Examples of expected overall distribution

(a) : the most desirable shape
(b) : very low counts genes usually have large p-values
(c) : do not expect positive tests after correction

Examples of not expected overall distribution

(a) : indicates a batch effect (confounding hidden variables)
(b) : the test statistics may be inappropriate (due to strong correlation structure for instance)
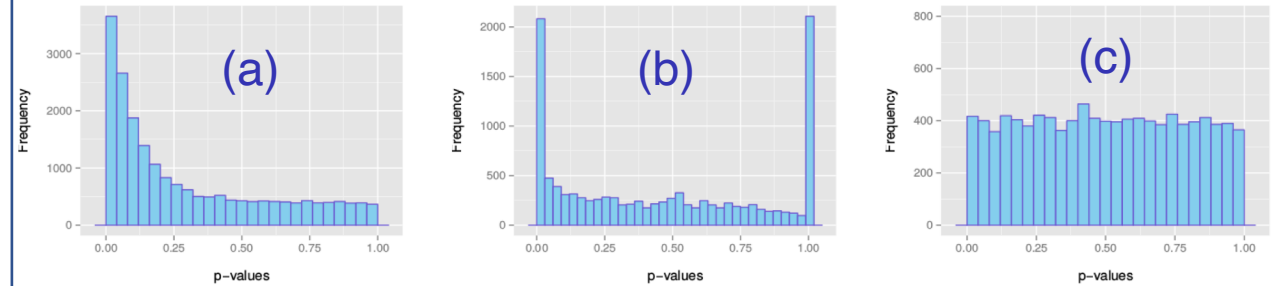(c) : discrete distribution of p-values : unexpected

Sources: G. Marot (INRIA)
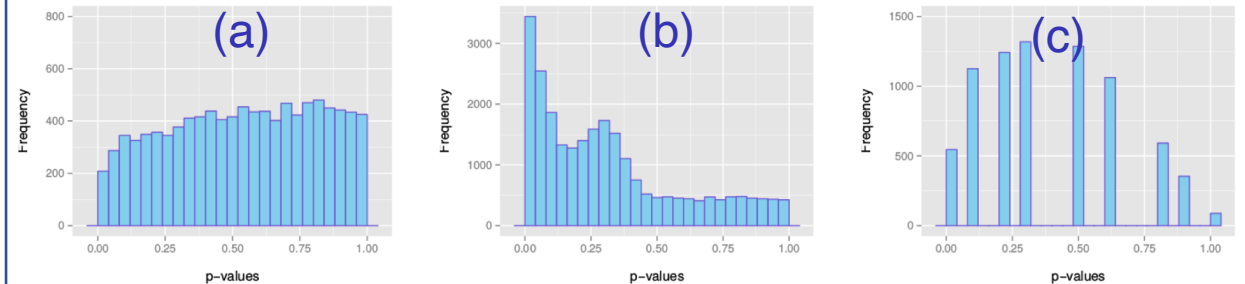J. Aubert et C. Hennequet-Antier (INRA)
M.A. Dillies (Institut Pasteur Paris)

Source : M. Guedj, Pharnext