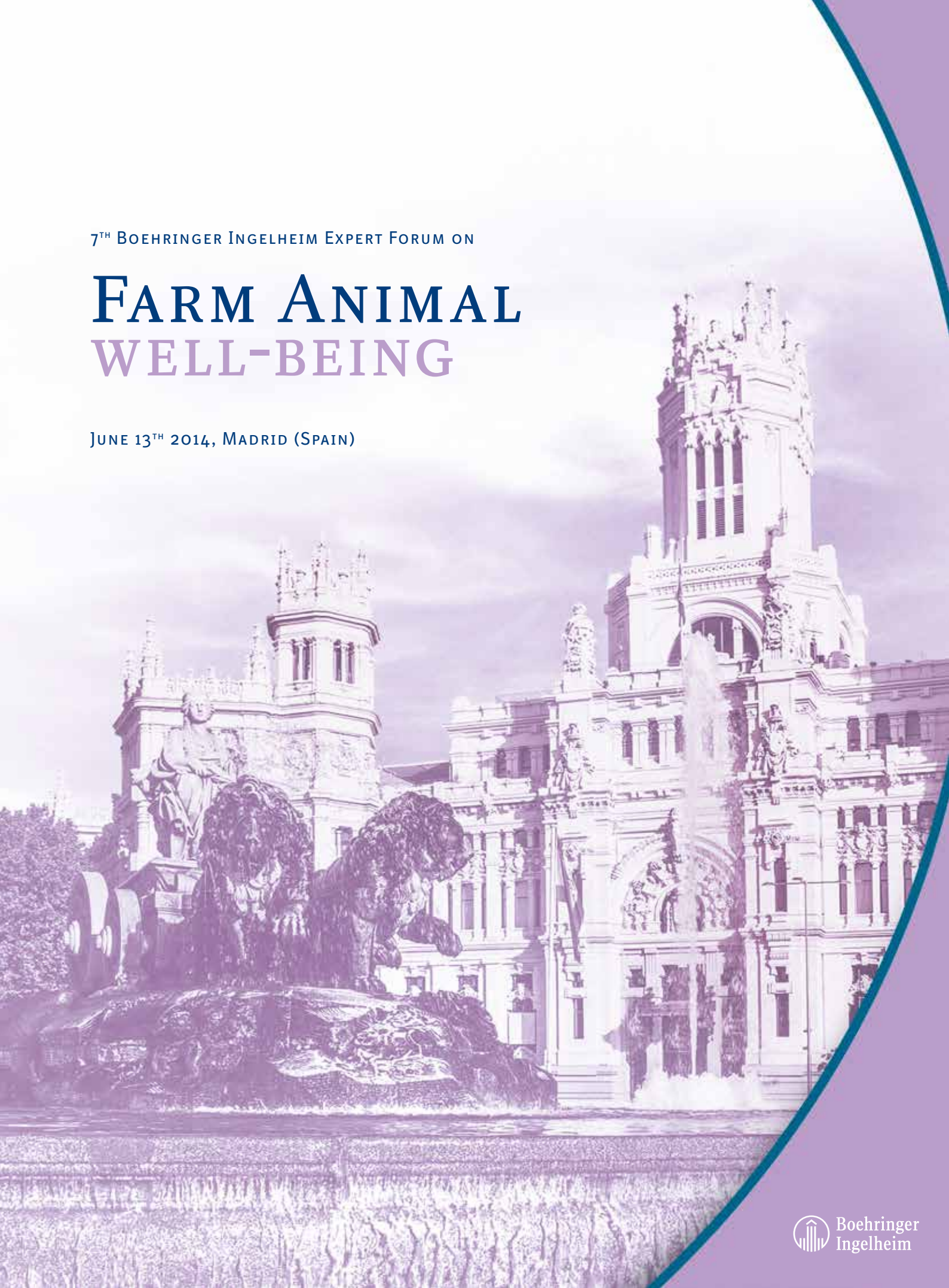
7TH BOEHRINGER INGELHEIM EXPERT FORUM ON

FARM ANIMAL WELL-BEING

JUNE 13TH 2014, MADRID (SPAIN)



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FARM ANIMAL WELL-BEING

Pain and stress around parturition: impact on mothers and their offspring.

Prof. Marina (Nina) A. G. von Keyserlingk and Prof. Daniel M. Weary

Daniel M. Weary (B.Sc., M.Sc., D. Phil., Professor) and Marina A.G. von Keyserlingk (B.Sc., M.Sc. Ph.D., Professor) are NSERC Industrial Research Chair holders at The University of British Columbia and are recognized internationally for their research and outreach in animal welfare science.

Dan is originally from the Province of Quebec, and did his B.Sc. and M.Sc. degrees in Biology at McGill University before moving to the UK to do his doctoral studies in animal behavior at Oxford University. Dan worked as a research scientist for the Canadian government before moving to UBC in 1997 to co-found the University's Animal Welfare Program.

