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# CERTIFICATE

## Inactivation of avian influenza virus by UVC irradiation in the cryostat Leica CM1850 UV

### Summary

**UVC irradiation within the working space of the cryostat Leica CM1850 UV can provide safe and effective surface and air disinfection of influenza viruses including highly pathogenic avian influenza A type H5N1 viruses.**

**High-level disinfection of influenza (flu) viruses can be achieved by UVC irradiation for 30 minutes. Influenza viruses are inactivated (reduction of infectivity by 5 $\log_{10}$ units) within this period of time, as long as they are directly exposed to radiation.**

**The cryostat should be cleaned of visible contamination with disinfectant before using the UV lamp.**

**The virucidal effect of radiation is restricted to directly illuminated areas. Therefore, UV irradiation cannot replace regular chemical disinfection of the cryostat chamber.**

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*Avian influenza*

Avian influenza ("bird flu") is an infectious disease of poultry caused by influenza type A viruses. An unprecedented epidemic of highly pathogenic avian flu (HPAI) spreads across large populations of domestic birds and migratory water fowl in Asia since 2003.

Avian influenza viruses do not normally infect humans. The first documented case occured in Hong Kong during the bird flu epidemic in 1997 involving the current highly pathogenic type H5N1 virus. H5N1 constitutes a major pandemic threat to humans. More than 50 people have already died from the disease in southeast Asia [1-4].

*Influenza viruses*

Influenza ("flu") viruses are classified into types A, B or C. Humans can be infected by all three types. Influenza type A viruses are divided into subtypes based on two proteins on the surface of the virus called haemagglutinin (H) and neuraminidase (N). There are 14 haemagglutinin subtypes and 9 neuraminidase subtypes of influenza A viruses, and potentially all H/N-combinations are possible. Influenza B viruses and subtypes of influenza A virus are further characterized into different strains.

Only some influenza A subtypes (i.e., H1N1, H1N2, and H3N2) are currently in general circulation among people.

Influenza viruses are members of the family Orthomyxoviridae. Their genome consists of eight segments of linear, single-stranded RNA with a total length of 13,600 nucleotides. Influenza viruses are enveloped viruses. In spherical forms, the virion diameter is 80-120 nm.

*Avian influenza viruses*

Influenza viruses that infect birds are called “avian influenza viruses”. Only influenza type A viruses infect birds. Influenza A viruses can infect people, birds, pigs, horses, and other animals, but wild birds are the natural hosts for these viruses.

To date, all outbreaks of HPAI have been caused by influenza A viruses of subtypes H5 or H7. HPAI is usually associated with high mortality in poultry.

Influenza viruses evolve rapidly. It is feared that the influenza A virus subtype H5N1 which causes the current epidemic in Asia could develop into a dangerous human pathogen by genetic reassortment with a human flu strain, possibly involving pigs as intermediate hosts [5-9].

*UVC inactivation of influenza virus*

Viruses like influenza virus with genomes comprised of single-stranded RNA are particularly sensitive to UVC radiation. This is supported by available data on UV inactivation: ssRNA viruses are generally highly sensitive to UVC radiation [10-12].

Accordingly, the decimal UVC (254 nm) inactivation dose for influenza A virus strains has been found to be as low as 1.8 - 4.1 mWs $cm^{-2}$. It is thus in the same range as that for sensitive vegetative bacteria like *Escherichia coli* and *Staphylococcus aureus* [12-14].

The susceptibility of influenza virus to UVC disinfection has also been noted by Riley (1977) [15].

In laboratory tests on the inactivation of *Staphylococcus aureus* by UVC (254 nm) in the cryostat CM1850 UV high-level disinfection (at least 5 $log_{10}$ units reduction) was achieved within 30 min irradiation [16].

The morphology, general structure and genome organization is the same in all influenza viruses. Data on UVC sensitivity of human influenza virus strains are thus equally applicable to avian influenza viruses including influenza A subtype H5N1.

It is concluded that a 30 min period of germicidal UVC irradiation in the cryostat CM1850 UV results in an inactivation of influenza virus by at least 5 $log_{10}$ units. This corresponds to high-level disinfection according to the U. S. Department of Health and Human Services [17, 18], the Association for Professionals in Infection Control and Epidemiology [19], the WHO [20, 21], and the German Association for the Control of Virus Diseases [22].

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