aerosols' transmission way. Many puzzling cases of the COVID-19 spread in groups can only be explained by aerosolization, but there is no direct scientifically proven evidence of this transmission route. There is no data in openly available literature about how the virus leaves the body to become an infectious agent. In other words, what allows the virus to abandon the hospitality of an infected individual's mucosa to become an aerosol wanderer and land on the surfaces of another individual's mucosa as an infectious agent. Actually, this is the crucial epidemiologic and clinical question during the world's current malady.

The scientific literature is saturated with aerosols studies starting with the classic Wells curve in the 1930s when the connection between aerosol formation by evaporation and humidity, temperature, and velocity conditions was established [1]. High-speed photography methods are now being used to trace the dispersion of aerosols [2,3]. However, these studies only imitate the transmission process and fail to identify the distribution of a real infectious agent. The problem will remain at the level of assumption unless scientists find a reliable method for studies.

## Introduction

The COVID-19 epidemic has revealed a troubling discrepancy between sophisticated methods of SARS-CoV-2 virus studies and an inability to answer basic epidemiology questions. While the role of direct contact with shedding viruses during symptomatic (cough, sneezing, speaking) and asymptomatic COVID-19 occurrences is commonly accepted, the role of contact

## Autopsy Experimental Platform

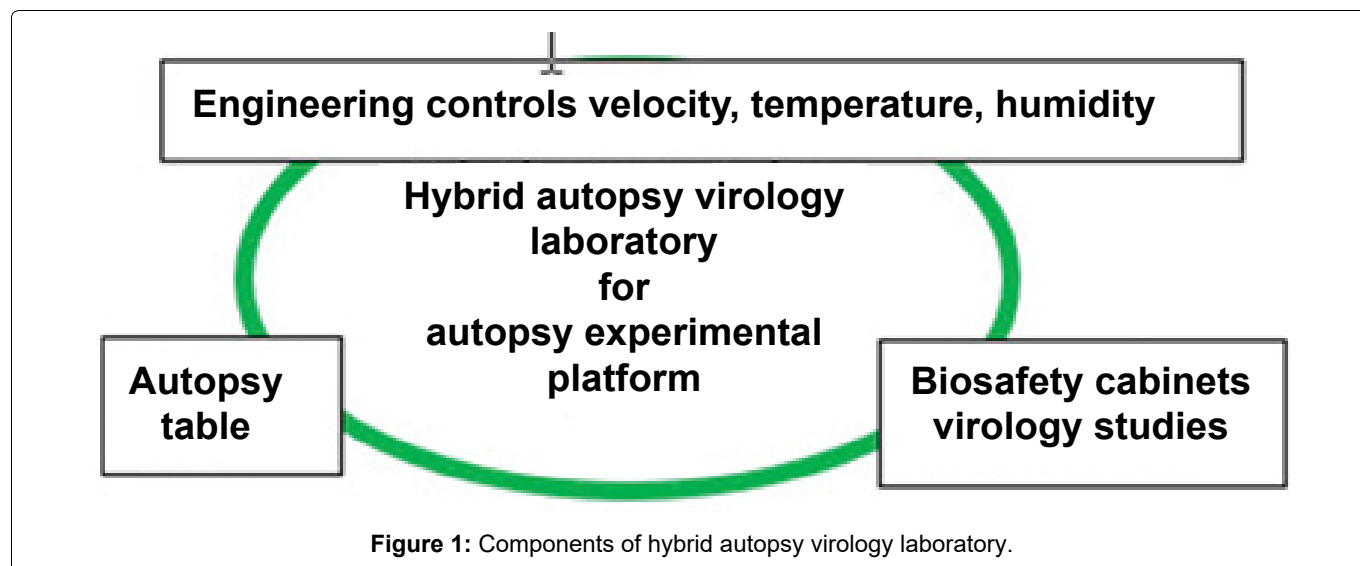
Postmortem examinations, or autopsies, became a victim of the scare that came from China and Italy at the onset of the COVID-19 pandemic. The Center of Disease Control and Prevention (CDC), the Occupational Safety and Health Organization (OSHA), and hospitals' administrations issued policies that minimized autopsies by imposing special requirements regarding engineer-



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ing controls, personal protective equipment (PPE), and autopsy procedures [4]. Because a cadaver does not sneeze or speak, the aerosolization of the virus is the only plausible explanation for the safety concerns of the environment and workers.

Autopsies would be an ideal experimental platform for aerosolization studies. Wide open mucosa surfaces presumably containing viruses in the body of a COVID-19 deceased can be a field for studying virus aerosolization. The main goal would be to study the conditions in which a containing virus droplet nuclei would leave the area of dwelling on/in the cilia respiratory and other mucosa epithelium.

Currently, if an autopsy on a COVID-19 case is performed, the dissection is usually limited to main organs, such as the lungs, liver, heart, and kidneys. However, the entire body, including as much as possible the hypopharynx and down through the respiratory tract to the bronchioles, has scientific value. The complete gastro-intestinal tract would also be of interest. In the tranquil situation of an autopsy suite, some sophisticated experiments can be carried out to obtain significant information about of the virus aerosolization.

### A Hybrid Autopsy Virology Laboratory

The University of Florida published no a peer reviewed study in which air samples from two COVID-19 patients were collected in a room using BioSpot-VIVAS air samplers. The collected material was tested for RT-qPCR and virus viability on Vero E6 cell culture [5].