Marina's love of animals began while growing up on a beef cattle ranch in British Columbia. She completed her undergraduate in Agricultural Sciences at UBC, her M.Sc. at the University of Alberta and Ph.D. in Animal Sciences at the University of British Columbia. Marina worked as a research scientist in the animal feed industry for 6 years before joining UBC's Animal Welfare Program in 2002.

Dan and Marina direct an active group of researchers working on a variety of problems in animal welfare and they are frequent speakers for professional audiences on this topic. Dan and Marina are the proud recipients of the 2013 Metacam 20 Bovine Welfare Award.

Knowledge and perceptions of cattle welfare among animal health professionals

Identifying shared and divergent stakeholder concerns regarding farm animal welfare

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Concern about the welfare of food animals is not new; producers and veterinarians have long been concerned about the condition of animals in their care and have tried to ensure that they are healthy and well nourished. In the tradition of good animal husbandry, good welfare is often seen as maintaining production and the absence of illness or injury. However, concerns about the proper treatment of farm animals also include affected states like pain and distress that the animals might experience as a result of procedures like castration and weaning, and concerns about the lack of naturalness, such as the inability to perform natural, motivated behaviors like grazing when kept in confinement housing (Fraser et al., 1997; von Keyserlingk et al., 2009).

At least some disagreements about animal welfare are due to differences in how individuals value these different types of concern. For example, an individual who highly values health and functioning outcomes may argue in favor of early separation of dairy cows and calves, on the grounds that this reduces vertical transfer of pathogens and thus improves calf health. However, others may disagree with early separation on the basis that that this interferes with the natural cow-calf bond and results in separation distress.

A survey of over 25,000 Europeans citizens found that they largely regard farmers as the individuals responsible for ensuring farm animal welfare. However, for farmers to safeguard societal values around animal welfare would require that they are aware of and share the values of other citizens on this issue. Research of farmer attitudes shows that the reverse may be true; farmers often discount the views of non-farmer citizens on the basis that these individuals are sometimes ignorant of farm practices (Benard and de Cock Buning, 2013). The results of a number of studies indicate that there is a disconnect between farm animal stakeholder groups (who have strong ties to the food animal production) compared to those who are more distant from the production cycle. For instance, citizens and farmers differ in the relative importance they ascribe to the animals' ability to engage in natural behavior, pain and stress (Te Velde et al., 2002; Vanhonacker et al., 2008). Contrary to citizens' views (Vanhonacker et al.,

2009; Fredriksen et al., 2011), farmers (Te Velde et al., 2002; Tuyttens et al., 2010; Spooner et al., 2014) and industry specialists (Cantrell et al., 2013) tend to associate animal welfare mainly from the perspective of the animal's health and biological functioning. For instance, intentionally causing pain to another creature is considered highly anti-social in mainstream society, but many pig farmers consider surgical castration of piglets without anesthesia an acceptable practice (Spooner et al., 2012; Tuyttens et al., 2012). In some cases it appears that these differences in values undermine citizen confidence in livestock producers. For example, Ventura et al. (2013), reported that some citizens who opposed cow calf separation at birth believed that producers were simply exploiting animals and seeking productivity over welfare.

Even among individuals associated with livestock production, different groups may hold contrary opinions. For example, Kristensen and Enevoldsen (2008) reported that Danish veterinarians believed that farmers prioritize production and profit, while farmers believed that they placed their highest priority on teamwork and animal welfare.

Building consensus on animal welfare issues, between key players including farmers, citizens, government, and industry representatives, must become a priority (Poletto and Hötzel, 2012). Failure to do so may result in lost opportunities that may have serious repercussions for all stakeholders, including those whose livelihood depends on the success of the food animal industries.

Broad stakeholder input is also required to set meaningful goals for research, policy, and producer innovation that may move us toward more socially sustainable food animal production systems (Swanson et al., 2011; von Keyserlingk et al., 2013). These stakeholder consultations must include discussions between diverse stakeholders but also within stakeholder groups. The facilitated discussion that will take place as part

of the 2014 Boehringer Ingelheim's Farm Animal Wellbeing Forum in Madrid provides one such opportunity.

These discussions will have three objectives: 1) to provide participants the opportunity to voice their concerns and discuss the most pressing animal welfare issues with their colleagues, 2) to allow researchers to describe and summarize the concerns discussed, and use this data to extend the scholarly literature on this issue, and 3) to provide the veterinary profession and the livestock industry with specific recommendations for how best to target solutions to animal welfare concerns. We predict that these discussions among the animal health professionals attending the Forum will help identify a shared sense of priorities and key constraints to addressing the issues.

