





Impact of the COVID-19 lockdown on basic science research in ophthalmology: the experience of a highly specialized research facility in France

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By the end of 2019, a pneumonia outbreak of then unknown etiology, was reported in Wuhan, China. The causative organism was identified on the 7th of January 2020 as a novel coronavirus (nCoV or 2019-nCoV), then renominated severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) as it was very similar to the one that previously caused SARS outbreak. Indeed, in the past 20 years, two additional coronavirus epidemics have occurred: in 2003 SARS-CoV caused a large-scale epidemic that spread from China and involved ~8000 patients, causing ~800 deaths. In 2012, the MERS-CoV epidemic began in Saudi Arabia involving about 2500 people, causing ~800 deaths with some sporadic cases still reported nowadays [1]. To date, coronavirus disease 2019 (COVID-19) has already affected more than 2,000,000 people with almost 150,000

deaths worldwide [2]. Evidence suggests that human-to-human transmission of SARS-CoV-2 can occur through droplets, contacts, tears, and fomites [3]. This has led several countries to adopt a series of confinement measures that aim to reduce the spread of the contagion and the number of simultaneous active, “serious” COVID-19 cases that risk overcharging hospitals and intensive care units. The French COVID-19 outbreak is among the five largest reported so far in Europe. The measures taken by the government consisted in recommending social distancing, while forbidding any form of assembly or crowd; furthermore, restaurant, cafes, and most of the shops were closed besides food stores and pharmacies. Hospitals and health care providers are trying to adjust to the current situation developing and/or ameliorating telemedicine services and privileging urgent/emergency care over routine practice [4]. The impact of the COVID-19 lockdown on the world of research is also inevitably heavy. Direct consequences of the lockdown measures are the slowdown of all research activities (in particular non-COVID-19-related) and the cancellation/postponing of national and international conferences. Research institutions are often left autonomous in deciding how to face the lockdown, deciding whether to shut down completely or continuing their research activities while ensuring the safety of their employees.

The *Institut de la Vision* in Paris counts about 300 researchers and students with 18 research teams organized in five departments (development, genetics, visual information, therapeutics, and photonics), embracing all fields of the ophthalmic research. In order to continue providing high standards in ophthalmic research while ensuring the safety of the workplace, several measures have been adopted. Overall, three general recommendations were made: (1) the number of employees simultaneously allowed in each facility was reduced and controlled to ensure the preservation of the safety distance; (2) it was forbidden to start any

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new bench experiments in favor of the adoption of protocols of maintenance; (3) a remote access software was implemented in all computers to allow homeworking. In addition, for each facility, further changes and dispositions were taken. For the animal facility (comprising mice and rats), three subsequent steps were followed: first, each team was asked to cut down the number of animals in order to reduce the burden of maintenance and allowing the co-presence of no more than two employees in the facility at the same time. Second, the protocol of animal maintenance was revisited to extend the time of cage change and feeding. Third, non-specialized personnel were trained for animal maintenance to have back-ups in case of unavailable specialized personnel (e.g., sick leave). For the cell culture facilities, most of cell cultures were frozen with few authorized exceptions for stem cell research requiring long protocols of differentiation and maturation. For the latter, protocols of maintenance were adapted to extend the time of medium change. Finally, for the Informatics facilities, priority was given to software over hardware development, allowing homeworking in most of the cases.

Overall, only employees who are required for the maintenance of the restricted activities are authorized to enter the Institute. The use of masks and gloves is highly recommended when entering a facility while all forms of face-to-face meetings have been strictly forbidden. Researchers had to be inventive in pursuing their work remotely, staying in touch with their team using social media and videoconferences (tools that are now widely available, compared with some years ago). Each team mostly shifted the priority of their research activity from advancing with new experiments to (1) updating their knowledge through the study of the literature or following on-line courses; (2) the analysis of previously collected data; (3) the preparation of manuscripts or presentations of their work. Of note, some researchers offered their help in supporting other laboratories in COVID-19-related activities (e.g., diagnostic procedures, pathophysiologic investigations, and/or therapeutic experimentations). At the same time, several students voluntarily joined the Civil Protection to help in hospitals and in the city as needed. Up to now, the impact of the COVID-19 lockdown manifested above all on short-term projects involving students (e.g., master's degree

students, 1-year fellowship programs) and affecting their training, which had to be redirected from a typically practical internship, to a more theoretical schooling provided by on-line courses or seminars. However, it is difficult to estimate the long-term consequences on research and teaching programs. Nevertheless, it is predictable that this experience will change our work and teaching habits, promoting and accelerating the development and usage of on-line tools and tele-working. For sure, it taught us the importance of having codified specific protocols to ensure the safety of researchers, while guaranteeing (as much as possible) the continuity of the research activities.

Compliance with ethical standards

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