Chicken Welfare
and the
Pros and Cons of Caging Systems

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Domestic Fowl

Modern domestic fowl descended mainly from Burmese Red Junglefowl

(Gallus gallus spadiceous)
Domestic Fowl

Burmese Red Junglefowl
(Gallus gallus spadiceous)
Chicken ancestry is complex

Red

G. gallus spadiceous – Burma
G. gallus bankiva – Java ?
G. gallus gallus – Indochina ?
G. gallus murgha – India ?

Sri Lankan

G. lafayetteii – Sri Lanka *

Grey

G. sonneratii – India *

Green

G. varius - Java
Chickens are derived from a sub-tropical species.

Myanmar (Burma)

Tropic of Cancer

Approx. range of Burmese Red Junglefowl

12° N
Domestication probably started around 7,400 years ago.

Almost certainly in areas where Junglefowl are found i.e. India, Burma, Indochina.

Movement first to the east – China.

Then to the west – Middle-East and Europe.
Interestingly, early keeping of chickens was not primarily for meat or eggs:

- Crowing
- Decorative feathers
- Sooth-saying (augury, haruspicy)

But this changed from the 18th century.
Many original breeds were “dual purpose” i.e. kept for eggs and meat.

In the 20th century, as our understanding of genetics increased, this changed.

Selection for:

- Egg production
- Meat production
Chicken Domestication

How have chickens changed in 7,400 years?
Modern chicken is very different

<table>
<thead>
<tr>
<th>Junglefowl</th>
<th>Domestic Fowl</th>
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</thead>
<tbody>
<tr>
<td>12-14 eggs/year</td>
<td>Layer 320 eggs/year</td>
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<td>(6.1 eggs in 7 days!)</td>
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Modern chicken is very different

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<tr>
<td>Grows to 600-800 g in a year</td>
<td>Broiler grows to 2 kg in 38 days</td>
</tr>
</tbody>
</table>
Junglefowl

- Small flocks. Territorial male + harem of 4-10 females + followers
- Seeds, grains, leaves, insects
- Ground-dwelling
- Ground-nesting
- Tree-roosting
- 70% of day spent foraging
- Complex visual and vocal communication system

Collias et al. (1966)
Feral Fowl

Known from two studies on feral fowl, (Australia and Scotland) that domestication has not changed behaviour all that much.
Feral Fowl

- Small flocks. Territorial male + harem of 4-10 females + followers
- Seeds, grains, leaves, insects
- Ground-dwelling
- Ground-nesting
- Tree-roosting
- *60% of day foraging*
- Complex visual and vocal communication system

McBride et al. (1969); Wood-Gush et al. (1978)
Feral Fowl

Additional information from Scottish study:

- Hens never shared a nest.
- Hens used a nest for one clutch of eggs only.
- Hens sought out animal protein when their chicks were small.
Domestic Fowl

Almost like two species

Layer strains

Broilers

Different husbandry systems

Different disease risks

Different welfare problems
Domestic Fowl

Asked to talk about cages, so 99% of talk will be about laying hens.

But broilers will be mentioned…

…why, will be revealed later.
Animal welfare is all to do with what animals feel:

With negative feelings we call “suffering”

With positive feelings we call “pleasure”
Animal Welfare

Now lots of evidence that chickens are sentient (i.e. they have feelings). They can experience:

<table>
<thead>
<tr>
<th>NEGATIVE</th>
<th>POSITIVE</th>
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<tr>
<td>pain/discomfort</td>
<td>contentment</td>
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<tr>
<td>frustration/deprivation</td>
<td>pleasure</td>
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<tr>
<td>fear</td>
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<tr>
<td>malaise</td>
<td></td>
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<tr>
<td>social stress</td>
<td></td>
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<tr>
<td>maternal separation</td>
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Laying hens

90% of layers currently kept in battery cages
Laying hens

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Laying hens

90% of layers currently kept in battery cages
Why Cages?

