Summary

An aspect of the present invention provides 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 filter assembly comprising a plurality of filter components, the plurality of filter components comprising:

a first filter component having no optical power, the first filter component consisting of a first filter characterized by at least one of (a) a first low-pass wavelength or (b) a first high-pass wavelength;

a second filter component characterized by a finite focal length, the second filter component comprising a singlet lens and a second filter characterized by at least one of (a) a second low-pass wavelength that is different than the first low-pass wavelength or (b) a second high-pass wavelength that is different than the first high-pass wavelength;

wherein the filter assembly selectively locates the plurality of filter components into the emission optical path;

wherein the singlet lens changes an effective focal length of the emission optical system and a magnification of the emission optical system.

CLAIMS

1. 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 filter assembly comprising a plurality of filter components, the plurality of filter components comprising:

a first filter component having no optical power, the first filter component consisting of a first filter characterized by at least one of (a) a first low-pass wavelength or (b) a first high-pass wavelength;

a second filter component characterized by a finite focal length, the second filter component comprising a singlet lens and a second filter characterized by at least one of (a) a second low-pass wavelength that is different than the first low-pass wavelength or (b) a second high-pass wavelength that is different than the first high-pass wavelength;

wherein the filter assembly selectively locates the plurality of filter components into the emission optical path;

wherein the singlet lens changes an effective focal length of the emission optical system and a magnification of the emission optical system.

2. The instrument of claim 1, wherein the plurality of filter components includes a third filter component comprising a third optical power and a third filter function.

3. The instrument of claim 1, wherein the plurality of filter components has a first condition in which the first filter component is disposed along the emission optical path and a second condition in which second filter component is disposed along the emission optical path, the optical power being sufficient to at least partially compensate for an aberration introduced by the

second filter.

4. The instrument of claim 3, wherein the aberration is a chromatic aberration.

5. The instrument of claim 1, further comprising a first lens element and a second lens element, the lens elements having positive optical power and disposed along the emission optical path, the first lens element disposed between the optical sensor and one of the filter component, the second lens element disposed between the one of the filter components and the sample holder.

6. The instrument of claim 5, wherein the second lens element is disposed along the excitation optical path.

7. The instrument of claim 5, further comprising a beamsplitter disposed along the emission optical path, the second lens element and the beamsplitter disposed along the excitation optical path.

8. The instrument of claim 1, wherein the optical sensor comprises a charge coupled device CCD detector array or a complementary metal-oxide-semiconductor CMOS detector array comprising at least 4,000,000 pixels.

9. The instrument of claim 1, wherein the instrument is a real-time polymerase chain reaction (qPCR) instrument.

10. The instrument of claim 1, further comprising a thermal control unit configured to control the temperature of the biological samples.