Literature Featherpecking - Importance

Bestman, M., et al. (2009). "Influence of farm factors on the occurrence of feather pecking in organic reared hens and their predictability for feather pecking in the laying period." Applied Animal Behaviour Science **121**(2): 120-125.

Feather pecking is one of the most obvious welfare problems in laying hens. It is seen in all types of housing systems. Although banned in some countries, beak trimming is generally used to reduce the damage caused by this behaviour. In organic farming, where beak trimming is prohibited, the animals are being kept in a less intensive way than in conventional farming in order to improve their welfare. However, feather pecking is also seen in organic laying hens. Generally, rearing circumstances play an important role in the development of this behaviour. Therefore, rearing flocks were monitored for feather pecking and the relations between rearing factors and feather pecking at a young and at an adult age were analysed. Also the correlation between feather pecking during the rearing period and feather pecking during adult life was studied. Twenty-eight commercial flocks of rearing hens were monitored. These flocks split into 51 flocks of laying hens. Flocks were scored for signs of feather damage during rearing at the ages of 7, 12, and 16 weeks and on the laying farms at 30 weeks. On the rearing as well as the laying farm, data were collected on the housing system. Logistic regression was used to analyse our data. Feather damage was seen in 13 out of 24 (54%) of rearing flocks. Logistic regression showed that a higher number of pullets being kept per square meter in the first 4 weeks of life were associated with feather damage during the rearing period (Chi square = 8.49, df = 1, p = 0.004). Moreover, the combination of not having litter at the age of 1-4 weeks and the absence of daylight at the age of 7-17 weeks was a significant predictor of feather damage during the laying period (Chi square = 13.89, df = 4. p = 0.008). In 71% of the cases that pullets did not show feather pecking damage during rearing, they did not show feather pecking damage in the laying period either. When flocks of pullets did show feather damage, in 90% of the cases they did so during adult life. These results lead to suggestions on how to improve the rearing conditions of laying hens and increase their welfare not only during rearing but also during later life. Although the observations were done on organic farms, the results can be applied for other non-cage systems too.

Carruthers, C., et al. (2012). "On-farm survey of beak characteristics in White Leghorns as a result of hot blade trimming or infrared beak treatment." The Journal of Applied Poultry Research **21**(3): 645-650.

Commercial laying hens in North America are typically beak trimmed to prevent injury and mortality caused by feather pecking and cannibalism. Beak trimming is most commonly performed on day-old chicks at the hatchery, either by hot blade (HB) or infrared (INF) techniques. The differences between these 2 methods and the potential variability within each method may cause morphological differences in the beaks of laying hens throughout their production cycle. Few data are available detailing variations between the beaks of laying hens after trimming in commercial settings. The purpose of this field survey was to measure beak lengths of 4 commercial laying hen flocks at 2 age ranges treated by either HB or INF techniques at hatch. Statistical analyses of the data for the 2 treatment types were not possible because of genetic and environmental differences between flocks; therefore, statements comparing treatments are not meant as definitive and are provided for general information only. Infrared-treated hens had shorter beaks with a lower SEM, and they generally exhibited fewer beak abnormalities than HB-trimmed hens at both ages. It is our observation in this field survey that INF-treated commercial hens seemed to have less variation in beak length and fewer beak abnormalities.

Cheng, H. (2006). "Morphopathological changes and pain in beak trimmed laying hens." Worlds Poultry Science Journal **62**(1): 41-52.

