Microbiological diagnostics – an overview

biametrics

Technique	Application examples	Sensitivity	Specificity	Advantages	Disadvantages
Conventional cell-based	culture in/on several media, microscopy, Gram-staining, biochemical tests	good-excellent	good	▪ quite inexpensive ▪ qualitative and quantitative data	▪ pathogens have to grow in artificial media ▪ labour-intensive and time-consuming
Immunological	ELISA, serological assay, Microarray	moderate-good	moderate-good	▪ high-throughput capacity ▪ rapid ▪ relatively low-cost ▪ ease-of-use ▪ qualitative and quantitative data	▪ detection limit for organisms/antigens with low abundance ▪ difficulties in generating selective antibodies
Nucleic-acid based	Hybridisation (*in situ*, Sandwich, Southern blot, Northern blot)	moderate-good	excellent	▪ rapid ▪ ease-of-use	▪ detection limit for organisms with low abundance ▪ pre-cultivation necessary ▪ limit number of probes in one experiment ▪ unknown species cannot be detected
	PCR (nested, multiplex, real time, competitive quantitative)	excellent	excellent	▪ rapid ▪ ease-of-use ▪ low amounts necessary ▪ qualitative and quantitative data	▪ limited capacity for multiplexing ▪ unknown species cannot be detected
	sequencing	good-excellent	excellent	▪ provides most detailed, unbiased information ▪ reveals novel organisms	▪ detection limit for organisms with low abundance ▪ expensive and time-consuming
	DNA/RNA-Microarray	good	excellent	▪ high-throughput capacity ▪ ease-of-use	▪ detection limit for organisms with low abundance ▪ medium expensive and time-consuming (when labelled) ▪ unknown species cannot be detected
Other	MALDI-TOF mass spectrometry	good	good	▪ high-throughput capacity ▪ rapid ▪ generates easily interpretable spectra ▪ qualitative and quantitative data ▪ low overall operating costs	▪ detection limit for organisms with low abundance ▪ host proteins and normal flora might overlap mass spectra ▪ high initial investments and maintenance costs ▪ lacking differentiation of closely related species