An Overview of Laboratory Animal Transportation

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What are laboratory animals?

• Laboratory animals are distinguished by their intended use in research, testing or education.
  – While the term “laboratory animals” could potentially include a wide range of wild and domestic species used for food, fiber or pets, in practice it is generally applied to those animals with a defined health and genetic status and purpose-bred for their intended uses in research, testing and education.
  – IATA’s LAR lists transportation standards for nearly 7000 species but less than 20 comprise over 98% of those used.
Laboratory Animals

• With very few exceptions they are sourced from *purpose bred colonies* or from *agricultural sources* of food and fiber production.

• They are *not intended* for use as *pets*.

• They are *not used for food or fiber*.

  ▪ In *some cases*, these animals possess specialized anatomic, genetic, physiologic or metabolic conditions that *differ from other members of the same species*. 
Sources of Animals

Wild Populations - Rarely Used

Commercial Breeders
- Closed Colony (non-rederived)
- Rederived -- Barrier Maintained Colony
  - Barrier Room, Isolator

Institutional Colonies
- Closed Colony (non-rederived)
- Rederived -- Barrier Maintained Colony
  - Barrier Room, Microisolator
LAB Animals

- Mice
- Rats
- Fish
- Guinea Pigs
- Hamsters
- Rabbits
- NHP
- Gerbils
- Dogs
- Swine
- Cattle
- Sheep
- Goats
- Poultry
- Amphibians
- Cats
The use of animals in research, a global perspective - species

- Mouse: 60.9%
- Rat: 18.0%
- Cold Blooded: 8.0%
- Birds: 6.4%
- Rabbits: 2.8%
- Guinea Pigs: 1.5%
- Pigs: 1.0%
- Primates: 0.1%
- Dogs: 0.3%
- Other: 1.0%

Est. global unit breakdown per species in 2010
The use of animals in research, a global perspective - geographies

- North America: 54%
- Europe: 23%
- Asia Pacific: 18%
- Other: 5%
Why are Lab Animals Transported Between Institutions?

- In order to share genetically unique strains
- To allow collaborative studies to be conducted
- To start up new colonies and genetically link existing colonies
- To eliminate the need to breed commonly used strains on site
Why Not Just Breed The Animals At The Institutions Where They Will Be Used?

The Process Is Simple – Right!
Breeding in house is logistically challenging

- “Can’t hurry biology” – 7 week breed cycle for most rodents (longer for G. pigs and larger animals)
- Easy to overproduce if the program is not closely monitored
  - Only need a certain number of animals at a particular time and of certain specifications (e.g. age, wt., sex, genotype, health status)
  - Frequently only a portion of a litter meets the required specification
- Space and resource intensive
  - Instead of just housing study animals must house breeders, replacement breeders and stock.
  - Limited options as to how animals not destined for studies can be used
- Collaboration and comparison of research findings complicated by colony divergence and formation of sublines in inbred strains as well as loss of heterozygosity in outbred stocks
- Commercial production can address these some of these issues but requires safe and humane transportation options.
In order to move animals between institutions there are two alternatives:

- Live Animals
- Cryopreserved Germplasm
Shipping Live Cryopreserved Embryos, Ova, And Sperm

- Shipment of germplasm (e.g. embryos, sperm, etc.) between institutions or repositories
  - Requires facilities at receiving institution to recover live animals
  - Makes especially good sense if complex long distance shipment required
  - Usually done in dry LN shippers
    - Approved for air transport
  - Minimizes health risk to receiving institution
Transfer Using LN Dry Shipper

Straws Containing Cryopreserved Embryos
Cryopreserved Embryo or Sperm Transport

- Not without some drawbacks
  - *Time delay* until founder animals produced and ready to breed *(9+ weeks)*
  - Variable *in vivo* rates (live animal recovery) *(0 – 60%)*
  - Assumes that institution can recover and maintain at desired health status
  - If reconstituted at a repository, *may still need to transport* live animals to final destination
Shipping Live Animals
Experience + Thoughtful Planning = Safe Transportation
Setting Achievable Goals for Transport

Minimizing Risk of:

- ILLNESS / INFECTION
- STRESS
- DEATH OR INJURY
– Process is analogous to using a bus or train to move people from one point to another:

  • System designed to meet the needs of the average person.
  • Not intended to be a personal transportation system for a few.
  • Seats designed for the average person, temperature set to avoid extremes, stops located where the most people are served, etc.
  • Regulations are designed (in theory) to ensure that **safe and reliable transportation** is maintained—*not necessarily optimal transport* for all those using the system.

    – Regulations can have unintended consequences—try to fix one problem and create others.
Shippers *need* to have an *understanding of* the *transportation process* for live animals
UNVERIFIED ASSUMPTIONS ARE THE ROOT OF MOST PROBLEMS IN TRANSPORTATION
NEED TO KEEP THINGS IN PERSPECTIVE!
Not Everyone Views Animal Transportation The Same Way
Mice do not always travel alone
Other Perishable Cargo Compete For Space And Conditions
Lab Animal Shipments Are Placed Into Existing Transport Systems
Laboratory animals are transported in commerce between institutions everyday.