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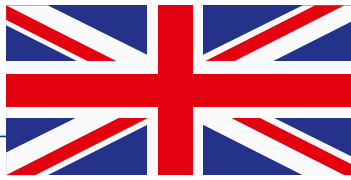
Dr. Kenny Rutherford

Kenny is an animal welfare researcher in the Animal Behaviour and Welfare team at SRUC (Scotland's Rural College) in Edinburgh. He completed his PhD in 2003 and since then has worked on various farm animal welfare research projects. These projects have involved on-farm welfare assessments of dairy cattle, investigations of the effects of prenatal stress in various livestock species, and work relating to animal pain assessment.



How stress during pregnancy affects the offspring

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The prenatal period is important in defining how individuals respond to their environment throughout life. Research in farm animal species has demonstrated the important role that variation in maternal state can have on progeny health, welfare, and production (Rutherford et al., 2012). In particular, prenatal stress or poor maternal nutrition can affect how well offspring cope with their social, physical and infectious environment during later life. Although, prenatal stress work in cattle has been limited, studies show that maternal health status and other experiences of stress in pregnant cattle can affect their progeny (Arnott et al., 2012). Such effects may be an important and overlooked source of variation in calf outcomes under commercial conditions.

Sources of prenatal stress in cattle

Various aspects of cattle production could challenge pregnant animals, with possible consequences for their progeny.

Husbandry practices

Common livestock production practices such as handling, restraint and transportation can be stressful for cows, and may have implications for the offspring. For example, exposing pregnant cows to repeated transport during gestation increased the stress reactivity of their offspring (Lay et al., 1997). Poor quality animal handling facilities, or poor stockperson behaviours, may also increase the stress experienced by cows either during their daily life, or for particular handling events (such as hoof trimming).

Environmental parameters

Studies have examined the effects of environmental conditions on offspring birth weight and other parameters. Calves from dams exposed to winter weather were lighter than those born to cows maintained in a thermo-neutral environment (Andreoli et al., 1988). Alternatively, heat stress can also adversely affect offspring. Tao and Dahl (2013) reviewed studies that have applied heat stress to cattle during gestation; they found that seven out of eight studies identified a significant reduction of calf weight as a consequence. Effects on birth weight have implications for welfare: low birth weight is associated with high neonatal morbidity and mortality rates, and can impair postnatal growth, performance and carcass traits. Prenatal effects of the maternal environment are not restricted to birth weight however. Calves born to dry cows exposed to heat stress had a reduced efficiency of transfer of IgG from colostrum to their circulation, and an

impaired T-lymphocyte immune response (Tao et al., 2012) compared to progeny whose mothers had access to cooling (sprinklers and fans).

In some cases there may be interacting effects of environmental conditions and nutritional challenges to animals. For instance, in regions at risk of drought, pregnant cattle may experience feed restriction due to restricted pasture growth. In Australia, drought during particular periods of gestation has been associated with a severe health problem of neonatal beef calves termed congenital chondrodystrophy (White et al., 2010).

Maternal health

Laboratory studies have shown that stimulation of the maternal immune system can cause variation in offspring biology. A particularly pertinent question for the cattle industry is the degree to which disease experienced by the dam during pregnancy can have consequences for developing offspring. An observational study of Swedish dairy farms found decreased calf size at birth if the dam had clinical mastitis during the 49 day period prior to calving (Lundborg et al., 2003). Calves born to cows that had a disease from conception to 50 days before calving had a higher risk of developing respiratory disease. Moreover, calves whose mothers experienced disease had a lower growth rate. Similarly, Lents et al. (2008) reported that dry cow treatment of beef cows with intramammary antibiotics improved calf growth during the subsequent lactation, while Loyacano et al. (2002) found that failure to treat dams for nematodes or liver fluke during gestation resulted in decreased offspring birth and weaning weights.

Experiences of poor health can impact upon developing offspring in a number of ways. For instance, animals may be debilitated, and lose body condition, and it is also possible that experiences of pain or sickness could act as a source of prenatal stress. In many countries large numbers of dairy cows are seen to be lame, often whilst pregnant, and this could have detrimental effects on calf development. A study in sheep (Wassink et al 2010) for instance, found that treating for footrot during gestation caused an improvement in flock financial performance through better lamb survival and growth.

Social stress

Although not studied in cattle, social stressors have been found to be a potent source of maternal stress in other farmed species (Rutherford et al., 2012). Cows may experience social stress by being kept in groups of inappropriate size or composition, or being subjected to regular or intermittent mixing with unfamiliar individuals.

Feeding set-ups that increase competition and aggression may also cause social stress.

Housing

Studies in other species have also shown how, even in the absence of social problems, aspects of the housing environment during pregnancy can affect offspring. For cattle, uncomfortable lying conditions, barren environments or housing systems involving behavioural restriction (such as tie-stalls) could all affect fetal development.

