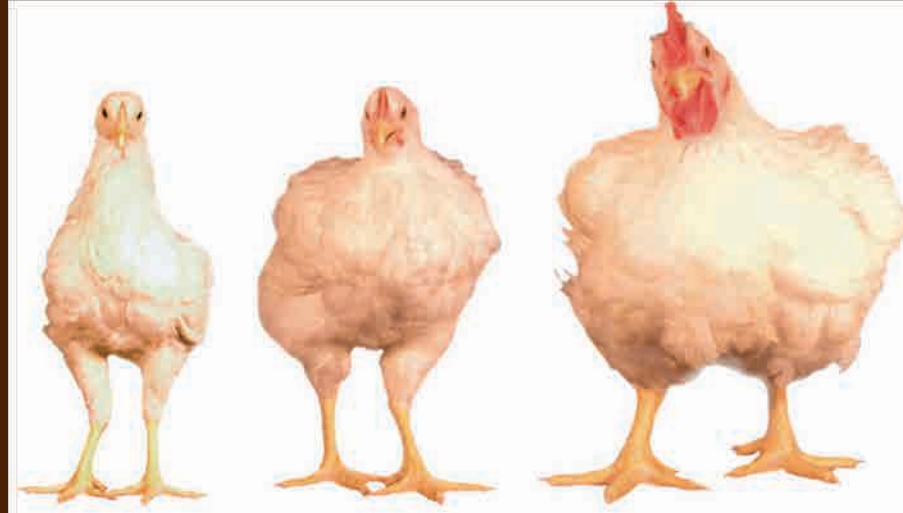




Domestication: Opportunities and limitations



Marcus Clauss

*Clinic for Zoo Animals, Exotic Pets and Wildlife, Vetsuisse Faculty, University of Zurich,
Switzerland*

Bio280 Domestication



**University of
Zurich^{UZH}**



Clinic
of Zoo Animals, Exotic Pets and Wildlife



Cattle and milk production





Major Advances in Nutrition: Relevance to the Sustainability of the Dairy Industry

