



## First Step Guidance for Small Pups

The important thing that needs to be determined is, is this:

**Poor Biology**

or

**Unavoidable Genetics**

Poor Biology – can be *rectified*

Unavoidable Genetics – is *unavoidable*

One does not want to write off something unavoidable, when it could be rectified.

### Firstly, define what you see as “Small Pups”

- Are all the pups in the litter small, or just a few, or just one?
- Are all the pups small across all the litters, or just with this breeding pair?
  - Have this breeding pair previously produced “normal” pups?
- Is there an MCMS colony prefix that is attributed to this, or is it across many prefixes? What links those prefixes?
  
- Are the pups small at birth but catch up by weaning?
- Or, are the pups all the same at birth and the difference develops by weaning?

### Poor Biology – what do we mean?

Pups need two things:

| <b>Warmth<br/>(thermoregulation)</b>                                           | <b>Energy<br/>(plenty of milk)</b>                                                |
|--------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| ✓ Good quality nest                                                            | ✓ Healthy mother who can produce enough milk                                      |
| ✓ Attentive mother to put them back                                            | ✓ Access to teats for long enough to drink                                        |
| ✓ Enough other litter mates to generate enough warmth                          | ✓ Can you see evidence of a full belly or milk spot?                              |
| ✗ Not enough bedding/ nesting – the cage is too cold                           | ✗ Pushed off teat by bigger siblings or older litters                             |
| ✗ Too many other mice (siblings or older litters) to push them out of the nest | ✗ Can you see a large, dark, gas-filled tummy indicating swallowing air not milk? |
| ✗ Not drinking enough milk for fuel                                            | ✗ A non-attentive mother                                                          |
|                                                                                | ✗ (Infection or illness in either mum or pup)                                     |



## Unavoidable Genetics – what do we mean?

When researchers add in, or take out, genetic material – making Genetically Altered Animals – the alteration will affect genes, which affects proteins, which may affect how the body functions, and this may affect growth or development.

It could be **intentional**:

- It could affect the mouse if one chromosome is affected – thereby affecting hets (heterozygous) and homs (homozygous)
- Or, it could only affect the mouse if both chromosomes are affected – thereby affecting homs only.
- Wild-types should not be affected: so, are all the pups in the litter small, or just a few, or just one?

It could be **unintentional**:

- Most genetic alterations come with a switch, and so the pups may not be expected to be affected at birth – so has the genetic material put itself in the wrong place?
- The gene of interest may not previously have been known to affect growth or development.

## Supporting small pups

“Runty” pups are a feature of nature – part of evolution’s “Survival of the Fittest”. So, some pups will not be salvageable, but they would not have been good experimental candidates anyway. You may not be able to save them all. However:

Use record keeping, observational skills, and liaising with the researcher and Named People to best work out whether we’re dealing with *rectifiable poor biology*, or *unavoidable genetics*. PS: the latter should be detailed in the Project Licence, if not, an amendment may be required.

To rectify poor biology, go back to:

- Warmth
  - What can be done to improve the warmth and thermoregulation in the cage?
- Energy
  - What can be done to improve the pup’s milk intake?
  - Do you need to improve mum, by providing mash, gels, high sugar and high calorific supplements, e.g., condensed milk?
  - Are the pups near weaning enough to also benefit from these supplements?
  - Are the pups too young that they still need to suckle, e.g., need fostering or trio mating?