



Facultat de Física




Facultat de Química

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Salón de Actos "Charles Darwin". Campus de Burjassot

El Premio Nobel de Química 2014: Combinando Óptica y Química para hacer visible lo indistinguible

The Nobel Prize 2014 in Chemistry



Their microscopes crossed the threshold

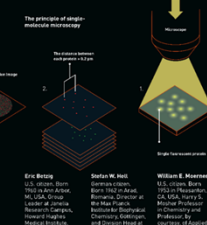
Optical microscopy had long been hindered by a presumed limitation: that it was impossible to achieve a resolution better than half the wavelength of light. Eric Betzig, Stefan W. Hell and William E. Moerner are awarded the 2014 Nobel Prize in Chemistry for ingeniously bypassing this limitation. Their revolutionary work has taken optical microscopy to nano dimensions.

Over the last few decades, scientists have been engaged in a quest to push the limits of optical microscopy to ever smaller scales. For example, you can see how molecules fit together between the two bases of a DNA double helix using a fluorescence microscope. However, a fundamental barrier to the resolution of optical microscopy is the wavelength of light. The theory behind the optical microscope, which uses light to illuminate a specimen, was first developed by the Dutch physicist Christiaan Huygens in 1690. The first practical demonstration of the diffraction limit was made by the German physicist Ernst Abbe in 1871. He showed that the resolution of a microscope is limited by the wavelength of light. This is why, until now, optical microscopes could not see structures smaller than about half the wavelength of light.

2004 - Betzig develops single-molecule microscopy

1. In 2004, Eric Betzig circumvented Abbe's limit by using a series of pulsed laser pulses to illuminate a single molecule at a time. Because he had never excited the fluorescent molecules before, they were not yet fluorescent. They remained so until they had been illuminated by a single laser pulse.
2. The blurry images were obtained using a technique called photoactivated localization microscopy (PALM). Because he had never excited the fluorescent molecules before, they were not yet fluorescent. They remained so until they had been illuminated by a single laser pulse.
3. He then repeated the process over and over again, building up a high-resolution image of the specimen. The images were repeated until a high-resolution image had been obtained.

The principle of super-resolution microscopy



2006 - Hell develops STED microscopy

1. In a regular microscope the light beam is focused to a spot that is larger than the wavelength of light. This means that the light is spread out over a larger area than the wavelength of light.
2. In STED microscopy, the light beam is focused to a spot that is smaller than the wavelength of light. This is achieved by using a second laser beam to deplete the excited state of the fluorophore.
3. The result is a much smaller spot of light, which allows for much higher resolution.

2008 - Moerner lays the foundation for single-molecule microscopy

Single-molecule microscopy (SMM) is a technique that allows scientists to study individual molecules in real time. It is used to study the structure and function of proteins, DNA, and other biological molecules. SMM is used to study the structure and function of proteins, DNA, and other biological molecules. SMM is used to study the structure and function of proteins, DNA, and other biological molecules.

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