M. J. VandeHaar*¹ and N. St-Pierre†

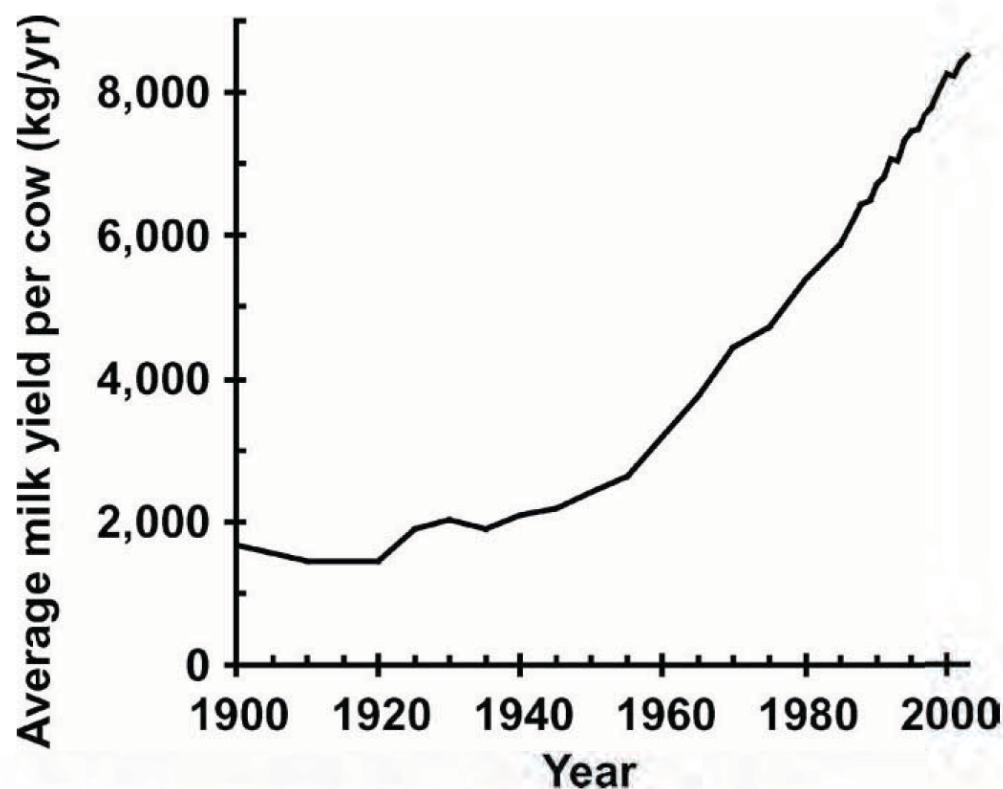


Figure 1. Milk production per cow in the United States over the past 100 yr.



Behavioural characteristics of two dairy breeds of cows selected (Hérens) or not (Brune des Alpes) for fighting and dominance ability

Pierrich Plusquellec, Marie-France Bouissou*

Applied Animal Behaviour Science 72 (2001) 1–21

As expected, cows from the H breed were dominant over the BA cows, they were also less fearful either in response to novel objects or in surprise effect tests and had higher social distances at pasture.