Beak trimming is routinely practiced in the poultry industry to reduce the incidence of feather pecking, aggression, and cannibalism in egg layers. Feather pecking is painful to birds and potentially induces cannibalism. Cannibalism happens in all current housing environments, cage- and free-production systems, and is one of the major causes of bird death in commercial laying hens without beak trimming. However, beak trimming has solicited a great deal of debate concerning the relative advantage and disadvantage of the practice and its impact on welfare. A bird's beak is a complex functional organ with an extensive nerve supply and various sensory receptors. Beak trimming may cause pain (acute, chronic, or both) in trimmed birds due to tissue damage and nerve injury. The complexity and plasticity of the nervous system and the animal's inability to communicate verbally make pain difficult to measure directly. However, pain in animals can be recognized and assessed using physiological and behavioural parameters in response to noxious events. When evaluating whether an animal is experiencing pain, a distinction should be made between what an animal may feel and what a human observing the animal may feel. It should be noted that beak trimming-induced pain in birds is genetic-, lesion-, and age-dependent. Based on the updated information, the author would like to indicate that 1) with some genetic flocks of laying hens, if beak trimming is needed to prevent feather pecking and cannibalism, it should be conducted at hatchery or younger than 10 days of age; 2) however, the most desirable approach is to eliminate beak trimming through a genetic selection of birds with less cannibalistic and aggressive tendencies, and 3) another solution is to develop an alternative means of trimming that has fewer painful implications and safeguards welfare before non-cannibalistic stocks are commercially available.

Dennis, R. L. and H. W. Cheng (2010). "Effects of beak trimming on pecking force." International Journal of Poultry Science **9**(9): 863-866.

Beak trimming of the production laying hen has come under great scrutiny by welfare and consumer advocacy groups as a potential source of acute and chronic pain as well as having the potential to inhibit the freedom to express normal behaviors such as feeding behaviors. Although several studies have shown evidence of immediate pain response from beak trimming, the long term effects on bird welfare are not well understood. In the present study we investigated the force with which chicks peck during feeding. Chicks were beak trimmed using hot blade trimming at 2 days of age and were tested on a force plate at 3, 4 and 5 weeks of age. Both the time spent pecking and the forces of those pecks were measured. Beak trimmed birds spent significantly less time pecking at the feed and used less force than untrimmed birds at 3 weeks of age ($p<0.05$). However, at 4 and 5 weeks of age the difference was no longer significant ($p>0.05$). Beak trimmed birds also had a higher pecking ratio (peck force:time, $p<0.05$) than untrimmed birds. The difference was no longer apparent at 4 and 5 weeks of age ($p>0.05$). Our data suggest that beak trimming alters feeding behavior at a young age. However, changes in pecking force and time spent feeding were not long lasting and became similar to those of untrimmed birds after 3 weeks post-trimming.

Dennis, R. L., et al. (2009). "Infrared beak treatment method compared with conventional hot-blade trimming in laying hens." Poultry Science **88**(1): 38-43.

Infrared lasers have been widely used for noninvasive surgical applications in human medicine, and their results are reliable, predictable, and reproducible. Infrared lasers have recently been designed for the express purpose of providing a less painful, more precise beak-trimming method compared with conventional beak trimming. This study was designed to examine the potential of the infrared (IR) beak treatment to provide a welfare-friendly alternative to the conventional hot-blade method for chickens. The birds were beak trimmed by IR at the hatchery or by hot blade at 7 to 10 d of age in a commercial production setting, in accordance with standard procedures. The beak morphology and associated physiological characteristics, including production and aggressive behavior of the birds, were analyzed at 30 wk of age. There was no difference in egg production or bird BW between the 2 beak-trimming treatments. Birds also exhibited no difference in stress physiology measured in the study, such as fluctuating asymmetry and heterophil and lymphocyte profiles. However, birds receiving the IR treatment showed a superior feather condition and reduced aggressiveness under high light intensity, even though they had longer beak stumps. The results may indicate that the IR beak treatment may reduce the damage done by aggressive pecking and feather pecking. Indeed, IR trimming may provide a more welfare-friendly alternative to conventional beak trimming without compromising productivity.

Dixon, L. M. (2008). "Feather pecking behaviour and associated welfare issues in laying hens." Avian Biology Research **1**(2): 73-87.