- Obviously expensive
- Big capital outlay
- How can cages be economical?
Why Cages?

Increasing demand for cheap food, in first half of 20\(^{th}\) century, .

Livestock industries begin to specialize.

Traditionally, egg producers had kept small flocks outside with moveable huts or inside in barns.
Why Cages?

This traditional system of egg production did not scale up well – inside or outside.
Why Cages?

Two main problems with scaling up traditional egg production:

1. Difficult to automate – so high labour costs.

2. Diseases transmitted through the gut – “fowl-sick land”.
Why Cages?

The disease problems were huge:

- Parasitic diseases such as coccidiosis (\textit{Eimeria} spp.) and various worm infestations.

- Bacterial infections such as:
  - Pullorum disease (\textit{Salmonella pullorum}),
  - Fowl typhoid (\textit{Salmonella gallinarum}),
  - Avian TB (\textit{Mycobacterium tuberculosis avium})

Mortality rates of 25-30\% were common
Why Cages?

- Putting hens in cages separated them from their feces and overcame the disease problems.
- Cages started to be introduced in the 1930s and caught on in the 1940s.
- Mortality rates dropped to <6%.
- Lots of opportunities for automation.
- Savings could be made 1 → 4 birds per cage.
- Space could be saved by arranging cages in tiers or ‘batteries’.
Why Cages?

The move to cages accelerated, until by 1980, 96% of laying hens in the developed world were in cages.

This happened in spite of criticisms:

1964  Ruth Harrison – *Animal Machines*

1965  Brambell Committee – *Command Paper 2836.*
Why Cages?

Both Harrison and Brambell were extremely critical of cages, suggesting that caging would lead to severe frustration.

However, there was no solid evidence that this was the case...

...and so cages proliferated.
Advantages of Battery Cages

- Hygienic
- Small group size
- Easy to automate
- Easy to manage
- Surprisingly, lower incidence of feather-pecking and cannibalism
- Better air quality in barn
Advantages of Cages

1. Hygienic

Separating hens from their droppings results in a much lower incidence of many parasitic and bacterial diseases.

Mortality rates drop from 25% to <6%.

Represents huge welfare improvement.
Advantages of Cages

2. Small group size

Solid evidence that hens prefer to be in smaller groups.

Less social friction.

Represents small welfare improvement.

Hughes (1977); Dawkins (1982)
Advantages of Cages

3. Easy to automate

Food and water delivery, egg collection, manure removal, and ventilation can all be automated. Huge savings in labour.

No immediate effect on welfare but reduces risks of human error.

However, also risk of disaster e.g. with power cut.
Advantages of Cages

4. Easier to manage

Because they can be automated, cages do not require high management skills.

No immediate effect on welfare.

However, danger that management skills will be quickly lost.
Advantages of Cages

5. Lower incidence of feather pecking and cannibalism

This seems surprising since feather pecking is misplaced foraging (and cages provide nothing to forage in).

Cages stop feather pecking from spreading.

Big welfare improvement.
Advantages of Cages

6. Better air quality in barn

The presence of litter in non-cage systems can lead to high ammonia and dust levels.

Big welfare improvement.
Advantages of Battery Cages

Surprising that there are advantages, including welfare advantages, for cages.

And that is why the industry adopted them so whole-heartedly.

They genuinely thought that this was the best thing for profits and for the hens.
Disadvantages of Battery Cages

- Frustration of nesting behaviour
- Too high social density
- Lack of physical space
- Hens cannot forage
- Hens cannot perch or roost
- Hens cannot dust-bathe
- Sloping floor → hyperkeratosis
- Lack of exercise → osteoporosis
- Inspection too time consuming
Disadvantages of Cages

1. Frustration of nesting behaviour

Most caged hens show symptoms of severe frustration 1-1½ hours before the egg is due to be laid:

- Stereotyped back-and-forward pacing
- Increased aggression
- Displacement preening

Duncan (1970); Wood-Gush (1972); Yue and Duncan (2003)
Normal nesting behaviour

About 1-1½ hours before an egg is due to be laid, a hen:

- Starts to separate herself from the flock
- Gives the pre-laying call
- Walks in a characteristic way with high steps
- Starts to examine nest sites
- Eventually chooses a site
- Performs nest-building behaviour
- Sits quietly
- Adopts a “penguin posture” and lays the egg
- Gives the post-laying cackle

Wood-Gush (1963); Duncan and Kite (1989)
Normal nesting behaviour

About 1-1½ hours before an egg is due to be laid, a hen:

- Starts to separate herself from the flock
- Gives the pre-laying call
- Walks in a characteristic way with high steps
- Searches for a nest site
- Starts to examine nest sites
- Eventually chooses a site
- Performs nest-building behaviour
- Sits quietly
- Adopts a “penguin posture” and lays the egg
- Gives the post-laying cackle
Disadvantages of Cages

1. Frustration of nesting behaviour

+80% of light hybrid strains (Leghorns) show frustrated nesting in cages…

…and a slightly lower percentage of medium hybrid strains (Brown egg layers).

No change in incidence between 1972 and 2003.

Yue and Duncan (2003)
Disadvantages of Cages

1. Frustration of nesting behaviour

Hens show symptoms of severe frustration for 1 - 1½ hours* before laying (6 days out of 7)...

...and we can ask them how important having a nest site is.

* Probably an underestimate
Disadvantages of Cages

1. Frustration of nesting behaviour

They will run down a runway very quickly to reach a nest site.

Duncan Kite (1987)
Disadvantages of Cages

1. Frustration of nesting behaviour

They will work very hard to reach a nest site

Duncan and Kite (1987)
Disadvantages of Cages

1. Frustration of nesting behaviour

Hens will work as hard to get to a nest site as they will to reach food when they have been deprived of food for 28 hours.

Nesting behavior is extremely important to hens and their welfare is greatly reduced by not being able to nest.
Disadvantages of Cages

2. Too high social density

Current Recommended Codes of Practice

Hens up to 1,700g (light hybrids) 432 cm²
Hens up to 1,900g (med. hybrids) 483 cm²

Hens prefer much more space than this.

Probably should be at least +600cm²
Disadvantages of Cages

2. Too high social density

Hens do not arrange themselves at random in available space.

Psychological forces keep them apart – they do not like to be crowded together.

If given lots of room, are also forces that pull them together (they are a flocking species).
Disadvantages of Cages

2. Too high social density

At Code cage space allowance, hens try to space themselves out as much as possible. Suggests that commercial stocking densities are far too tight.

Keeling and Duncan (1989)
Disadvantages of Cages

2. Too high social density

But this is over-simplified. Birds space themselves according to their activity:

• Farthest apart when walking and foraging
• Closer when ground pecking
• Even closer when standing
• Even closer when preening
• Closest (touching) when roosting and dust-bathing

Keeling and Duncan (1991)
Disadvantages of Cages

2. Too high social density

Preferred space for walking, foraging, ground pecking and standing, is *NOT* available at ‘Code’ cage densities.

Preferred space for preening *IS* available.

Preferred space for roosting and dust-bathing *IS* available, but these activities are denied because roosts and dust-baths are not provided.

Keeling and Duncan (1991)
Disadvantages of Cages

2. Too high social density

Welfare is reduced through crowding.
Disadvantages of Cages

3. Lack of physical space

Many activities and postures are affected by the physical space available in battery cages.
Disadvantages of Cages

3. Lack of physical space

Normal *height* of battery cages does not allow hens to adopt the common ‘standing alert’ posture.