Implications

Prenatal stress in cattle has implications for offspring welfare and performance. Cows spend a large proportion of their post-pubertal life pregnant and many of the factors that are known to affect cow welfare (e.g. health states such as lameness or mastitis, housing conditions, quality of stockhandling) have potential to alter developing fetal offspring with consequences for their postnatal life. Prenatal conditions may be a hidden risk factor for negative health and welfare outcomes in cattle. In addition to effects on welfare, prenatal conditions may also affect the economics of cattle performance. Further work is required to identify which possible causes of prenatal stress matter under commercial conditions, and how farmers could adapt their management to improve performance. However, paying closer attention to the management of pregnant animals may allow farmers to achieve higher standards of health, welfare and production efficiency in the next generation of stock.

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Prof. Patricia Lavand'homme

After graduating as a Medical Doctor, Mrs Lavand'homme completed her PhD on "Alternative Drugs to Spinally administered Opiates in Animal Models of Neuropathic Pain" in 1999.

In 1997 and 2002 she participated in a Visiting Scholarship Program at the Wake Forest University School of Medicine, North Carolina, USA where she worked in the Pain Mechanisms Laboratory.

Patricia Lavand'homme is currently working at the Saint Luc University Hospital in Brussels, where she is director of the Acute Postoperative Pain Unit. She is also past-chairperson of the Scientic Subcommittee "Acute and Chronic Pain" of the European Society of Anesthesiologists (ESA) and associate editor of 2 scientific journals.

Long term effects of painful childbirth in women

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Advances in Analgesia and Anaesthesia for Childbirth

Obstetric anaesthesia is currently one of the most valuated aspects of the anaesthesiology specialty as patient's safety and wellbeing are now considered as indices of health care quality. It is worth noting that obstetric anaesthesia and analgesia involves the management of two patients: the mother and the foetus/newborn. However, for many years, the existences of false beliefs regarding labour and childbirth have hampered the development of obstetric anaesthesia:

- Myth of painless vaginal childbirth both in women and in animals. Later supported by the fact that pregnancy itself may induce some analgesia.
- Religious beliefs presenting labour and childbirth pain as an inflicted punishment.
- Beliefs that labour pain has important biological functions and should not be relieved.
- Fear of deleterious effects of pharmacologic methods of pain relief on both the labour course and the foetus.

The development of safe and efficacious analgesic techniques (Lavand'homme and Roelants 2009, Cohen et al. 2000) as well as the social acceptance that it is unnecessary for the parturient to deliver children in pain and sorrow have permitted considerable progresses in the field during these last 150 years (Crowhurst and Plaat 2000). More importantly, the progresses have been associated to a dramatic reduction in maternal and foetal mortality in developed countries.

The benefits of labour analgesia

The immediate benefits of labour analgesia not only concern maternal comfort but also foetal wellbeing as the stress and the pain from labour contractions increase maternal levels of systemic catecholamines with deleterious effects on labour progress and foetal heart rate. Further, pain causes maternal hyperventilation which favours uterine vasoconstriction and foetal acidosis. Besides, obstetric guidelines currently recommend early placement of epidural analgesia in complicated parturients, i.e. at high risk of emergency caesarean delivery, to increase both mother and foetus safety.

Recently, as it is the case for other surgical procedures, new concerns have emerged regarding long term effects of the anaesthesiology practice. Patients' outcomes like rehabilitation, fast recovery, cancer recurrence and persistent pain after surgical procedures have received major interest. In obstetric anaesthesia, the quality

Table 1. Evolution of Obstetric Analgesia and Anaesthesia

1853 Safe administration of chloroform to Queen Victoria for labour and delivery of her 8th child.	Opening the way to Obstetric Analgesia: several volatile anaesthetic agents were used e.g. nitrous oxide (Entonox) is still currently used for labour analgesia as an alternative to epidural analgesia.
1900 Administration of morphine with scopolamine to induce a state of semi consciousness called « twilight sleep ». **1939** Synthesis of meperidine (pethidine), opioid used until late 1980s for labour analgesia. **2000** Use of patient-controlled intravenous analgesia with ultra-short acting opioid remifentanil (pharmacokinetic adapted to labour physiology).	Opioid analgesics have been used for many years with several risks (e.g. respiratory depression, loss of consciousness, inhalation) and without proof of analgesic efficacy until the development of remifentanil.
1901 to 1921 Development of spinal, caudal and lumbar epidural blocks mostly for operative obstetrics e.g. caesarean deliveries.	
1970s Establishing epidural analgesia services. **1980s** Understanding and avoiding local anaesthetics systemic toxicity. **1990s** Development of « selective analgesia » for labor and delivery.	Local anaesthetics with lower cardiac toxicity (like levobupivacaine and ropivacaine) were developed. The combination of low doses of local anaesthetic with low doses of opioid has led to the reduction of motor and sympathetic blocks during epidural analgesia with less impact on labour course and mode of delivery (less assisted vaginal delivery), allowing “walking epidural analgesia”.
2000s Evaluation of both short- and long-term effects of peripartum anaesthesia and analgesia.	Impact of the type of anaesthesia/analgesia on · The mode of delivery · Maternal safety · Quality of life, mood and persistent pain after delivery.