Feather pecking, the pecking at or removal of feathers from one bird by another, is a problem in the poultry industry. Elimination of damaging feather pecking from flocks is made especially difficult by the numerous factors that appear to influence its prevalence. This review outlines the various contributors to feather pecking organised around Tinbergen's four questions on causation, ontogeny, phylogeny and function. There is growing evidence that feather pecking (especially severe feather pecking) is related to foraging motivation and gut function. However, other factors, such as improper early experiences, strain and individual differences and perseveration of the behaviour help explain its continued occurrence, even if the birds are kept in enriched environments. To date, methods of dealing with feather pecking are inadequate and involve welfare concerns of their own and alternate solutions, such as provision of forages, are not usually successful in abolishing feather pecking behaviour. The problems of excessive pelage/plummage removal or redirected oral/foraging related behaviour are not unique to poultry and seem to occur in other species in which foraging and forage intake is important. Between species comparisons of related behaviour patterns may improve our understanding of feather pecking and help to design effective solutions. In order to solve the problem of feather pecking, the factors discussed in this review need to be accounted for or we risk applying 'band-aid' solutions, which may appear outwardly to be solving the problem. However, the underlying cause(s) may still be present and the animal's welfare may still be compromised.

Fahey, A. G., et al. (2007). "Relationship between body weight and beak characteristics in one-day-old white leghorn chicks: Its implications for beak trimming." Poultry Science **86**(7): 1312-1315.

Beak trimming is a routine practice used in laying hens to prevent feather pecking and cannibalism. The effect of beak trimming on bird well-being depends on multiple factors, including the amount of beak that is trimmed and the quality of the procedure. The aim of this work was to determine if a relationship existed between BW and beak characteristics in 1-d-old chicks, with a future aim to develop an automated system for standardizing beak trimming. Three hundred forty-four 1-d-old chicks (Hy-Line W-36) were sorted into 3 categories based on their BW (heavy, intermediate, and light), and their beaks were photographed. Dimensional measures of beaks, including the lengths of the culmen, gonys, maxillary tomia, mandibular tomia, and the width of the upper mandible and lower mandible measured at 2, 3, and 4 mm from the tip of the upper and lower beaks, were calculated using imaging software. Correlations between BW and beak measures were evaluated using Pearson product-moment, Spearman rank-order, Kendall's tau, and Hoeffding's dependency tests. Results showed there were no significant correlations between beak dimensions and BW in the light BW group. In contrast, correlations were present between BW and the width of the upper mandible measured at 4 mm from the tip of the upper beak ($P < 0.05$) and the width of the lower mandible measured 2 to 4

mm from the tip of the lower beak (P < 0.05) in the intermediate BW group. In the heavy BW group, BW was positively correlated with mandibular tomia, gonys, and the width of the lower mandible measured at 2 mm from the tip of the lower beak (P < 0.05). However, in general, these correlations were too low (all below 0.23) to have any practical use for predicting beak size. Overall, the data indicated that BW cannot be used as a reliable predicator of beak size in 1-d-old Hy-Line W-36 chicks.

Fiks-van Niekerk, T. G. C. M. and A. Elson (2005). Abrasive devices to blunt the beak tip. Poultry welfare issues - Beak trimming. P. C. Glatz. Nottingham, Nottingham University Press**:** 127-131.

Although beak-trimming is performed to minimise feather and injurious pecking in laying hens and thus will reduce stress induced by these behaviours, the treatment itself is a stressor to the birds as well, especially because part of the living tissue of the beak is removed (refer to Chapter 3 and 4). It is however very difficult to mechanically shorten the tip of the beak without touching sensitive beak tissue. Also, the treatment may need to be repeated frequently as the tip can be expected to regrow. In both the Netherlands and the UK research has been conducted to blunt the tip of the beak by using abrasive materials in the feed trough. The idea for beak blunting by abrasion came from claw shortening by abrasion, which has been a requirement of the EU Council Directive 1999/74/EC for laying hens in cages since 01/01/03. A variety of abrasive materials have been found to be effective for claw shortening when fitted to the anti-egg eating baffle plates of laying cages. The idea was that hens blunt the tips of their beaks themselves and will continue to keep the beaks blunt. The reason for placing the abrasive device in the feeder is because hens spend a lot of time pecking the feed, the feed trough and flicking their beaks over the inner surfaces of the feeder.

