

## Completion Report for BSAS Scholarships

**Name and affiliation:**

Sandra Starke  
The Royal Veterinary College, University of London, UK

**Award Name and value of the award:**

Murray Black Award, £ 1500

**Was any additional funding secured to support the activity?**

(If yes, please state the value and source of funding):  
£ 600, Dr Hilary Clayton

**Start/end date of the award:**

17 September to 16 November 2012

**Summary of the award (Briefly describe the objectives and how was it undertaken):**

(approximately 300 words)

I visited Dr Hilary Clayton and her team at the McPhail Equine Performance Center at Michigan State University, USA, between 17 September and 16 November 2012. The reason for the stay was a collaborative research project, in which we investigated mechanisms of equine locomotion on the circle. The aim of our project was to identify and understand changes in forces and movement adaptations in sound horses during lunging. In spite of the fact that this locomotion on a circle is part of the regular routine for most horses (any basic schooling programme involves lunging and riding in a circle), the biomechanical effects are largely unknown. It is reasonable to assume that circling alters the forces on the limbs and may increase the risk for injury.

To address our research questions, we used a variety of technologies to quantify kinetics (using force plates) and kinematics (using optical motion capture and inertial sensors) in sound horses moving on a circle and in a straight line at different gaits. After determining the optimal equipment setup and synchronization of systems in the first week, a typical week consisted of data collection for two horses across four days: at first we performed a baseline lameness assessment and marked 112 palpable landmarks on the horses' body for attachment of markers during motion capture. Over the following days, data were collected under various conditions (circle, straight, different gaits etc.). After completion of data collection for each pair of horses, the quality of the data was checked before proceeding to the next horses in the following week.

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## **Benefits of the Award:**

This is the main part of the report and the two sections below should be approximately 1000 words in total. You may focus on benefits to yourself, to the animal science community, or both – depending on the nature of the activity undertaken.

### **Benefit of the award to you (e.g. new knowledge or skills, new contacts and collaborations):**

Collaborating with Dr Hilary Clayton at the Mary Anne McPhail Equine Performance Center has been absolutely amazing for many reasons: we have been able to assemble an outstanding database that will lead to many important publications, I had the opportunity to observe and learn from Dr Clayton who is generally regarded as the leading authority in my area of research and I was introduced to many wonderful people. I feel that the stay allowed me to develop both on a personal and scientific level and I would thoroughly recommend a research visit to a different institution to any final year PhD student.

A great benefit was to see and understand how another lab works. This included new routines, working with a larger team of people on a project than I have previously done and getting to know new equipment setups: I learned a lot of new things that I found extremely useful, such as dotting horses prior to marker attachment; this makes it much easier to re-attach markers in the same location if they fall off. This was the first project I am involved with that uses segment-based marker clusters and I really liked this approach. Since our project was of such large scale, our team consisted of several core members and lots of student helpers, with roles covering e.g. setting up and running different pieces of equipment, preparing the horses, lunging the horses for training or during data collection and building what must have been 3000 or more reflective markers. Seeing how such a large team can be organised so that the work runs smoothly was very insightful, and it was great getting to know each team member. Since McPhail uses a different brand for motion capture cameras / forceplates and different software for data acquisition and data analysis compared to my lab, I had the opportunity to learn the basics for these new systems and see the differences to the hardware and software that I am familiar with: at McPhail I liked the visual integration of motion capture data, forceplate locations and force vectors / centers of pressure all in one software; I felt this setup simplified real-time evaluation of data. And, last but not least, it was of course and absolute delight to see Dr Clayton working with horses.

Another benefit has to be the challenge of joining one of the world's best equine biomechanics labs. You really want to live up to the standards, and I am sure every PhD student would agree that this can be quite intimidating. To be in that situation and to find that things work just fine is a great experience; it gives you confidence in your skills and makes you appreciate how much you have learned since starting a PhD. In addition I very much enjoyed being part of a huge university like Michigan State; the campus is as large as a city center and has absolutely everything on site: a horse farm where, amongst other breeds, Arab horses are bred; the foals had just been weaned, and watching them was the sweetest thing ever. There is an event center for anything relating to agriculture where we watched a big draft horse show and there is a big center for performing arts, where some amazing shows stopped off. Since the university has its own music department, there were many music venues and I attended lots of gigs

spanning e.g. classic, jazz and modern percussion on tea pots; as I am a bit of a music fanatic, these evenings were absolutely thrilling and inspiring. And of course there is an ice skating arena (well, a proper stadium) that was open to the public, where Hilary's husband Rich improved my skating abilities by 1000%. So it was really nice to have these awesome things right on the doorstep if there was time.

Apart from being able to develop on both a personal and academic level, one of the highlights of my stay was meeting and talking to lots of new people from various backgrounds. Apart from all the lovely members of the research group, I frequently met e.g. the manager of the horse farm where the horses that we used were located, clinicians working at McPhail and / or people from other departments. Further, Dr Clayton introduced me to lots of colleagues that visited McPhail during my stay and I really enjoyed meeting them, often having a relaxed chat about equine science and other things. I even met Kevin Keegan for the first time who has done a lot of groundbreaking work in the area of lameness detection. I hope to see them all again one day and stay in touch. Dr Clayton also kindly took me along to events such as a training course for dressage judges; this was great fun and very informative.

I consider my two months with Dr Clayton and her team as one of the highlights of my PhD and am very much looking forward to the next steps and all the fantastic work that will come out of this project.

**Benefit of the award to the animal science community, academic and industrial:**

With the collected dataset we will be able to quantify the kinematic and kinetic adaptations shown by sound horses when moving around circles. This work has the potential for far reaching impact: decoding the mechanics of circular locomotion will allow us to understand changes in limb posture and relate it to safety margins and wear of individual limb structures. This understanding will hopefully be an important stepping stone towards predicting and preventing stress-related injuries during circling and provide a foundation for appropriate training regimes across all equine disciplines. Understanding the basic mechanics of quadrupedal movement in a circle will also be of great interest to researchers concerned with other species, as this topic is still largely unexplored. Aside from these fundamental biomechanical questions, the work will also provide a foundation for understanding the adaptations of lame horses during trot in a circle and the detection of subtle lameness.

**Other supporting information:**