Summary

According to a first aspect of the present invention, there is provided, an instrument for biological analysis, comprising: an excitation source producing electromagnetic radiation; a sample holder configured to receive a plurality of biological samples; an optical sensor configured to receive an emission from the biological samples; an excitation optical system disposed along an excitation optical path and configured to direct the electromagnetic radiation from the excitation source to the biological samples; an emission optical system disposed along an emission optical path and configured to direct electromagnetic emissions from the biological samples to the optical sensor; a plurality of filter components configured to be interchangeably located along at least one of the optical paths, the plurality of filter components comprising: a first filter component characterized by a first optical power and a first filter having a first filter function, the first filter function characterized by at least one of a first low-pass wavelength or a first high-pass wavelength; a second filter component characterized by a second optical power and a second filter having a second filter function, the second filter function comprising at least one of a second low-pass wavelength that is different than the first low- pass wavelength or a second high-pass wavelength that is different than the first high-pass wavelength.

According to a second aspect of the present invention, there is provided an instrument for biological analysis, comprising: an excitation source producing electromagnetic radiation; a sample holder configured to receive a plurality of biological samples; an optical sensor configured to receive an emission from the biological samples; an excitation optical system disposed along an excitation optical path and configured to direct light from the light source to the biological samples; an emission optical system disposed along an emission optical path and configured to direct light from the biological samples to the optical sensor; a plurality of optical components configured to be interchangeably located along at least one of the optical paths, the plurality of optical components comprising: a first optical component having a primary optical characteristic and a secondary optical characteristic; a second optical component having different values of the primary optical characteristic and of the secondary optical characteristic than first optical component.

According to a third aspect of the present invention, there is provide an instrument for biological analysis, comprising: a light emitting diode (LED) light source producing light having wavelengths over the entire range from 450 nanometers to 700 nanometers; a sample holder configured to receive an two-dimensional array of biological samples; a two-dimensional optical sensor array; an excitation optical system disposed along an excitation optical path and configured to simultaneously direct light from the light source to the biological samples; an emission optical system disposed along an emission optical path and configured to direct light from at least some of the biological sample to the optical sensor; a first filter component comprising a first filter having a first filter function configured to transmit light over a predetermined range of wavelengths and a first refractive element having a non-zero optical power; a second filter component comprising a second filter function configured to transmit light over a range of wavelengths not included in the predetermined range of the first filter; a first configuration in which the first filter component is located along the emission optical path and the second filter component is located outside the emission optical path; and a second configuration in which the second filter component is located along the emission optical path and the first filter component is located outside the emission optical path.

According to a fourth aspect of the present invention, there is provided an instrument for biological analysis, comprising: an excitation source producing electromagnetic radiation; a sample holder configured to receive a plurality of biological samples; an optical sensor configured to receive an emission from the biological samples; an excitation optical system configured to direct light from the light source to the biological samples; an emission optical system disposed along an emission optical path and configured to form an image of the biological samples at an image plane located on or proximal the optical sensor; a plurality of filters having different transmission wavelength bands, the filters being interchangeably located along the emission optical path; wherein the image plane of the biological samples have the same location along the emission optical path when any one of the filters is located along the emission optical path.

According to a fifth aspect of the present invention, there is provided a method for monitoring a plurality of biological samples, comprising: providing an instrument as defined in

the first aspect; locating a sample array comprising a plurality of biological samples within the sample holder; locating the first optical component along the at least one of the optical paths; using the optical sensor to simultaneously record an image of the plurality of biological samples while the first optical component is located along the at least one of the optical paths; locating the first optical component away from the at least one of the optical paths and locating the second optical component along the at least one of the optical paths; using the optical sensor to simultaneously record an image of the plurality of biological samples while the second optical component is located along the at least one of the optical paths.

According to a sixth aspect of the present invention, there is provided an instrument for biological analysis, comprising: an excitation source producing electromagnetic radiation; a sample holder configured to receive a plurality of biological samples, the sample extending over a rectangular area characterized by a first aspect ratio having a first value; an optical sensor configured to receive an emission from the biological samples; an excitation optical system configured to direct the electromagnetic radiation from the excitation source to the biological samples; an emission optical system configured to direct electromagnetic emissions from at least some of the biological samples to the optical sensor; a rectangular emission filter disposed along an optical path between the sample holder and the optical sensor, the rectangular emission filter characterized by a second aspect ratio having a second value; wherein the first value is within twenty percent of the value second value.