Fiks - van Niekerk, T. G. C. M. and B. F. J. Reuvekamp (2004). Proef met touwbosjes tegen pikkerij: afdoende afleiding blijft uit. Pluimveehouderij. **34:** 18-19.

Touwbosjes in verrijkte kooien hielpen niet tegen pikkerij. De bosjes werden weliswaar flink aangepikt, maar de uitval door pikkerij was ook hoog.

Gentle, M. and S. Wilson (2004). Pain and the laying hen. Cambridge, Cabi Publishing.

Pain in animals can best be defined as 'an aversive sensory experience caused by actual or potential injury that elicits protective motor and vegetative reactions, results in learned avoidance, and may modify species-specific behaviour, including social behaviour'. Freedom from pain is essential for animal welfare. The ability to respond in an appropriate manner to aversive environmental stimuli is a basic characteristic of animals. Noxious stimuli excite cutaneous receptors (nociceptors), leading to reflex or non-reflex behavioural responses. While nociceptor activity cannot in isolation be considered indicative of pain, there is a clear relationship between nociceptor responses and pain experienced in humans. In animal studies of pain, it is necessary to combine nociceptive information with a range of behavioural and physiological measurements in order to estimate the probability of pain. In the life of a modern commercial hen, pain is likely to arise from acute traumatic injury caused by shackling, beak trimming or skeletal fracture, or from chronic pain caused by disease. Nociceptors, the most common of which were mechanothermal nociceptors, have been identified and physiologically characterized in the chicken beak, wattles, scaly skin, joints, mouth and nasal cavity. These send information to the CNS via small unmyelinated nerve fibres (C-fibres) and have differing properties according to location; those in the beak have lower thermal but higher mechanical thresholds than those in the scaly skin. A second group of mechanothermal nociceptors, the small myelinated A-delta fibres, occur in both the scaly skin and joints of the chicken and are similar to those only previously reported in the hairy skin of humans and primates. The combination of these nociceptors is thought to be responsible for a double pain sensation; the A-delta fibres being responsible for the immediate pain sensation and rapid reflex response to the stimulus while the second, qualitatively different pain sensation modulated by the slower C-fibres would prevent repetition. The nociceptors in the chicken ankle joint show little spontaneous activity or response to normal flexion or extension but respond to excessive lateral or rotational movements, thus serving as protection against joint damage. The forces applied to the legs of chickens during shackling have been shown to exceed the mechanical threshold required to excite the C-fibre mechanothermal nociceptors in the skin of the leg. Stimulus response curves for these nociceptors demonstrated that the maximum response in 63% of these was below the force applied in shackling, providing evidence that the process is likely to be painful. The initial pain resulting from beak trimming probably lasts for between 2 and 48 s and is followed by a pain-free period of several hours, Thereafter, the painful consequences of beak trimming vary according to the age at which the procedure was conducted. If beak trimming occurs before 10 days of age, pain-related behavioural changes do not occur immediately: pecking is not reduced 6 h post-procedure but is reduced significantly by 26 h. Beak trimming in adults has more pronounced effects. Both beak-related and non-beak-related activities are affected for at least 5 weeks postprocedure. Electrophysiological recordings from the beak stump support this; in the weeks following beak trimming. large numbers of spontaneously active nerve fibres were recorded. There was no beak regeneration and extensive neuroma formation was observed adjacent to the scar tissue at the end of the beak. While skeletal fracture is common in laying hens, and pain following fracture in humans is common, there is no published information on the electrophysiological or behavioural responses to fracture. In view of the proposed ban on conventional cages, and with the fact that skeletal fracture is more common in aviary systems. there is a clear requirement for research on the welfare consequences of fracture in laying hens. Although widespread spontaneous arthropathies leading to loss of locomotor function are more common in meat-type poultry than layers. the latter do develop gout, bacterial and mycoplasma infections. The painful consequences of these conditions in the chicken have been investigated in experiments involving intra-articular injection of sodium urate or mycoplasma. After the injection of

