Autoradiography Encyclopedia Article

Autoradiography

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Autoradiography

Autoradiography is a method used to detect the distribution and quantify radioisotope deposited in a specimen. This technique originated in 1867, when Niepce de St. Victor first observed the blackening of silver chloride and silver iodide emulsions by uranium nitrate and uranium tartrate.

Several radioactive elements can be used for autoradiography. Their choice depends on the type of sample, the component of the sample being radiolabeled, the thickness of the target (some radionuclides will penetrate further into tissues than others, and the type of radiation emitted. Most radionuclides used are B-emitters - common ones are ^{3}H and ^{14}C. Other **species** include ^{125}I and ^{35}S; the latter is particularly adept at labeling proteins, and is used to gauge the production of protein by organisms such as **bacteria**.

Autoradiography can be performed on samples ranging from microorganisms to plants to whole animals such as mice. The latter are frozen into a block of carboxymethyl cellulose following injection of the radiolabel and sacrifice. Thin slices of tissue are obtained for analysis. Examination of the pattern of radiolabel deposition can involve light or electron microscopy or the use of electrophoretic gels in which various proteins can be separated from each other.

The process of conventional autoradiography involves the placing of the sample next to photographic film consisting of a base, photosensitive emulsion and a protective coat of non-photosensitive gelatin. The emulsion layer is made up of silver halide grains interspersed within gelatin. Bromine, iodine or sulfur-containing compounds can also be incorporated into the silver halide crystals to provide increased photosensitivity. The silver grains can be variously sized, depending on whether the experiment demands increased detection sensitivity or detection **resolution**. When the emulsion is next to the sample tissue slice or electrophoretic gel, the emitted radiation causes the formation and precipitation of elemental silver in the emulsion. Photographic development renders the silver grains permanent and prevents the precipitation of the undeveloped silver halide. The pattern of silver grains corresponds to the location of the radiolabeled material in the sample.

Limitations in image quality and detection of low levels of radiolabeling have prompted the search for improved means of resolution. Digital autoradiography, where the patterns of radiolabeling are determined by digital technology instead of using film, have shown value in **biochemistry**, pharmacology, nuclear medicine and radiotherapy.