ABSTRACT
In 1981, University of Georgia experimenters observed that two littermates—Rusty and Dusty—exhibited signs of Golden Retriever muscular dystrophy (GRMD). This observation initiated decades of deliberate breeding of dogs to be afflicted with this disease marked by the progressive degeneration of skeletal and cardiac muscle. As MD ravages their bodies, dogs experience difficulty walking, eating, swallowing, and breathing. Potential treatments in dogs are assessed using measurements of muscle strength and joint contractures. Clinical milestones such as loss of ambulation and the need for ventilator support are tracked. However, researchers acknowledge that after decades of testing on generations of debilitated dogs, there is still no cure or treatment to reverse the course of MD in humans. We consider the global proliferation of colonies of MD dogs, challenges encountered in using dogs, and promising alternative research methods.

MUSCULAR DYSTROPHY

Differences Between Human MD and Canine MD

<table>
<thead>
<tr>
<th>Indication</th>
<th>Humans</th>
<th>Dogs</th>
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<tbody>
<tr>
<td>Neonatal death</td>
<td>Rare</td>
<td>20-30% of canine DMD puppies</td>
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<tr>
<td>Age at first symptom</td>
<td>2 to 4 years</td>
<td>Birth to 3 months</td>
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<td>Growth retardation</td>
<td>Absent</td>
<td>60% of normal by 6 mos.</td>
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<td>Ambulation</td>
<td>Lost during early teens</td>
<td>Complete loss absent</td>
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<tr>
<td>Cardiomyopathy</td>
<td>Evident at 16 years</td>
<td>Detectable at 6 months</td>
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<tr>
<td>Neurocognitive symptoms</td>
<td>33% of affected individuals</td>
<td>Not noted</td>
</tr>
<tr>
<td>Lifespan</td>
<td>25-35% of normal length</td>
<td>50% normal length</td>
</tr>
<tr>
<td>Functional orientation</td>
<td>Bipod</td>
<td>Quadruped</td>
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The Experiences of a Dog in a Canine MD Lab

The suffering of dogs bred to have GRMD begins early in life. Symptoms manifest in puppyhood, often requiring specialized care. Dogs with GRMD experience the following:

- Inability to suckle
- Striated growth
- Stiff gait and exercise intolerance
- Cannot open their mouths fully due to spasms of the jaw muscles (trismus)
- Abnormal stance from muscle weakness
- Contracted muscles, causing the spine to curve inward
- Enlarged muscles in the tongue and diaphragm
- Difficulty breathing and swallowing
- Lifetime imprisonment in barren cages, unable to run, play, or even eat properly

In addition, dogs in canine MD laboratories, their suffering is magnified by the invasive and painful tests to which they are subjected, including:

- Repeated surgeries to obtain muscle biopsies and other tissue samples
- The use of mechanical levers to stretch the dog's muscles until they tear
- Injection of experimental drugs, often with painful and/or lethal side effects
- Delivery of repeated electrical shocks to stimulate muscle contractions

LACK OF TRANSPARENCY
Texas A&M University (TAMU) has been purposefully breeding dogs to have MD. Despite publications and records detailing this, TAMU has attempted to mislead the public:

- “Aged dogs are born with the disease and are not artificially made to be ‘sick.’” – Texas A&M Official Statement

The Humane Society Veterinary Medical Association disagrees that perpetuating this agony is in any way helping dogs. Other experts refute the scientific claim that these experiments help humans suffering from muscular dystrophy:

“[T]he difference between dogs and humans… makes dogs poor surrogates for muscular dystrophy research. Indeed, canine muscular dystrophy research has not led to treatments that cure or target the cause of muscular dystrophy in human children.” – Narda G. Robinson, D.O., D.V.M., M.S., F.A.A.M.A.

MUSCULAR DYSTROPHY

Dogs that carry the GRMD gene but are asymptomatic are kept as breeding stock. Confined in small kennels for their entire lives, they exhibit stereotypic and abnormal behaviors due to boredom, stress, and anxiety.

CONCLUSION

In a cost/benefit analysis, the negligible information gained through MD experiments on dogs does not outweigh the tremendous suffering experienced by these animals. Funds currently being spent on canine MD research should be reallocated towards human-based methods.

PEONY'S STORY

Peony, a golden retriever who was bred to have canine muscular dystrophy, was born on May 19, 2011 at the University of North Carolina (UNC) Chapel Hill. At UNC, Peony suffered from bouts of intestinal parasites normally associated with poor sanitation and crowding. These infections caused vomiting, nausea, an uncomfortably bloated abdomen, weight loss, decreased energy, and pain, often bloody diarrhea.

Peony was subjected to painful muscle biopsies. One of her incisions became infected, swelling painfully and oozing thick yellow pus. She was already underweight, and her growth was stunted because of the GRMD, but her body condition worsened with the infection and repeated experimentation. In 2012, Peony was transferred to TAMU.

Her enlarged tongue, a symptom of GRMD, made her salivate more than usual. The lead experimenter suggested she could be experiencing heart problems associated with GRMD.

Peony was euthanized on March 3, 2013, two months shy of her second birthday.

The current standard of care for patients, corticosteroids, is only palliative and has many negative side effects.

DRUG DEVELOPMENT

The Eteplirsen Controversy

In 2016, a U.S. Food & Drug Administration (FDA) review committee recommended anal stem approval for Eteplirsen, a drug that skips a stripping that was tested in mice, dogs, and monkeys. Following a 12-person clinical trial, the FDA concluded that there was little evidence of Eteplirsen’s efficacy, but their recommendations were contested by director Janet Woodcock after a heartfelt plea from patient advocacy groups.

“The research history for DMD, and in particular the animal experiments using dogs have been an absolute failure despite several decades of effort. The unwarranted approval of Eteplirsen is a measure of the futility and frustration around the fact that there is nothing to show for all this research” – John Pippin, M.D., F.A.C.C.

PAST AND PRESENT CANINE MD BREEDING COLONIES

ALTERNATIVES

Microfluidics: “Human Muscle-on-a-chip”
- Can be integrated with other organs: cardiac, respiratory systems
- Most accurate representation of the human body
- Potential for personalized medicine
- High-throughput

Stem cell technologies
- Patient-derived induced pluripotent stem cells have a human genetic MD background
- Can study early cellular phenotypes of MD
- Adult-human satellite cells can produce muscle progenitors for drug screening, cell therapy, or functional enrichment

CONCLUSION

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