of life and the duration of pain after childbirth have attracted the attention of both the anaesthesiologists and the obstetricians. Among the 20 % of the U.S. and European population who report chronic non-cancer pain, the majority are females. Women are at increased risk compared to men to develop chronic pain and to exhibit higher chronic pain intensity. Any tissue trauma has the potential to cause persistent pain. While most patients will recover and return to normal life, others will suffer chronic pain and long lasting disabilities. Although childbirth may be considered as a natural process, some deliveries necessitate instrumentation and/or surgical intervention and thereby, a possibility of persistent pain secondary to the physical trauma of delivery should not be ignored.

Impact of acute pain around birth

Among the risk factors to develop persistent pain after surgery, the degree of tissue injury (by example, a nerve lesion) and the intensity of acute postoperative pain are commonly reported (Kehlet et al. 2000, Lavand'homme 2011). As the rate of caesarean delivery is increasing worldwide (reaching 25 to 30 % in EU) for both medical indications and maternal choice, an important debate has raised over the relationship of the method of delivery to maternal postpartum physical health. Inadequately controlled acute postoperative pain may result in harmful physiological and psychological consequences. Pain treatment after childbirth may be even less adequate than after surgery because the majority of mothers hesitate to use regular analgesics like non-steroidal anti-inflammatory drugs and opioids during breastfeeding. The PAD study ("Pain After Delivery"), the first large prospective multicentred study including patients both in US and Europe) tried to examine the impact of those factors on the quality of life of women after delivery (Eisenach et al.2013, Eisenach et al. 2008).

In the PAD study, severe acute pain (i.e. a pain score > 6 on a scale from 0 = no pain, to 10 = worst possible pain) within 36 hours postpartum was present in 10.9 % of the women after vaginal delivery and in 17 % of the women after caesarean delivery, Eisenach et al. 2008). Caesarean delivery was associated with a 32.5 % increase in acute pain scores

and interfered more than vaginal delivery with daily activities of the mother. The prevalence of pain 8 weeks after delivery was 10 % (95 % CI: 7.7 – 12.3) after vaginal delivery and 9.2 % (95 % CI: 5.5 – 12.6) after caesarean delivery. Almost half of the women reported pain affecting daily life activities. Interestingly, independent to the mode of delivery, the severity of acute pain after childbirth was associated to the risk of experiencing persistent postpartum pain as women with severe peripartum pain had a 2.5-fold increased risk of persistent pain. One point increase in acute pain score was associated with a 13 % increase in the odds of experiencing pain 8 weeks later. In another prospective study, the degree of perineal trauma (lacerations, episiotomy) was responsible for the immediate intensity of pain (from 24 h until day 7 postpartum), but did not account for the incidence of persistent perineal pain (around 9 %) at 6 weeks (Macarthur and Macarthur, 2004).

The overall prevalence of postpartum depression was 11.2 % at 8 weeks (11.4 % after vaginal delivery and 10.5 % for caesarean delivery) (Eisenach et al. 2008). Chronic pain and depression often co-exist. Postpartum depression is a complication affecting 8 – 15 % of postpartum women within the first 6 weeks after delivery. This condition may affect both maternal and neonatal health. Postpartum depression increases the risk of insecure infant attachment and behavioural problems in the child. Further, postpartum depression favours mother's suicide which accounts for 17 % of late pregnancy-related death. As for the pain, independent to the mode of delivery, women reporting severe post-delivery pain were also at higher risk for the development of postpartum depression i.e. 3.0-fold risk of postpartum depression at 8 weeks by comparison with women having mild pain after delivery.

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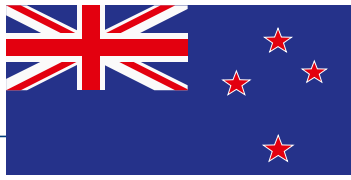
Notes

Dr. Richard Laven

After having qualified from the University of London in 1989, Richard Laven went into veterinary practice in the Cotswolds fulfilling the first of his veterinary ambitions. After almost four years he ended up back at the University of London doing a PhD on the bovine placentome. This was followed by working on a 650-cow dairy research farm in the South Downs – the main focus of which was lameness research. He acquired an interest in diagnosis and treatment of lameness, with a particular interest in the modification of the pain associated with lameness, especially the use of NSAIDs. This led to a more general interest in the use of NSAIDs in cattle and how the veterinary profession can best use them to enhance cattle welfare.



