Optical reader and method of analyzing biological samples

Technical field of the invention

The present invention relates to an optical reader. The invention also concerns a method of analyzing biological samples.

Background of the invention

Enzyme-Linked Immunosorbent Spot Assay (ELISPOT) is a method that is typically used for monitoring cellular immune responses in humans and other animals or organisms. The ELISPOT method allows detecting cells that secrete various substances. The ELISPOT assay can be used, for example, for detecting antigen-specific antibody secreting cells or cytokine producing cells. The examined cells are placed into the wells of a microplate or into some other suitable small vessel and treated to trigger a reaction at least in part of the cells. The cells reacting to the treatment secrete biologically relevant molecules that can be detected as spots. In this assay, one spot represents one immunologically reactive cell. These spots can be detected and counted either manually using for example a microscope or automatically using a specific reader adapted to ELISPOT assays.

ELISPOT readers have been designed so that the samples are illuminated and a camera is used for taking an image of each sample. A problem with many known devices used for ELISPOT assays is the amount of stray light produced by the light illuminating the samples. The stray light decreases the contrast of the image and makes analyzing of the samples more difficult.

Summary of the invention

Embodiments of the present invention provide an improved optical reader for analyzing biological samples arranged in the wells of a microplate. Embodiments of the invention provide an improved method of analyzing biological samples arranged in the wells of a microplate, which is arranged in a horizontal reading plane.

According to a first aspect of the invention, there is provided an optical reader for analyzing biological samples arranged the wells of a microplate, the optical reader including a horizontal reading plane for receiving a microplate comprising a plurality of wells, an illuminating arrangement comprising a light source and being arranged to illuminate the samples in the wells of the microplate, an imaging device arranged to receive light from the microplate, a beam splitter, which is arranged to direct part of the light from the illuminating arrangement towards the reading plane and to direct part of the light received from the microplate to the imaging device, and a lens system comprising at least one lens and being arranged between the beam splitter and the reading plane to focus the light received from the illuminating arrangement to a sample and to focus an image of the sample to the imaging device. The optical reader is configured to transmit from the illuminating arrangement to the lens system only light having a specific polarization, and the optical reader comprises a polarizer that is arranged between the lens system and the imaging device and configured to block polarized light reflected from the surfaces of the lens system.

According to a second aspect of the invention, there is provided a method for analyzing biological samples arranged the wells of a microplate, the method including the steps of producing polarized or unpolarized light by means of an illuminating arrangement, directing part of the produced light by means of a beam splitter towards a sample in a well of a microplate, in case of unpolarized light, polarizing the light received from the beam splitter, directing light with a specific polarization by means of a lens system to the sample, passing at least part of the light reflected from the microplate and the sample and/or emitted by the sample through the lens system, directing part of the light received from the microplate and the lens system by means of the beam splitter towards an imaging device, and forming an image of the sample by means of the imaging device. Polarized light reflected from the surfaces of the lens system are blocked by means of a polarizer arranged between the lens system and the imaging device.

By directing the light from the illuminating arrangement via the beam splitter and the lens system to the well of the microplate, it is possible to form a uniform and bright spot on the bottom of the well. Stray light around the well can be significantly reduced, which increases the contrast of the image. However, as the illumination beam goes through the lens system, stray light is formed on each lens