sodium urate, joint capsule C-fibre nociceptors became sensitized and birds exhibited behavioural changes indicative of pain, including one-legged standing, limping and sitting dozing, but rapidly returned to normal following the injection of local anaesthetic into the treated joint. Injection of killed Mycobacterium tuberculosis into the ankle joint produced a severe inflammatory arthropathy with a pronounced synovitis together with destructive cartilage damage. Recordings from the sensory receptors in the ankle joint showed that they were clearly sensitized and that inflammatory arthropathies found in the chicken are likely to be painful. This technique, when combined with quantitative gait analysis, showed that histological and electrophysiological changes were accompanied by a quantifiable, severe limp in the early stages (7-21 days after infection). At the more chronic stage of the disease (49-56 days after infection), while pathological changes were still observed in the joint capsule, the sensory fibres responded normally to mechanical stimulation and joint movement, and gait analysis showed that the birds were not lame.

Glatz, P. and M. Bourke (2006). Beak trimming handbook for egg producers: best practice for minimising cannibalism in poultry. Collingwood, CSIRO Publishing.

This handbook is a practical guide to beak trimming of egg-laying hens to minimize cannibalism. It provides comprehensive information on why birds peck and how pecking can lead to problems like cannibalism; the methods available to beak trim birds; why a particular method should be chosen; and at what age birds may be trimmed. The book addresses quality control enabling egg producers to be confident that equipment is properly set up, that birds are handled and trimmed according to best practice and farm biosecurity is maintained. Management of birds following beak trimming, to protect the welfare of the birds and to ensure maximum productivity, is covered in detail. Best-practice, current methods of beak trimming, costs and ways to reduce the use of trimming are examined, along with expected future developments. The advantages and disadvantages are fully explored, covering both public and industry attitudes to the operation. Alternatives are canvassed to understand how the use of fitted devices, enrichment devices, abrasives, low lighting and the choice of low-pecking strains of birds can reduce the need for beak trimming.

Gunnarsson, S., et al. (1999). "Effect of rearing factors on the prevalence of floor eggs, cloacal cannibalism and feather pecking in commercial flocks of loose housed laying hens." British Poultry Science **40**(1): 12-18.

1. Effects of rearing conditions on behavioural problems were investigated in a cohort study of commercial flocks of laying hens housed in 2 different loose housing systems. The sample population was 120 385 laying hens from 59 flocks of various hybrids at 21 different farms. 2. Logistic regression modelling was used to test the effects of selected factors on floor eggs, cloacal cannibalism and feather pecking. In addition to early access to perches or litter, models included hybrid, stocking density group size, housing system, age at delivery, identical housing system at the rearing farm and at the production farm and, in models for floor eggs and cloacal cannibalism, nest area per hen. Odds ratios were calculated from the results of the models to allow risk assessment. 3. No significant correlations were found between the prevalence of floor eggs, cloacal cannibalism and feather pecking. 4. Access to perches from not later than the 4th week of age decreased the prevalence of floor eggs during the period from start-of-lay until 35 weeks of age, odds ratio 0.30 ($P<0.001$). Furthermore. early access to perches decreased the prevalence of cloacal cannibalism during the production period, odds ratio 0.46 ($P=0.03$). 5. No other factor had a significant effect in these models. Although it was not significant, early access to litter had a non-significant tendency to reduce the prevalence of feather pecking.

