Rapid detection of microorganisms by peptide nucleic acids

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Peptide nucleic acid (PNA) molecules are DNA mimics, where the negatively charged sugar-phosphate backbone is replaced by an achiral, neutral polyamide backbone formed by repetitive units of N–(2-aminoethyl) glycine. Due to their superior hybridization properties, PNA probes to detect pathogens by fluorescence in situ hybridization (FISH) have been challenging DNA probes over the last few years. In our lab, we have already designed and developed several new probes for the specific detection of bacterial species such as *Helicobacter pylori*, *Cronobacter* spp., *Staphylococcus epidermidis*, *Salmonella* spp. and *Proteus* spp. [1, 2]. During development and validation, probes are tested against several related species, and have been shown to be highly specific for the microorganisms of interest. All techniques were optimized in slides and then adapted for different types of samples, depending on the microorganism: *H. pylori* probe has been developed to work on gastric biopsies and will soon be tested in a clinical trial for a potentially commercial application; *Cronobacter* spp. is a major contaminant of milk-based powdered infant formula, and as such a probe to detect the pathogen after pre-enrichment of contaminated milk was devised; *S. epidermidis*, which is frequently present on the skin of humans, had methods developed for its identification in blood samples and catheters; and analysis of interest for *Salmonella* and *Proteus* spp. included pipes of drinking water distribution systems and urinary samples. Future work with PNA probes will involve simultaneous detection of several species in a single sample and quantitative signal detection by flow cytometry.

References:

[1] Guimarães N, Azevedo NF, Figueiredo C, Keevil CW, Vieira MJ, “Development and application of a novel peptide nucleic acid probe for the specific detection of *Helicobacter pylori* in gastric biopsies” *J. Clin. Microbiol.* (2007) **45**:3089-3094.

[2] Almeida C, Azevedo NF, Iversen C, Fanning S, Keevil CW, Vieira MJ, “Development and application of a novel peptide nucleic acid probe for the specific detection of *Cronobacter* Genomospecies (*Enterobacter sakazakii*) in powdered infant formula”. *Appl. Environ. Microbiol.* (2009) doi:10.1128/AEM.02470-08.