

Training for manual scoring of micronuclei in binucleated cells, on Giemsa stained slides

Aim

This training exercise is an online survey and consists of a number of consecutive candidate micronucleus-positive BN objects, which should be evaluated. You should decide whether the object is a binucleated cell, if it contains micronuclei and score the micronuclei according to the scoring criteria.

With this survey we aim to standardize the manual MN scoring throughout all the laboratories.

How

Prior to starting the training, please print and read the scoring criteria (see next page).

For optimal visualization of the images, we suggest using a **high resolution screen**.

Start

[The training survey for manual scoring of micronuclei in binucleated cells.](#)

Scoring criteria

1) Criteria for selecting binucleated (BN) cells which can be scored for micronucleus frequency

The cytokinesis-block cells that are scored for MN frequency should have the following characteristics:

- a) The cells should be binucleated.
- b) The two nuclei in a BN cell should have intact nuclear membranes and be situated within the same cytoplasm.
- c) The two nuclei in a BN cell should have a regular shape and be approximately equal in size, staining pattern and staining intensity.
- d) The two nuclei within a BN cell may be unconnected or may be attached by one or more fine nucleoplasmic bridges, which are no wider than 1/4th of the nuclear diameter.
- e) The two main nuclei in a BN cell may touch but ideally should not overlap each other. A cell with two overlapping nuclei can be scored only if the nuclear boundaries of either nucleus are distinguishable.
- f) The cytoplasm of a BN cell should be somewhat visible and distinguishable from the cytoplasm of adjacent cells.

2) Criteria for scoring micronuclei (MN)

- a) MN are morphologically identical to but smaller than the main nuclei.
- b) The diameter of MN in human lymphocytes is variable. The largest MN should be smaller than 1/3rd of the diameter of the main nuclei; on the other hand MN can also be very small.
- c) MN are non-refractile and can therefore be readily distinguished from artefacts such as staining particles.
- d) MN are not linked or connected to the main nuclei.
- e) MN may touch or slightly overlap the main nuclei but the micronuclear boundary should be distinguishable from the nuclear boundary.
- f) MN usually have the same staining intensity as the main nuclei but occasionally staining may be more or less intense.

These scoring criteria are adapted from the manual scoring criteria described in the IAEA Manual (EPR-Biodosimetry 2011, p 114-115).