Use of non-steroidal anti-inflammatory drugs around calving can maximize comfort, productivity and fertility for the dam

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Calving is a critical time for the health and welfare of the cow. A normal calving is essential if subsequent fertility and production are to be optimized. Dystocia significantly decreases milk production and fertility, and increases culling (Tenhagen et al., 2007). Much of this is mediated by inflammatory disease such as metritis. Dystocia is also painful. Veterinarians asked to estimate the pain associated with moderate dystocia and a caesarean section scored the former as 7–8 (median on a 0–10 scale) and the latter as 10 (Huxley and Whay, 2006, Laven et al., 2009).

The use of analgesia at calving

Providing cows that have had dystocia with effective analgesics and anti-inflammatories is thus likely to improve cow well-being, and, perhaps, productivity. On first principles, non-steroidal anti-inflammatory drugs (NSAIDs) are likely to be the most effective drug group for such treatment as they are anti-inflammatory, anti-pyretic, and anti-endotoxic as well as producing peripheral and central analgesia. NSAIDs are relatively frequently used by veterinarians. Surveys have shown that > 65 % of veterinarians give NSAIDs, at least occasionally, to cows with dystocia (Huxley and Whay 2006). However, on most farms, dystocia cases are dealt with by farm staff and Huxley and Whay (2007) reported that < 50 % of farmers thought analgesia was necessary for moderate dystocia. So many dystocia cases do not receive NSAIDs.

Furthermore, there has been a paucity of studies focusing on the short-term benefits on feed intake and behaviour of treating dystocia with NSAIDs. Newby et al. (2013) found no significant effect of treating cows with dystocia with meloxicam 24 h after calving on dry matter intake, milk production, blood metabolites, or health events. However, meloxicam increased feeding time as well as bunk visit frequency for 24 h. This may be because the meloxicam was administered too late after calving. This again highlights the issue that getting farmers to use NSAIDs is likely to have the most benefit.

“Blanket treatment” with NSAID’s

Studies which have analyzed the benefits of treating all calving cows with NSAIDs are more

common. Blanket treatment with flunixin seems to be contra-indicated: Shwartz et al. (2009) reported that it significantly increased rectal temperature and decreased dry matter intake, while Duffield et al. (2009) found that it increased placental retention and metritis risk.

Data on blanket treatment with other NSAIDs is not so negative. Meier et al (2014) reported no effect of carprofen treatment immediately after calving on milk production, cow health or reproductive performance, while Richards et al. (2009) concluded that treatment with ketoprofen after calving had no effect on productivity, health or production except for a tendency to reduce placental retention. This finding is at odds with the prominent role that PGF2α plays in placental release (Laven and Peters, 1996). In contrast there are several reports that blanket treatment with salicylates can result in improvements such as improved milk production (Trevisi and Bertoni 2008; Farnley et al., 2013). These differences may be due to differences in the action of different NSAIDs.

This focus on blanket treatment with NSAIDs is interesting from a scientific perspective, but none of the successful studies have identified an economically viable treatment model, despite blanket treatment of normal cows implying a focus on economics rather than welfare. If we want to improve welfare then it is surely better to look at the economic benefits of treating cows which need NSAIDs, such as those with dystocia.

Restoration of ovarian and uterine function

One key focus of NSAID studies post-calving is the effect of NSAIDs on the restoration of ovarian and uterine function after calving. Flunixin treatment can reduce PG production, but time after calving has a bigger impact (Königsson et al., 2002). Treatment with NSAIDs may therefore not return PG production to normal in cattle with an abnormal puerperium; i.e., their impact on inflammation may be insufficient to prevent the negative effects of elevated PG.

In cattle with a normal puerperium, higher concentrations of PGFM are associated with a shorter involution period (Lindell et al., 1982); thus the use of NSAIDs post-partum could potentially compromise involution. However, both Odensvik and Fredriksson (1993) and Guilbault et al. (1987) showed that treatment with NSAIDs suppressed PG production but not involution.

Both Guilbault et al. (1987) and Stahringer et al. (1999) suggested that treatment with NSAIDs had a negative impact on ovarian activity. Both of these studies were small studies and used multiple frequent doses of NSAIDs. In contrast, both Richards et al. (2009) and Meier et al (2014) found no negative fertility effect of two or three doses of NSAIDs, so it may be frequency and length of treatment that is driving the effect; such a treatment is likely to be uneconomic, particularly in cattle with a normal puerperium.

The recumbent cow

Another area where NSAID treatment can be useful is in the treatment of the recumbent cow. For cows with disease, such as toxic mastitis/

metritis, the benefits of NSAIDs are relatively clear. For calving injury, the published evidence is little more than anecdotal. Longo et al. (1993) compared ketoprofen with flunixin in cattle that were recumbent after dystocia, and concluded that both treatments resulted in significant, rapid improvement. This was a small study with no negative control, so further research is needed to establish the value of using NSAIDs in cows which are recumbent due to calving injury.