Instead of a patient's bed, an autopsy table in the morgue can form part of a hybrid autopsy virology laboratory as an investigative experimental platform equipped with the necessary instruments for collecting material for virology studies (Figure 1). The autopsy room's engineering controls can provide the necessary conditions for manipulating the air flow, temperature, and humidity. It is not necessary for all components of the hybrid autopsy virology laboratory to be located in

the same room as aerosol-capturing devices. The rest of the equipment can be in adjacent rooms or even further away if the technology allows.

Using a frozen section for intraoperative consultations or other diagnostic purposes is considered an aerosol-generating procedure that requires some additional safety measures (separate cryostat for TB and other infections, additional PPE, special decontamination of the cryostat's chamber). If the cryostat becomes a part of the hybrid autopsy virology laboratory, studies on the virus aerosolization become more reliable because the tissue of concern is taken just on the spot without any transitional steps. Moreover, the aerosolization can be experimentally instigated in the cryostat chamber by use of freezing sprays, which should be avoided during regular frozen sections due to the possible formation of aerosols. This practice would be interesting as an experimental study of SARS-CoV-2 aerosolization.

Due to the instigation of the virus aerosolization, the biosafety measures should be almost at the BL-3 level, along with all rules of the negative pressure ventilation and air filtration. Details of the virology laboratory organization and design are not within the author's skill-set. This article suggests the principle of such an experimental platform. Perhaps it already exists in research or clandestine military installations due to the obvious triviality of the concept and the apparent necessity of such studies.

### Discussion

While correctly raised questions can determine the direction of a study, His Excellence's method is the driving force for successes on the study's objectives. Foucault rotating and fixed mirrors method allowed Michelson carry out his fundamental studies speed of light, Rosalind Franklin's DNA X-ray crystallography allowed James Watson and Francis Crick to create double-helix model, hybridoma method allowed César Milstein and Georges J. F. Köhler to develop monoclonal antibody methodology. Actually, classic Wells' studies in 1934

started with the development of an instrument for air bacterial examination method at Harvard School of Public Health in 1931 [1].

A clinical ward can be a place for scientific or epidemiologic studies. However, it is, understandably, impossible to experiment with sick people in a ward. Fortunately, the majority of COVID-19 hospitalized patients recover. As the average COVID-19 death rate is 0.6%, no autopsy should be wasted as a source of additional knowledge about the disease.

The autopsy experimental platform method can answer some fundamental questions. Is SARS-CoV-2 virus aerosolization possible from the organs, and predominately the mucosa, of a person who died from COVID-19? A YES result would shed light on the possibility of aerosolization in principle. Manipulations with air flow above large simultaneously opened mucosa surfaces with specially designed methods of virus capturing would provide the answer to the main question of the virus aerosolization “take off” during an autopsy. However, a NO result in science is sometimes a more important result than an uncertain positive result. Moreover, negative result of aerosolization during autopsy procedure would diminish the fear of infection inoculation for workers and retract administrative limitations in the performance of autopsies.

The YES result would lead to a variety of additional studies to determine the conditions of aerosolization by experimenting with air velocity, temperature, and humidity. These studies would be a useful addition to previous data about the sizes of droplets and the distances they travel [6-8].

How viable is the aerosolized virus in the YES outcome of experiments? This question is also of practical importance. Epidemiological implications the viability of an aerosolized virus is difficult to overestimate.

The autopsy experimental platform can evaluate the quality and reliability of the molecular tests from a methodological approach. The diagnostic sensitivity and specificity of the test are still uncertain. Is the detected SARS-CoV-2 viable? Could the test not be just fragments of the virus’s RNA? Tissue-based PCR tests would also be beneficial for the clinical laboratory.

The notion of asymptomatic SARS-CoV-2 positive individuals shedding viruses is based purely on epidemiologic observations. A model describing COVID-19 community transmission by asymptomatic carriers was recently described [9]. SARS-CoV-2 transmission by asymptomatic carriers is the urgent unresolved problem for testing and the epidemic mitigation. But a mathematical model needs laboratory data substance for reliable reproducible scientific studies.

Immunohistochemical (IHC) and *in situ* hybridization (ISH) assays can be used for tissue identification of the SARS-CoV-2 virus [10]. These studies might be beneficial for COVID-19 diagnostic and scientific studies.

In the YES situation, if the mucus containing SARS-CoV-2 aerosols could be obtained from the mucosa surface, opportunities for surface contact (fomites) studies would be promising. Besides the epidemiologic value of these data concerning to cleaning recommendations, manufacturers would be highly interested in testing disinfection reagents on the real thing rather than an imitation model.

A remote but not completely unreasonable perspective is the interest of the pharmaceutical industry in such an experimental platform. To some degree, the autopsy experimental platform might be additional and more fruitful to animal testing. Actually, the autopsy hybrid laboratory can be paired with different research laboratories.

The time has gone when clinicians were active participants during an autopsy. There are many rational reasons for this trend, which have already widely discussed. While autopsies will remain an educational tool for clinicians, though with diminished significance, hybrid autopsy laboratories can become experimental investigative pathology platforms. The new autopsy paradigm: Clinicians are unfortunately being gradually moved out of the autopsy room, while experimental scientists are moving in.

## Conclusion

A clinical ward can be a place for scientific or epidemiologic studies. An autopsy experimental platform in a hybrid autopsy virology laboratory can be a step ahead in receiving reproducible scientific data. Currently the hybrid autopsy virology laboratory is a necessity-an urgent task for the problem of studying SARS-CoV-2 aerosolization. There is also the need to prepare for future epidemics.

## Funding

No funding.

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