

Illumination during image acquisition in the EmbryoScope time-lapse system

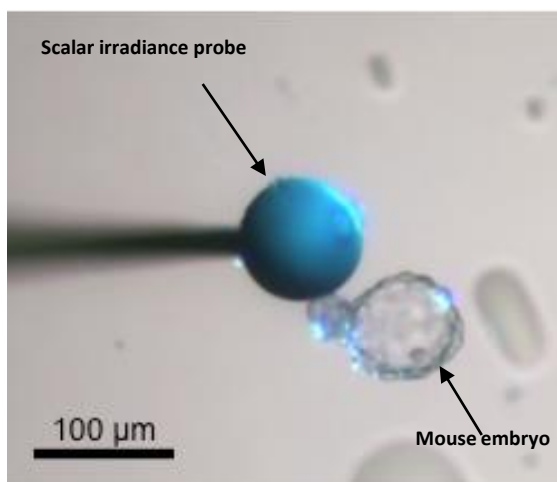
The optics used in the EmbryoScope time-lapse system are specially designed to acquire images with illumination from a single red LED (635nm). Built-in controls ensure that light exposure does not exceed a defined limit, which is well below total light exposure in average standard IVF procedures.

It is possible to acquire image stacks with 1 to 17 focal planes. In a typical setting with image cycle intervals of 10 minutes in 7 focal planes the EmbryoScope time-lapse system acquires approximately 1000 images per embryo per day with a total illumination time of 31 seconds per day. This is an improvement compared with the time an embryo is illuminated during typical IVF procedures.

Quantifying light exposure

In order to quantify and compare light exposure in the EmbryoScope time-lapse system with standard clinical microscopic techniques, studies were performed in collaboration with Dr. Michael Kühl from the University of Copenhagen. He used a scalar irradiance probe with dimensions similar to a mouse embryo to measure the integrated light exposure inside the EmbryoScope time-lapse incubator and in microscopes used in standard IVF procedures.

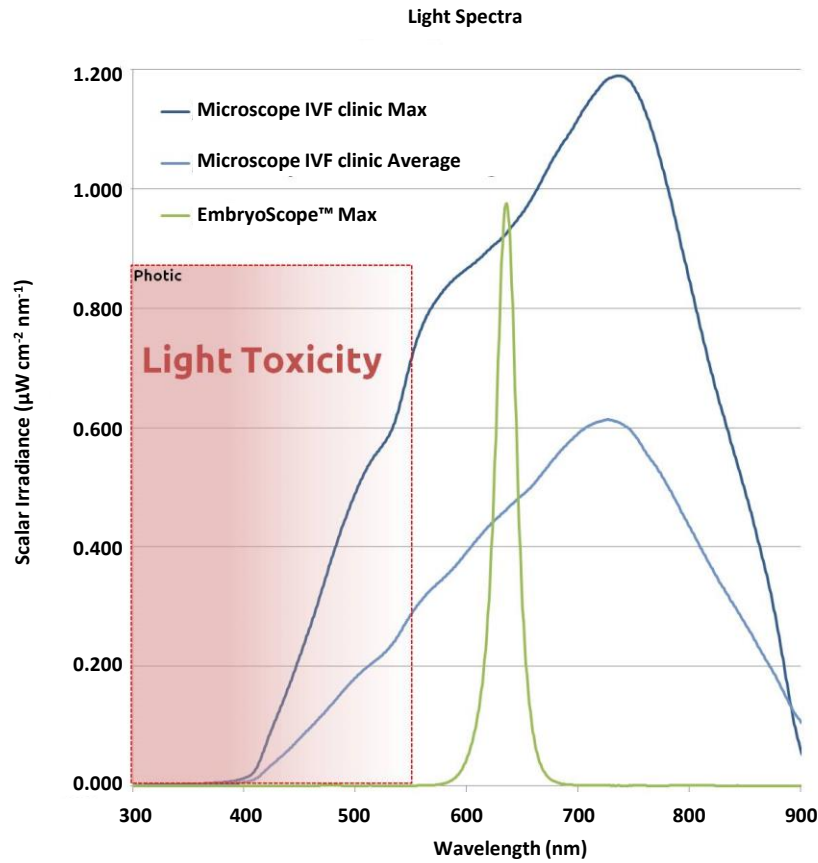
The use of an optic micro-probe allows accurate measurement of the actual light exposure at the size scale of the embryo. To measure within an optical system in which illumination is focused on the embryo by a condenser lens, this method is superior to the use of larger macro-probes, which integrate light over a larger area.



Light exposure in the EmbryoScope time-lapse system is limited to low-energy red light

The total light intensity was measured for all wavelengths emitted by the light source in both standard microscopes used in an IVF laboratory and in the EmbryoScope time-lapse system. Measurements were taken with the same scalar irradiance sensor placed at the position of the embryo in a medium-filled cultivation vessel with an oil overlay (medium-filled EmbryoSlide culture dish for the EmbryoScope time-lapse system and a Petri dish for microscopes).

The microscopes spectra were very similar due to their halogen lamp light source with a substantial amount of the irradiation (7% – 15%) present as energy-rich blue and green light with wavelengths below 550 nm. Irradiation at wavelengths below 550nm could not be detected in the EmbryoScope time-lapse system (i.e. scalar irradiance < 0.01%).



Light intensity at all wavelengths for the EmbryoScope time-lapse system and two microscopes used in conventional IVF measured using the scalar irradiance probe. Li et al. (2014), Zygote 23(3)

Light exposure in the EmbryoScope time-lapse system is superior to routine IVF procedures

Total light intensity is calculated by combining the results from the scalar irradiance measurements and the illumination times in the EmbryoScope time-lapse system and in standard IVF microscopes, respectively.

Total light exposure during image acquisition in the EmbryoScope time-lapse system is calculated for an image cycle length of 10 minutes and acquisition from 7 focal planes.

These settings will generate more than 5000 images during five days of culture.

Total light energy exposure during a typical IVF / ICSI routine has been reported to be 3200/ 9800 J/m², respectively using conventional microscopy (Ottosen et al. (2007) J Assist Reprod Genet, 24: 99-103).

Total light intensity (J/m ²), 5 day culture	Full spectrum	380 – 550 nm
EmbryoScope time-lapse system, typical	53	0
EmbryoScope time-lapse system, max.	99	0
IVF Microscope, average	394	43
IVF Microscope, max.	776	113