Sensor based data acquisition in health control programs

E.A.M. ROSENDAAL, Bonn
B. PETERSEN, Bonn

1 Introduction; efficient and effective production

There are several economic, environmental and ethic aspect of today's animal production, which have their influence on the way this production take place. Main aspects are a decrease of financial support, specific demands of consumers concerning quality and quantity of products and production, overcapacity, environmental pollution and welfare of the pigs.

Nowadays, animal production is forced to satisfy the high quality demands of product and production. Therefore, controlling in the animal production chain is important. Controlling is not only monitoring the animal production and its product, but get information on factors and parameters which can influence the quality of the product and production as well.

Body temperature, as a physiological parameter is related to ovulation (Schilling and Röstel, 1964; Foote, 1975), birth introduction (King et al., 1972; Elmore et al., 1979) and diseases (Gershon-Cohen, 1964). These studies prove that physiological data can give a good insight into reproduction or health state of the animal.

In case this information is combined with the data which the farmer already has collected (e.g. day of weaning or birth), and visible and audible subjective parameters (e.g. behaviour, visible heat or disease symptoms), the probability of a better decision toward a high quality product (e.g. better meat quality) and production (e.g. less feed intake) will increase.

The problem with physiological parameters is that data is difficult to record in practical circumstances. Not only, it is impossible for the farmer to measure certain parameters with on farm equipment (for instance heart rate or blood pressure), but sometimes it takes too much time to get data about these parameters of each individual animal with traditional methods as well (e.g. body temperature measurement with a traditional thermometer). A development which makes it even harder is the group housing of sows.

2. Physiological data; measurement and interpretation

New technical developments have made it possible to measure physiological parameters with electronic sensors, like body temperature, pH-level, blood pressure and level

of hormone concentrations in blood (Hauptmann, 1990). Biological telemetry makes it possible to get data automatically on a continuous scale, without restriction of the animals movements.

However the opportunities given by a continuous measurement of physiological parameters with electronic sensors are not known yet. There is a lack of knowledge how they can be applied in animal production.

Main questions concern measurement and interpretation of the physiological data. Not only insight in the physiology of the pig, but knowledge about complex statistical procedures as well, is needed. For many parameters, it is still unknown how pathological deviations can be distinguished from physiological deviations.

Recent research shows the influence of stress on subcutaneous temperature measurements (Geers, 1992). Aim was to gain a better understanding of changes in body temperature of piglets in relation to halothane sensitivity and exercise, simulating handling and transport conditions. In this study thermistors (diameter 2 mm) were implanted about 5 mm under the skin. They found a significant effect of handling and exercise of the piglets.

In an other study the deep body temperature of weaned pigs was followed during unpredictable exposure to draught (cold air with high air speeds) and compared to deep body temperature of control piglets (Scheepens, 1991). The piglets were equipped with temperature telemetric devices according to the method previously described (Verhagen, 1987) and fixed to the ventral wall of the abdomen. Average deep body temperature was significantly lower during exposure to draught in the first fifteen days after starting the draught regime. It was also shown that minimum daily deep body temperature tended to be lower for draught-exposed pigs for 30 days. Periodicity of deep body temperature was of small magnitude and more obvious for draught-exposed pigs.

Interesting will be if in both cases, a physiological-pathological breakpoint can be detained. Then, body temperature value indicates the thermal condition of pigs and will be a process control parameter in the pork production chain.

However because of the many factors which are related to body temperature, a single value doesn't give any information. For application in practical management an expert system has to be build for interpretation of this process control parameter into useful information for the user

Research at the University of Bonn examines the application of the MONI T2000 system (Moll, 1990) in pork production. MONI T2000 is a telemetric system which uses passive injectable micro transponders (diameter 3.5 mm, length 25 mm, weight 0.3 g) for temperature measurement.

3. Interpretation; body temperature values

Interpretation of body temperature values measured by the MONI T2000 system needs interpretation. For the on-farm use of MONI T2000 three main concepts for an expert system (Barrett and Jones, 1989) will made:

Decision rules; the rules of an expert system normally use the if-then statement. For example, if the body temperature has a certain value then the the farmer has to take a certain action.

Data base; the decision rules embodied in a program are usually employed to help the user select from among a list of products, objects, conditions or procedures, and their attributes, i.e. a database. The database might be a list of pigs, and their characteristics.

The expert rules and the database are referred to collectively as the knowledge or information base.

User interface; this is the part of the computer program that enables the user to communicate with the computer It must be possible to address the expert system in a common language and the system has to respond understandingly

Finally, it is expected that body temperature is suitable for use within a generally applicable quality assurance system, and it will contribute to a method of farming which is more favourable to the animals and kinder to the environment by a more efficient production.

4. Literature

BARRETT, J.R. and JONES, D.D. 1989: Knowledge engineering in Agriculture. Number 8 in a series published by American Society of agricultural engineers. Michigan, USA.

ELMORE, R.G., MARTIN, C.E., RILEY, J.L. and LITTLEDIKE, T 1979: Body temperature in farrowing swine. J. Am. Vet. Med. Assoc. 174, 620-622.

FOOTE, R.H. 1964. Estrus detection and estrus detection aids. J. Physiol. 155, 72-85. London.

GEERS, R. et al. 1992: Changes of body temperature of piglets as related to halothane sensitivity and treadmill exercise. J. ther Biol. Vol. 17 No. 2, pp 125-128.

GERSHON-COHEN, J. 1964: A short history of medical thermometry Ann. N.Y Acad. Sci. 121, 4-11

HAUPTNER, P 1990: Sensoren; Prinzipien und Anwendungen. Carl Hanser Verlag München Wien.

KING, J.O.L., WILLOUGHBY, R.A., HACKER, R.R. 1972: Fluctuations in rectal temperature of swine at parturition. Can. Vet. J. 13, 72-74.

MOLL, R. 1990: Grundlegende Eigenschaften passiver Telemetriesysteme am Beispiel eines Transponderinjektates für die Identifikation und Temperaturmessung. Agrarinformatik Band 20, p30-37 Beiträge zur Tagung EDV-Anwendungen in der Herden- und Gesundheitskontrolle Oktober 1990 in Bonn. Verlag Eugen Ulmer Stuttgart.

SCHEEPENS, C.J.M. 1991 Effects of draught as climatic stressor on the health status of weaned pigs. Thesis State University Utrecht, the Netherlands. 158 pp.
SCHILLING, E. and RÖSTEL, W 1975: Methodische Untersuchungen zur Brunstfeststellung beim Schwein. Deutsche Tierärztlichen Wochenschrift 16, 429-436.
VERHAGEN, J.M.F 1987· Acclimation of growing pigs to climatic environment. Thesis Agricultural University Wageningen, the Netherlands. 128 pp.