Introduction
Digital dermatitis is an economically important infectious cause of lameness in dairy cattle as well as beef feedlot cattle. Despite 35 years of research, the etiology and developmental process of digital dermatitis has yet to be fully described. The majority of research into the etiology of digital dermatitis has focused on identifying cattle with “classic” lesions either during routine foot trims or at slaughterhouses. This method of research is hampered by the inability to accurately classify lesions as acute versus chronic and does not consider treatment history in the evaluation of the lesion. In the present study we have developed a novel scoring system based on long-term (32 months) longitudinal observation of lesion development. This system has allowed for the identification of changes to the bovine skin consistently recognizable weeks to months prior to “classic” lesion development and lameness.

Materials and Methods
Sixty one adult Holstein dairy cattle were enrolled in the study and allowed to develop digital dermatitis lesions via diversion from the farm’s foot bath and topical treatments. These cattle were followed for up to 978 continuous days and have been examined and photographed every 2-4 weeks to document lesion development. These cows were also monitored for recrudescence and/or reinfection with digital dermatitis over this same time period. Through examination of images prior to development of digital dermatitis, a consistent pattern of development was observed and categorized into six stages.

Results
A consistent pattern of lesion development has been identified from the analysis of more than 7000 photos over the course of 32 months. Histopathologic and microbial metagenomic studies have validated that these morphologic lesions progress through a systematic progression of lesion severity and represent distinct lesion stages. Two years of morphologic lesion progression monitoring on these cows have confirmed that all lesions develop systematically through these described stages. Temporal evaluation of the lesion stages has demonstrated that cows can routinely have early stage “non-active” lesions for weeks to months (some even years) prior to the development of classical digital dermatitis lesions that would be identified in most cross-sectional studies. These early stage cows remain non-lame and in most cases would not be identified without examination of the foot after cleaning. Each “step up” in lesion severity on our scoring system represents an increased risk of developing an active “classical” lesion. Interestingly, a significant number of cows on our study with advanced lesions fail to show significant lameness (ie. locomotion score of 4/5 or more). Locomotion scoring was found to have a low correlation with lesion severity in all but the most severe lesions. Finally, aggressive post-treatment follow up of cows has identified that many cows do not regress back to normal skin following treatment. Many of these treated lesions regress into earlier lesion stages with cows that achieve the lowest lesion scores post-treatment being the least likely to redevelop advanced lesions during the follow-up period.

Discussion
The identification of lesions months prior to the onset of classically described stages of digital dermatitis has allowed us to study lesions at their earliest stages of development. Furthermore, our data suggest that our scoring system may be useful as a prognostic indicator or risk for further lesion development or risk of reoccurrence of advanced lesions. Finally, the evidence suggests that locomotion scoring may not be effective at identifying cows with early stage lesions.