An International Genetic Survey of Working Canines from the United States, Israel and Poland

Lisa G Shaffer, PhD, FACMG\textsuperscript{1,2}, Christina Ramirez, DVM, PhD, DACVP\textsuperscript{1}, Patricia Phelps, PhD\textsuperscript{3*}, Maya Aviram\textsuperscript{4}, Marta Walczak, PhD\textsuperscript{5}, Gila Kahila Bar-Gal, PhD\textsuperscript{4}, Blake C Ballif, PhD\textsuperscript{1}

\textsuperscript{1}Paw Print Genetics, Genetic Veterinary Sciences, Inc., Spokane, WA, USA
\textsuperscript{2}School of Molecular Biosciences, College of Veterinary Medicine, Washington State University, Pullman, WA, USA
\textsuperscript{3}Smithsonian Museum of Natural History, Washington DC, USA
\textsuperscript{4}Koret School of Veterinary Medicine, The Robert H Smith Faculty of Agriculture, Food and Environment, Hebrew University of Jerusalem, Israel
\textsuperscript{5}Department of Animal Behavior, Institute of Genetics and Animal Breeding, Polish Academy of Sciences, Magdalenka, Poland
Introduction

Genetic diseases are found in dog breeds commonly used as working dogs.

As important members of their teams, dogs are expected to operate at peak performance for several years.
Introduction

Working dogs are a significant investment for both cost of purchase and training.

Previous studies examining reasons for discharge or euthanasia failed to include genetic risks.

Photo courtesy of Fairchild Air Force base.
Study Objective & Goal

❖ To identify breed-specific genetic risks for inherited diseases in working dogs
❖ With the goal of providing a justification for screening dogs prior to breeding, buying or training
Study Design, Sample, Procedures

- 304 dogs were ascertained
  - 267 law enforcement dogs
    - 122 US, 87 Israel, 58 Poland
  - 37 search & rescue (SAR) dogs (US)

- Study participants included dogs in training, active duty or retired

- Handlers collected 3 cheek swabs (US) or veterinarians collected blood in EDTA (Israel, Poland)

- Dogs were screened with routine molecular genetic methods for 1-15 disease mutations based on breed
Degenerative Myelopathy

- DM occurs in more than 150 breeds of dog
- DM affects white matter of spinal cord
- Average age of onset for symptoms is 9 years
- Mutation in \textit{SOD1}
  - Also found in humans, Lou Gehrig’s Disease (amyotrophic lateral sclerosis, ALS)
- Gradual muscle atrophy, begins in hind limbs
- Progressive disease
Degenerative Myelopathy - GSD

Previous studies cite degenerative diseases, spinal cord disease, or musculoskeletal disease, as reasons for early discharge or euthanasia of working dogs, leading to the speculation of possible DM.

Our study showed DM in a substantial number of German shepherd dogs and other working breeds tested.

Thus, DM is likely a significant challenge among law enforcement and other working dogs.
Exercise-induced Collapse - Labrador

- Neuromuscular disorder presents with exercise intolerance
- Many dogs diagnosed after 2 years of age
- 5-20 min. of strenuous exercise results in collapse with recovery within 5-30 min.
- Episodes would be stressful to the handler and could jeopardize both handler and dog in certain situations
Leukocyte Adhesion Deficiency III

- Blood disorder characterized with abnormal platelets, abnormal clotting and immune system dysfunction
- Dogs may present with lameness, prolonged bleeding, recurrent infections
A substantial number of dogs studied were either carriers or at-risk for known genetic diseases.

Based on this study, before breeding, buying or training, working dogs should be screened for common, breed-specific genetic conditions.

Identifying carriers allows informed breeding decisions and avoidance of breeding carrier x carrier.

Conditions identified in this study are likely to put the dog, handler or the mission in jeopardy (EIC) or shorten a K9’s career (DM).
The loss of dogs due to early retirement or euthanasia as a result of preventable genetic conditions has emotional costs to handlers and financial costs to service organizations.

Known genetic conditions are easily avoided through relatively low cost genetic testing.

These findings and conclusions are applicable to any working or assistance dogs.
Disclosures & Acknowledgments

Paw Print Genetics is a fee for service lab that provides genetic testing to breeders, owners and trainers.

Funding was provided by Paw Print Genetics and NCN grant 2012/07/D/NZ9/03370 to GKB-G.

This study was part of a high school summer internship for A Giri, at the Smithsonian Museum of Natural History, Washington DC.

We thank all of the handlers, officers and K9s that participated in this study.