Chicken and meat production





Growth, efficiency, and yield of commercial broilers from 1957, 1978, and 2005¹

M. J. Zuidhof,^{*2} B. L. Schneider,[†] V. L. Carney,[†] D. R. Korver,^{*} and F. E. Robinson^{*}

2014 Poultry Science 93:2970–2982

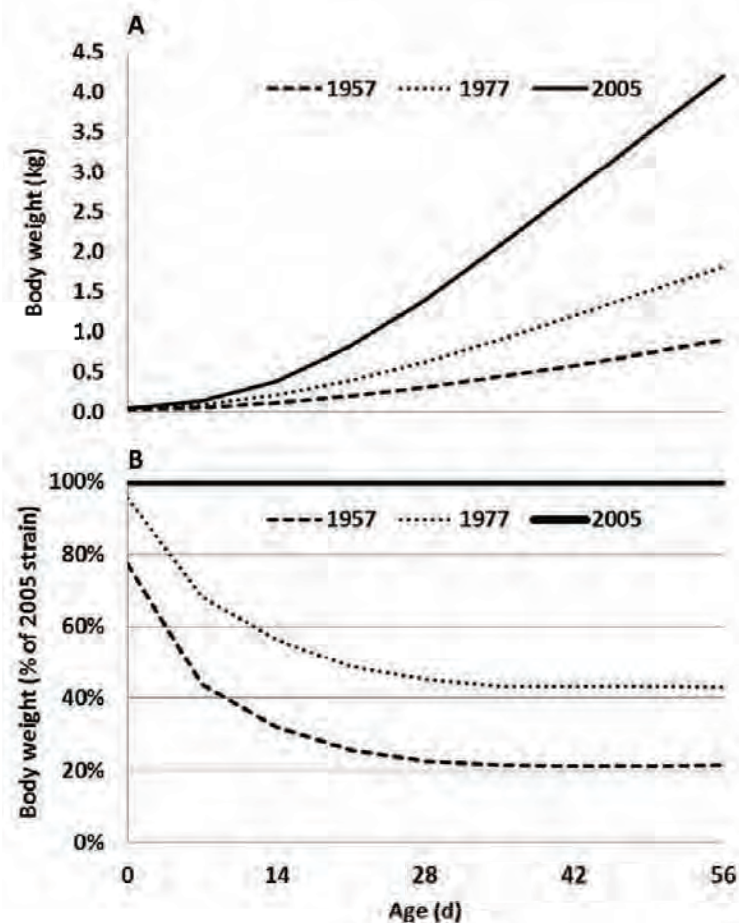
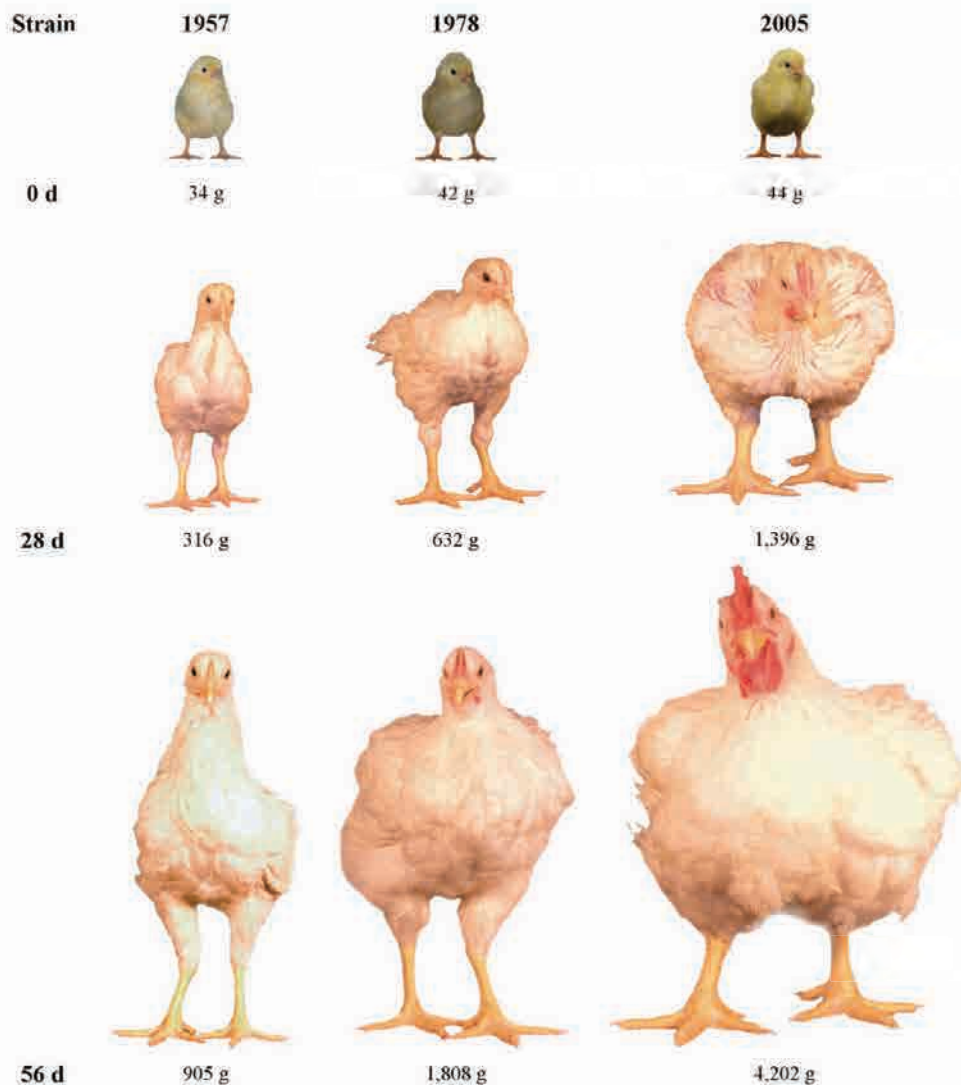


Figure 2. Absolute (panel A) and relative (panel B) BW of mixed sex University of Alberta Meat Control unselected since 1957 and 1978, and Ross 308 broilers (2005).