For hypocalcaemia, the benefit of NSAIDs may not seem immediately obvious; however, irrespective of the cause of recumbency, recumbent cattle suffer significant trauma resulting in muscle and nerve damage. Nevertheless, even though an expert review (Huxley et al., 2010), concluded that, other than fluid therapy, the provision of NSAIDs was the only important aspect of veterinary treatment for downer cows, published research on this topic is conspicuous by its absence.

Conclusions

Inflammation and pain are commonly seen post calving. In such cases, first principles suggest that NSAIDs are likely to be of value in improving the health and welfare of cattle. However, the evidence base regarding their effectiveness is limited, so currently they are likely to be underused as cost will limit farmer acceptance without demonstrable benefits.

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The impact of dystocia on dairy calf health, welfare, performance and survival

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On a dairy farm, the birth of a calf marks the start of the productive lactation period for the cow and the farming business. However, parturition is a challenging process and a high-risk time for both the mother and her offspring. A difficult or dystocial birth often means that assistance must be provided during delivery. It is difficult to assess the internal state of the cow in terms of what she experiences, so operationally, dystocia is normally described in terms of the level of assistance that is required, from none through mild to severe. Reported prevalence of severe calving difficulty in dairy cows ranges from 2 to 22 %. However, assistance at calving (which includes lower degrees of difficulty) is more prevalent, with estimates varying from 10 % to over 50 % of calvings (Mee, 2008).

Risk factors for dystocia

The most common cause of dystocia is the physical incompatibility between the pelvic size of the dam and the size of the calf. Because of this, a high calf birthweight is known to be a risk factor for dystocia. It also follows that male calves are also more likely to experience dystocial birth because of their higher birthweight. Pelvic size is influenced by the stage of maturity of the cow, so it is commonly observed that heifers are more likely to experience dystocia than mature cows. Twin calves are also a risk factor due to the increased possibility of malpresentation. Over- and under-condition of the dam are also risk factors (Mee, 2008).

Impact of dystocia

Dystocia has negative impacts on the farm, the cow and the calf. Increased labour requirements and often professional assistance is required for difficult calvings. Dystocia is associated with a reduction in milk yield in the subsequent lactation, and poorer cow fertility and health, which have negative consequences for farm economics as well as for cow welfare. With respect to the

calf, it is well-documented that dystocia is associated with higher mortality in the immediate post-natal period. In general, however, there has been less attention paid to the effects of a dystocial birth on the surviving calf. The growth, survival, health and welfare of the calf may be adversely affected (Murray and Leslie, 2013).

Survival and growth

A number of studies have shown that the calf or calves are more likely to be stillborn or die shortly after a difficult birth (Lombard et al., 2007; Barrier et al., 2012b). In our study, stillbirth rates were up to 7-8x higher in calves delivered after a very difficult calving. Post-mortem examination of stillborn calves showed that mild and more extensive bruising of the body was only present in calves that experienced an assisted birth, and were absent in still-born calves from non-assisted births (Barrier et al., 2013a). Survival to weaning was also shown to be affected by a dystocial birth, with affected calves having a threefold greater risk of dying compared to calves from a normal birth. Survival to the age of first breeding or service was also affected, with calves born from a moderately difficult birth having a higher risk of dying. However, those animals that survived beyond this stage showed the same probability of survival as calves from a normal birth. Growth rates did not appear to be affected, as we found no evidence of an effect of a dystocial birth on growth to weaning (Barrier et al., 2012).

Calf vigour and neonatal stress

We can assume that the increased mortality is due to damaging impacts of the difficult calving on the biological functioning of the animal. Dystocia can cause hypoxia and acidosis in the calf, which can be fatal. For those that survive, there may be other effects that adversely affect functioning and health. We assessed levels of stress hormone in neonatal calves and found that calves born with assistance had 4x higher

cortisol levels in first 24 hours of life, compared to calves born without assistance. We also assessed rectal temperature, as an indication of the ability to thermoregulate, but there was no difference shown.

In the neonate, passive immunity is acquired from immunoglobulins in the colostrum, but the capacity of the gut to absorb immunoglobulins decreases rapidly after birth. Prompt suckling after birth maximises the acquisition of passive immunity. We used video-recordings to compare the behaviour of calves from non-assisted and dystocial births in the first 3 hours after birth. The results showed that assisted calves were less vigorous and took longer to attempt to stand, achieve standing, walk and reach the udder than unassisted calves. Assisted calves were not less likely to suck, nor was there a difference in the time taken to achieve a successful suck. However, only a third of assisted animals achieved successful suckling within 3 hours of birth. These differences were not due to the behaviour of the dam, as there was no difference between assisted and unassisted dams in the level of maternal behaviour shown (Barrier et al., 2012b). Murray and Leslie (2013) suggested that a method of assessing calf vigour would help to identify animals that require therapeutic interventions, and increase survival and welfare in calves.