- Represent a tiny fraction of all goods moved.
- By in large, journeys are successful—obviously depends on your measure of success.
- Overall failure rate is **LOW**:
  - Expressed as number of containers with problems / all containers shipped (A&L)* by commercial breeders
    - Air 0.04% (A)
    - Land 0.03% (L)
    - Total 0.07%

* NOTE: All containers in shipment counted even if problem with only one container; includes non transport related issues
Shipping Errors Caused by Customers Make Airlines Nervous
Inconsistency in message regarding risks gives concern to airline employees and passengers.
Ground Transportation

Ventilation / thermodynamics based on load configuration and container types

Weather, traffic, and mechanical breakdowns can all result in delays or failures

Ultimately, it takes longer to get to distant destinations than by a combination of land and air transportation.
Ground Transportation

- Local and regional carriers are available
  - Not a lot of choices
  - *Animals* and *other perishable and non perishable cargo* from multiple institutions could be *carried together* for some or all of the journey

- Costs for dedicated truck are high:
  - The mileage cost is based on *round trip*
Ground Transportation Within North America

- Must have the right equipment and more importantly the knowledge
- Only USDA registered carriers can carry USDA regulated species
- **Strict DOT requirements and licenses**
- Few available qualified carriers in some areas
- Few carriers willing to take on the challenges and associated headaches of transporting live animals (e.g. conflicts with their other customers’ non-animal freight, potential Govt. audits and fines, liability associated with errors in shipment, etc.)
AIR TRANSPORT

- Less than 40% of the global commercial air fleet capable of carrying animals.
- Not all cargo compartments may have appropriate environmental controls.
- Mixed loads: Must balance various perishable cargo needs

<table>
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<tr>
<th></th>
<th>Bulk compt.</th>
<th>Compts. 3/4</th>
<th>Compts. 1/2</th>
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<tr>
<td>Temperature</td>
<td>6 °C to 25 °C (see note 'Heat sensitive cargo')</td>
<td>6 °C to 25 °C</td>
<td>above 4 °C; usually around 10 °C to 18 °C *</td>
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<tr>
<td>Heating</td>
<td>yes</td>
<td>yes</td>
<td>indirect *</td>
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<td>Heat Adjust</td>
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<tr>
<td>Cooling</td>
<td>yes</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>Ventilation</td>
<td>yes</td>
<td>yes</td>
<td>limited (see note 'Wet or humid cargo')</td>
</tr>
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BOEING 747 - 400
Ground Transport is Always a Component of Shipping by Air

Don’t forget!
A Few Facts About Air Transportation

- **Air is the fastest and sometimes the only way to get animals to the consignee**

- **Live animal shipments represent less than 0.1% of all air cargo and Lab Animals a fraction of that**

- **Many documents can be required for transport**
  - Errors or missing docs can stop or delay transport

- **Pets are “Preferred Citizens” – lab animals are not**

- **Pilots or airlines can refuse to carry animals**
  - Many airlines will not carry animals

- **The shipper (you) is ultimately responsible for the microbiological status of animals transported by air**

- **The shipper can be responsible for escaped animals**

- **Weather delays, temperature embargos, and cancelled flights need to be anticipated – “Have a Plan B”**
Some Things To Keep In Mind

- Once an animal leaves an institution you have limited control over their environment and handling. *Don’t make assumptions*
  - If you insist on unrealistic conditions: (1. They will not be able to be met and (2. The animals will not go!

- **Journey planning** including anticipating how things can go wrong is the *only way to minimize the risks* in shipping

- **Animal transportation is highly regulated** so you can’t make any assumptions about what is or is not required especially when shipping internationally.
Animals **will experience some stress** in transit but there are too many variables to precisely control it.

When receiving animals shipped using a commercial carrier understand that the **outside of the container** and, rarely, even the animals could become microbiologically **contaminated**.

Occasionally animals will become sick or die during or after transit which **may or may not be the result of errors** in the process of shipping. – Just **complaining does little** to help – working with the transportation provider in collecting and analyzing the facts (**not assumptions**) does help in improving future shipments.
Regulation Of Animal Transportation

- Lab animals and biological materials of animal origin need to be transported both within and between countries
  - In US many agencies and organizations regulate/impact this activity
    - e.g., US Fish and Wildlife, USDA, CDC, DOT, Homeland Security (TSA)
  - In other countries different agencies and rules apply
  - Sometimes requirements conflict
Regulation Of Animal Transportation

- Species specific requirements and prohibitions that are unique to individual countries may exist.
  - Sometimes interpretation and requirements can even vary between BIPs within the same country

- May be as simple as wording on health certificates or the outright prohibition of transport into or through a country of certain species or biological materials
  - e.g., DEFRA: publishes conditions to import germ plasma and live animals into and through the UK
Diminishing Availability Of Air Transport

- In response to adverse transportation events, pressure from NGOs as well as a better understanding of animal needs and improved transportation practices, regulations are continually being developed and “refined” adding increased complexity to an already complex process.

- Ever increasing documentation, licensing, certification, and inspection requirements have added to the cost and time required for shipment.
  - This is compounded by inconsistent interpretation of the requirements by those charged with implementing them. In turn this has added increasing liability to the process.
THANK YOU!