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Dear colleague,

Our group has been working with steroid hormones for over 30 years and we aim to extend analytical possibilities for this research. The measurement of steroid hormone metabolites in faeces was described by us as early as 1982 (oestrogen metabolites for pregnancy diagnosis in cattle) and, to our knowledge, this was the first application in the world for measuring endogenous hormones in this matrix. We developed methods for the determination of faecal progesterone and androgen metabolites subsequently and more recently, assays for cortisol and corticosterone metabolites were established.

#### Overview of the recent work of our “Research Group Stress”

##### *Non-invasive monitoring of glucocorticoid production*

In animals under stress, glucocorticoids and catecholamines are secreted by the adrenals. These hormones help an organism to cope with the situation. Their concentrations in blood have been widely used to evaluate the effects of various stressors. Blood sample collection itself disturbs an animal and is dangerous or even impossible in some zoo and wildlife species. Non-invasive methods for the determination of glucocorticoids or their metabolites are therefore a prerequisite for assessing stress in these animals. Above all, faecal samples offer the advantage that they can be collected easily without any need to handle the animal.

As information about faecal metabolites was very limited, our special interest during the past several years has been steroid metabolism and excretion in mammals, mainly domestic livestock (Palme et al., 1996). Starting with these infusion experiments (in the meantime, we have added further studies in cats, dogs, hares, rats, mice, primates, elephants and several bird species; for review, see Palme et al., 2005), we have focused on faecal glucocorticoid metabolites. Since we were not able to find authentic cortisol in faecal samples of ruminants and horses and only negligible amounts in pigs, specific cortisol immunoassays do not work in these species. In sheep, we characterized <sup>14</sup>C-cortisol metabolites by HPLC/MS. This helped to establish an enzyme immunoassay for 11,17-dioxoandrostanes (11-oxo-aetiocholanolone-EIA) for a determination of faecal cortisol metabolites (Palme and Möstl, 1997). It was the first EIA worldwide to measure cortisol metabolites in ruminants. This EIA provided the basis for a non-invasive evaluation of adrenocortical activity. The biological relevance of this non-invasive method has been proven in ruminants (cattle, sheep) and horses following stimulation (ACTH) or suppression (dexamethasone) of cortisol release by the adrenal cortex and transportation. In the meantime, we have developed and established a total of more than 15 different EIAs for other faecal cortisol or corticosterone metabolites. The biological relevance of these EIAs for faecal glucocorticoid metabolites in various species (including birds; see ref.) has been proven (Möstl et al., 2005; Palme, 2005; Palme et al., 2005; Touma and Palme, 2005; Palme, 2012; 2019).

Thus, our successfully established and extensively validated non-invasive techniques to monitor stress hormone metabolites in faecal samples of various species are a useful tool in different research fields, such as ethology, field endocrinology, ecology, animal conservation and animal welfare, and can open new perspectives in biomedical and behavioural sciences.

### *Glucocorticoids in hair*

As a potential long-time parameter of average glucocorticoid concentrations, the measurement of cortisol in hairs (corticosterone in feathers) has attracted much attention. As recent studies from others and our group (Keckeis et al., 2012) suggest also a local glucocorticoid production in the skin, we try to evaluate mechanisms of and possible influences on glucocorticoid (or their metabolites) production in skin appendages.

### *Glucocorticoid metabolites in the environment*

Especially in ruminants high amounts of C<sub>19</sub>O<sub>3</sub>-steroids are excreted. Those metabolites can be measured as parameters of glucocorticoid production. However, some are known to act as pheromones and androgens in fish (11-ketotestosterone is an important androgen). We investigate formation and stability of these possible endocrine disruptors.

As we are interested in endocrine rhythms and responses to stress or disturbance, we are collaborating with research groups from all over the world (e.g., Australia, Argentina, Austria, Brazil, Belgium, Canada, Denmark, France, Germany, Great Britain, Italy, Netherlands, New Zealand, Norway, Poland, South Africa, Spain, Sweden, Switzerland, USA). We are also involved in animal welfare projects. Feel free to contact us if you are interested in a collaboration or if you have further questions. For copies of papers please click (+Strg) the respective ([pdf](#)) after the reference below for its download. We also offer basic information about non-invasive measurement of steroid hormones (including our detailed laboratory protocol for extraction and EIA and the PDFs of our papers) that is directly available on our website via the following link: <http://www.vetmeduni.ac.at/Stress-CD/>

With kind regards

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References of papers published by our group (klick the respective link to download the pdf!)  
Papers describing a newly established EIA for the first time are given in blue letters

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