Jendral, M. J. and F. E. Robinson (2004). "Beak trimming in chickens: historical, economical, physiological and welfare implications, and alternatives for preventing feather pecking and cannibalistic activity." Avian and Poultry Biology Reviews **15**(1): 9-23.

Beak trimming is a commonly practiced procedure in the poultry industry and usually involves partial amputation of the upper and lower beak. Beak trimming is performed to reduce mortality and production losses associated with feather pecking and cannibalistic behaviour. Although the procedure is traumatic and may cause acute and chronic pain, the consequences of feather pecking and cannibalistic activity may be more detrimental to bird welfare than the act of beak trimming. This review addresses the predisposing factors for feather pecking and cannibalism, and the historical and legislative developments of beak trimming. Beak anatomy is reviewed and post-trimming physiological effects are considered, as they relate to pain. Methods of beak trimming and alternative solutions are presented.

Kuenzel, W. J. (2007). "Neurobiological basis of sensory perception: Welfare implications of beak trimming." Poultry Science **86**(6): 1273-1282.

The practice of beak trimming in the poultry industry occurs to prevent excessive body pecking, cannibalism, and to avoid feed wastage. To assess the welfare implications of the procedure, an emphasis of this paper has been placed on the anatomical structures that comprise the beak and mouth parts and a representation of the structures removed following beak trimming. Five animal welfare concerns regarding the procedure have been addressed, including the following: loss of normal beak function, short-term pain and temporary debilitation, tongue and nostril damage, neuromas and scar tissue, and long-term and phantom limb pain. Because all of the concerns involve the nervous system, the current knowledge of the avian somatosensory system was summarized. The critical components include touch, pain, and thermal receptors in the buccal cavity and bill, the trigeminal system, and neural projections mapped to the pallium (cortical-like tissue in the avian forebrain). At the present time, a need remains to continue the practice of beak trimming in the poultry industry to prevent head, feather, and vent pecking in some lines of birds. The procedure, however, should

involve conservative trimming and be limited to young birds. Importantly, data show that removing 50% or less of the beak of chicks can prevent the formation of neuromas and allow regeneration of keratinized tissue to prevent deformed beaks and therefore positively affect the quality of life of birds during their lifetime.

Lunam, C. A., et al. (1996). "The absence of neuromas in beaks of adult hens after conservative trimming at hatch." Australian Veterinary Journal **74**(1): 46-49.

Objective To determine the effects of the amount of beak removed and cauterisation time on neuroma formation in hens. Design A pathology study with controls. Animals Twenty domestic fowl were beak-trimmed. Three non-beak-trimmed domestic fowl were used as controls. Procedure Beaks of two age groups with two levels of beak removal and either 2 s or 4 s cauterisation, were investigated macroscopically and microscopically for deformities. Results Scattered trauma-associated neuromas were present in the beaks of pullets 10 weeks after moderate trimming at hatch, Neuromas were not present in beaks of adult hens that had been similarly trimmed. Sensory corpuscles were present 10 and 70 weeks after moderate trimming, though fewer in number than in intact control hens. In contrast, trauma-associated neuromas persisted in beaks of 70-week-old hens that had been severely trimmed at hatch. A range of deformities that were absent in moderately trimmed, hens, were observed in hens with severely trimmed beaks. Receptors were not seen in severely trimmed beaks. Conclusion Beak-trimming al hatch induces the formation of neuromas, regardless of the amount of tissue removed. There is a critical amount of beak tissue that can be removed, beyond which trauma-associated neuromas will not resolve, but will persist in mature hens.

Marchant-Forde, R. M., et al. (2008). "Comparative effects of infrared and one-third hot-blade trimming on beak topography, behavior, and growth." Poultry Science **87**(8): 1474-1483.