Dawkins (1985)

At normal battery cage height:
- Head stretching ↓
- Head scratching ↓
- Body shaking ↓
- Length of time sitting ↓

Nicol (1987)
Disadvantages of Cages

3. Lack of physical space

At normal battery cage area:

- Head scratching ↓
- Body shaking ↓
- Feather raising ↓
- Cage pecking ↑

Nicol (1987)
Disadvantages of Cages

3. Lack of physical space

Results suggest that the normal dimensions of battery cage may compromise welfare by restricting hens’ behavioural repertoire.
Disadvantages of Cages

4. Hens cannot forage

Feeding behaviour comprises:

Appetitive phase (or foraging) – walking, ground scratching and pecking, probing and flicking with beak, tearing leafy material.

Consummatory phase – picking up with beak and swallowing.

Hughes and Duncan (1988)
Disadvantages of Cages

4. Hens cannot forage

Hens in cages can still pick up and swallow food i.e. they can satisfy the consummatory aspects of feeding.

BUT the appetitive phase of feeding (foraging) has its own motivating factors.

Hens still need to walk, scratch and peck, probe and flick, tear leafy material, etc. – and they cannot do that fully in cages.
Disadvantages of Cages

4. Hens cannot forage

Foraging is extremely important:

- Junglefowl spend 70% of their day foraging.
- Feral fowl spend 60% of their day foraging.

Savory et al (1978)
Disadvantages of Cages

4. Hens cannot forage

In addition, there is strong evidence that feather pecking behaviour is foraging behaviour directed at other hens’ feathers.

(But a strong genetic component as well).

Dixon et al. (2008)
Disadvantages of Cages

4. Hens cannot forage

Lack of foraging opportunities leads to frustration and a reduction in welfare.

Also contributes to feather pecking and a reduction in welfare.
Disadvantages of Cages

5. Hens cannot perch or roost

Hens perch to rest, avoid other hens, perform maintenance activities, etc.
Disadvantages of Cages

5. Hens cannot perch or roost

When it occurs at night accompanied by sleeping, it is called roosting behaviour (also during day – “siesta”)
Disadvantages of Cages

5. Hens cannot perch or roost

Hens are highly motivated to roost at night, and to roost as high above the “ground” as possible.

Olsson and Keeling (2000)
Disadvantages of Cages

5. Hens cannot perch or roost

Lack of roosting opportunities leads to frustration and a reduction of welfare.
Disadvantages of Cages

6. Hens cannot dust-bathe

- Hens do not bathe in water.
- Hens bathe in dust.
- Dust-bathing functions to remove stale oil and dirt from the feathers.
- However, it is not a build-up of stale oil that triggers dust-bathing.

Duncan et al. (1998)
Dust-bathing is a vigorous activity.
Dust-bathing is a social activity
Disadvantages of Cages

6. Hens cannot dust-bathe

Dust-Bathing is triggered by

- Sight of a dry dusty substrate
- High level of illumination
- High temperature
- Sight and sound of other birds dust-bathing
- Build up of some internal factors

If these factors are absent, dust-bathing will not be triggered.

Duncan et al. (1998)
Disadvantages of Cages

6. Hens cannot dust-bathe

Therefore, not the same risk of frustration as with other motivational systems.

Occasionally caged hens attempt to dust-bathe, triggered by the sight of dusty food in the food-trough.

This can break feathers.
Disadvantages of Cages

6. Hens cannot dust-bathe

So lack of dust-bathing does not necessarily reduce welfare.

However, there is evidence that performing dust-bathing may lead to *PLEASURE.*

Widowski and Duncan (2000)

In assessing the overall quality of life that hens have, experiencing some pleasure may be important.
Disadvantages of Cages

7. Hyperkeratosis of foot pads

The sloping floor of cages means that hens are constantly slipping down the slope.

This leads to friction on the foot pads and hyperkeratosis.

The thickened skin is liable to crack – a route for infection.
Disadvantages of Cages

7. Hyperkeratosis of foot pads
Disadvantages of Cages

7. Hyperkeratosis of foot pads

Hyperkeratosis of the foot pad and toe pads is *not* a major factor in reducing welfare.

However, in severe cases it can be painful and is a potential route for infection both of which reduce welfare.
Disadvantages of Cages

8. Osteoporosis

Lack of exercise in caged hens leads to osteoporosis.

