9 Summary

The technology of artificial noses has been developed for aroma analysis and is successfully used for monitoring processes and quality control in food industries for some years. The study was designed to determine the possibility of the application of this technology for periodontal microbiological diagnosis. The purpose was to evaluate the possibility to discriminate five periodontal pathogens in vitro with a new developed electronic nose (Olfaktograph®).

The device is an automated headspace analyser based on a detector system with two semiconductor sensor-arrays. Each of the sensors responds to different volatile organic compounds leading to characteristic changes in electrical conductance of the sensors.

Two clinical isolates and five strains (DSMZ and ATCC) were anaerobically grown for two to ten days on Columbia agar petri dishes. A total of 150 measurements were made by sampling the volatiles over the headspace of an agar plate with pure bacterial cultures of the following species: *Actinobacillus actinomycetemcomitans, Prevotella intermedia, Eikenella corrodens, Fusobacterium nucleatum, Porphyromonas gingivalis*. Additionally twelve samples of clinical isolates of *P. gingivalis* and *P. intermedia* were analysed. Linear pattern-analysis method has been used by the linear discriminant analysis (LDA) to evaluate sensor-array data. The purpose of the LDA is to find the optimal linear separation between the giving bacterial groups. It was established a model for five bacterial aroma classes which was tested.

The bacteria from different pure cultures were “mapped” to five different clusters in the LDA-model. However the five bacterial aroma-groups are partly overlapping. Two of the tested species (*Porphyromonas gingivalis* and *Eikenella corrodens*) are identified with a high prediction rate of 91 %, 77 % respectively. The other three species (*F. nucleatum, P. intermedia, A. actinomycetemcomitans*) can be recognized but they don’t reach a high prediction rate. The clinical isolates of *P. gingivalis* are very good classified in the LDA-model of the five laboratory strains with nearly 85 % prediction rate. By way of contrast the clinical isolates of *P. intermedia* are misclassified with a high rate. The prediction rate of *P. intermedia* is only 13 % in this model.

The presented results have to be critically discussed in the points of sampling system in the comparison with similar studies. There exist few evaluations of similar applications for other bacterial species reaching better results. Electronic nose data are predominantly nonlinear in nature. More powerful, nonlinear prediction tools like artificial neural networks are widely used for pattern recognition.

But parts of the presented results and the other discussed applications of electronic noses suggest a potential for further tests with other species or the possibility of a clinical application.