This research examined the effects of infrared beak treatment on layer chicks. Seventy-two layer chicks were assigned to hot-blade trimming (HB), infrared treatment (IR), or a control treatment. Day-old chicks were pair-housed by treatment. Beak photographs, behavior, and production indices were obtained at intervals for 9 wk posttreatment. All beaks were normally shaped at the onset of the study, and no perceptible treatmentrelated differences in shape occurred over time ($P > 0.05$). Posttreatment, HB birds had shorter beaks relative to the other 2 groups ($P < 0.05$). Control and IR beaks remained comparable in length until tissue eroded in IR beaks at 1 to 2 wk posttreatment. Thereafter, beak length increased in all treatments over time ($P < 0.01$). Two weeks posttreatment, beaks were longest in control birds, intermediate in HB birds ($P < 0.001$), and shortest in IR birds ($P < 0.001$). The HB birds had abnormal deviations from a normal upper-to-lower mandible length ratio than the IR or control birds ($P < 0.05$). Notable effects of treatment on production emerged by +2 d and persisted for 5 wk. Growth and feed intake were lower in HB and IR birds compared with control birds ($P < 0.05$), with IR birds performing least well until the fourth week of the study ($P < 0.05$). Thereafter, they performed similarly to the HB group. Feed waste was lowest in the IR group and was generally greatest in the control group ($P < 0.05$). There was an overall effect of trimming, irrespective of method, on behavior, particularly eating and drinking behaviors ($P < 0.05$). Specifically, IR birds were less active ($P < 0.01$) and spent less time eating ($P < 0.01$) and drinking ($P < 0.05$) than did control birds. Behavior in HB birds often ranked intermediate in duration and incidence, but was not significantly different compared with behavior measured in the control and IR groups. Effects of treatment on behavior were not present after 1 wk posttrimming. Results indicate that acute pain occurred with both trimming methods. Although the impact of trimming appeared to be greatest in the IR birds initially, these differences disappeared relatively quickly, and subsequent performance was similar in both trimmed groups.

Persyn, K. E., et al. (2004). "Feeding behaviors of laying hens with or without beak trimming." Transactions of the Asae **47**(2): 591-596.

This study quantifies feeding behavior of W-36 White Leghorn laying hens (77 to 80 weeks old) as influenced by the management practice of beak trimming. The feeding behavior was characterized using a newly developed measurement system and computational algorithm. Non-trimmed (NT) and beak-trimmed (BT) hens showed similar daily feed intake and meal size. However the BT hens tended to spend longer time feeding (3.3 vs. 2.0 h/d, $P < 0. 01$), which coincided with their slower ingestion rate of 0.43 g/min-kg(0.75) vs. 0.79 g/min-kg(0.75) for the NT counterparts ($P < 0.05$). The BT hens had shorter time intervals between meals (101s vs. 151s, $P < 0.01$). Selective feeding, as demonstrated by larger feed particles apparent in the leftover feed, was noted for the BT hens. The leftover feed had a lower crude protein/adjusted crude protein content for the BT birds than that for the NT birds (16.7% vs. 18.7%, $P < 0.05$). In addition, the leftover feed of the BT birds had lower contents in phosphorus, magnesium, potassium, zinc, and manganese ($P < 0.05$), although no significant differences were detected in calcium, sodium, or metabolic energy content. Baseline feeding behavior data of this nature may help quantify and ensure the welfare of animals through exercising proper engineering design and/or management considerations.

Prescott, N. B. and R. H. C. Bonser (2004). "Beak trimming reduces feeding efficiency of hens." Journal of Applied Poultry Research **13**(3): 468-471.

The ability of beak-trimmed and intact laying hens to ingest feed pellets was examined by highspeed video filming of feeding birds. The birds were exposed to either a deep layer of pellets or a single layer of pellets. In the single layer treatment, there was a negative correlation between mandible asymmetry and feeding success. These data have important implications for poultry welfare, since the

degree of bill asymmetry caused by beak trimming may, under certain circumstances, result in inadvertent feed deprivation.