The acute form, ‘cage layer fatigue’, is rare nowadays.

However, over the course of a laying year, bones are weakened in ‘spent hens’ and at high risk of being broken during handling and transport.
Disadvantages of Cages

8. Osteoporosis

Spent hens ‘suffering’ from osteoporosis have a terrible price to pay:

- Weak bones
- Carcasses worth very little
- Cages not designed for de-population

This combination leads to high risk of broken bones and other injuries and a huge welfare reduction.
Disadvantages of Cages

9. Lack of inspection

Assume a flock of 10,000 laying hens with 5 birds per cage = 2,000 cages.

Assume all tiers can be seen adequately from the walkway.

Assume 4 seconds inspection of each cage = 8,000 seconds = 133 minutes = 2 hours 13 minutes
Disadvantages of Cages

9. Lack of inspection

“The Sniff Test”

There must be a dead bird near here!

Surely means that sick and injured hens are not found and treated or euthanized. Represents a large reduction in welfare.
Alternatives to cages

Free Range – means access to outside. Where climate permits, offers much more behavioural freedom, but there are other welfare risks.

Free Run – means cage-free within a barn; there are many variations. Some offer welfare advantages, others do not.

Furnished cages – very variable, but certainly better than battery cages.
Free Range
Free Range

Free range only possible in southern tip of B.C.
Advantages of Free Range

- Almost complete behavioural freedom
- Nesting allowed
- Foraging allowed
- Perching and roosting allowed
- Spacing allowed according to activity
- Birds can choose micro-climate
Disadvantages of Free Range

- Birds exposed to weather extremes
- Birds exposed to predators
- Risk of internal parasites especially Coccidia
- Risk of external parasites especially Red Mite
- Risk of feather-pecking and cannibalism
Free Run
Free Run

Chain feeder running in food trough

Upper tier with perches

Nest-boxes

Nipple drinkers with spill trays

Litter area
Advantages of Free Run

- A lot of behavioural freedom
- Nesting allowed
- Perching and roosting allowed
- More space than battery cages (but still may be crowded)
- Foraging usually allowed
- Dust-bathing usually allowed
Disadvantages of Free Run

- If deep litter area is included, ammonia and dust may be a problem
- Group size may be huge
- Risk of external parasites
- All-slatted floor (to improve air quality) prevents foraging
- All-slatted floor prevents dust-bathing
- Risk of feather-pecking and cannibalism
Furnished Cages

Commercial Swedish Cage for 10 hens
Furnished Cages

Commercial Swedish Cage for 20 hens
Furnished Cages

Commercial Swedish Cage for 40-44 hens
Furnished Cages

Commercial Swedish Cage for 8 hens
Advantages of Furnished Cages

- Hygienic
- Nesting allowed…but
- Perching and roosting allowed…but
- Dust-bathing sometimes allowed…but
- Small group size
- More space than conventional battery cages…but
Disadvantages of Furnished Cages

- Still very obviously a cage
- Foraging provision is inadequate
- Dust-bathing provision is inadequate
- Insufficient space
- Insufficient height for roosting
Finally, I come to the 1% of my talk that is NOT about cages for laying hens
Cages for Broilers

Made in China, popular in various Asian countries. Flat plastic floor – less breast blisters & foot lesions.
# Battery Cages

<table>
<thead>
<tr>
<th>Welfare Pros</th>
<th>Welfare Cons</th>
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<tbody>
<tr>
<td>Hygienic</td>
<td>Frustrated nesting</td>
</tr>
<tr>
<td>Small group size</td>
<td>Lack of social space</td>
</tr>
<tr>
<td>Less feather-pecking</td>
<td>Lack of physical space</td>
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<tr>
<td>Better air quality</td>
<td>Lack of roosting</td>
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<tr>
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<tr>
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<td></td>
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<tr>
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In my view, there is overwhelming evidence against battery cages.

In Canada, we should be moving on to develop welfare-friendly free-run systems.