Immunity stress and health

Although assisted calves were statistically not less likely to suck, the results suggest that assisted calves had lower vigour than non-assisted calves. It is recommended that calves achieve a first suckling within 3-4 hours of birth, so this suggests that assisted calves may suffer. This finding was confirmed using a zinc sulphide turbidimetry (ZST) test which assesses immunoglobulin levels in blood. It was shown that assisted calves had lower levels of immunoglobulins , although all calves had low levels. By following the calves through the first months of life, it was also shown that calves born from a more severe dystocial birth (malpresentation) had more health treatments than those with normal births or less severe dystocia (Barrier et al., 2013b).

In conclusion, a dystocial birth can have profound effects on the survivability, health and welfare of calves. This suggests that reducing overall levels of dystocia or severity of dystocia will have positive impacts on the health and welfare of calves but also on the economics of dairy farms.

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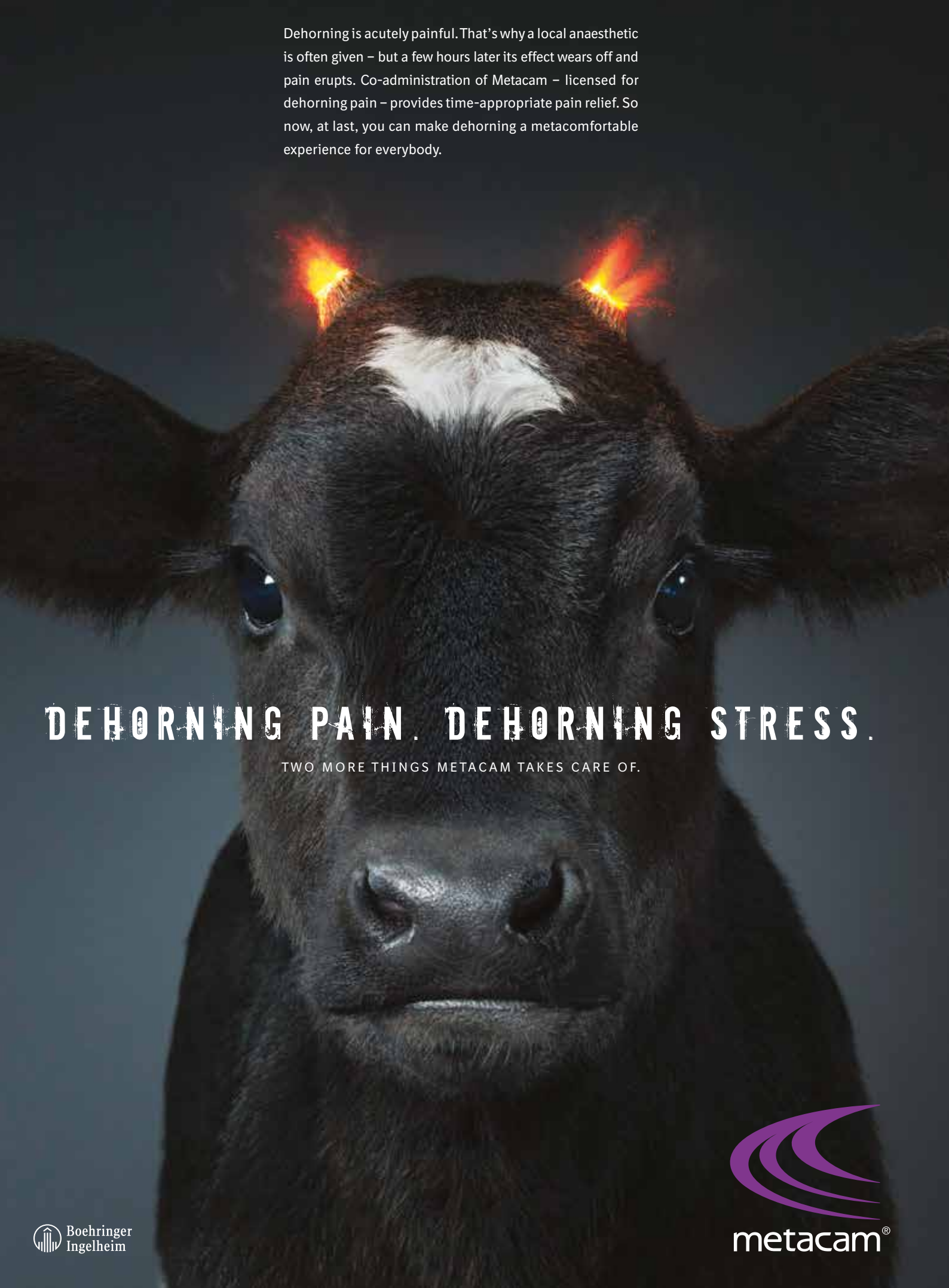
Notes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