Growth, efficiency, and yield of commercial broilers from 1957, 1978, and 2005¹

M. J. Zuidhof,^{*2} B. L. Schneider,[†] V. L. Carney,[†] D. R. Korver,^{*} and F. E. Robinson^{*}

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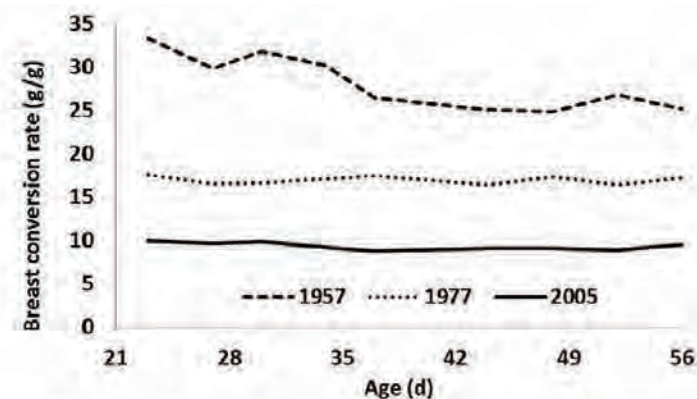
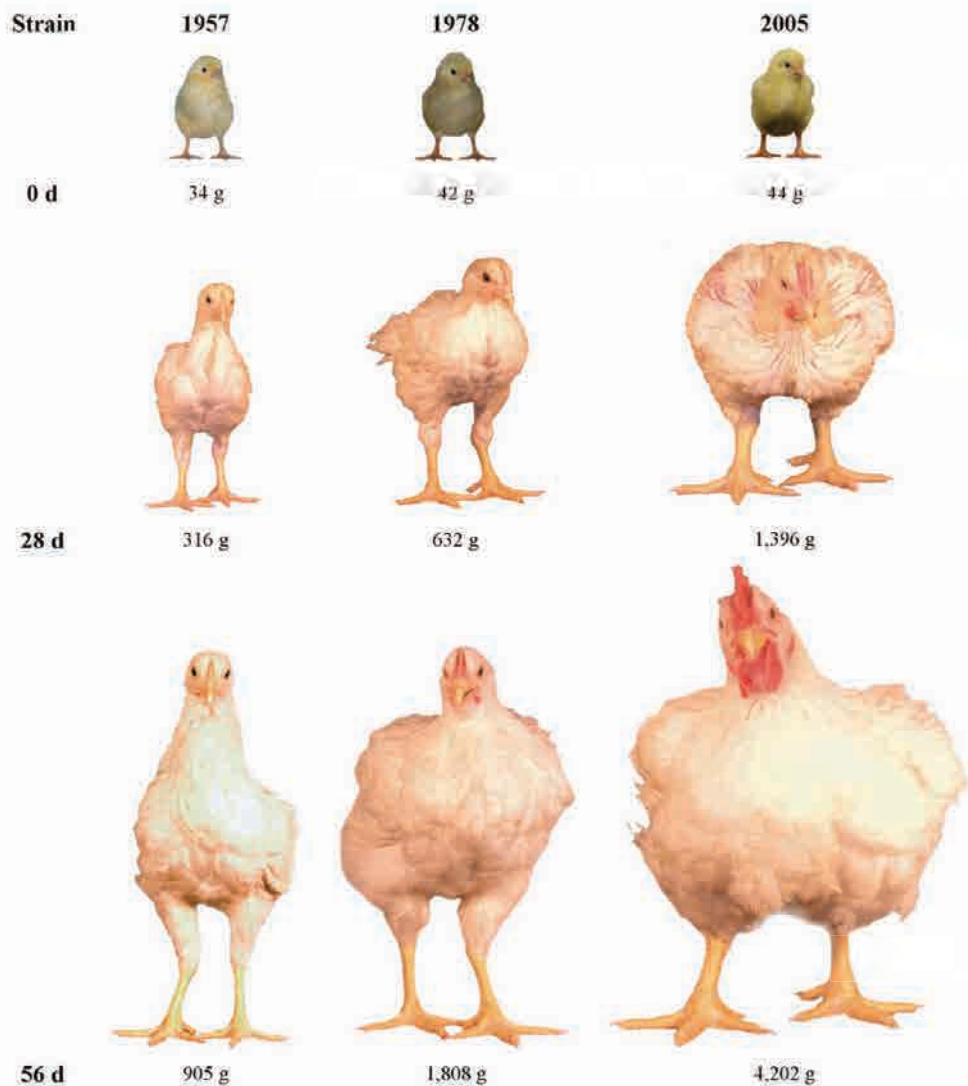


Figure 4. Breast conversion rate (g of feed/g of breast meat) of University of Alberta Meat Control unselected since 1957 and 1978, and Ross 308 broilers (2005).

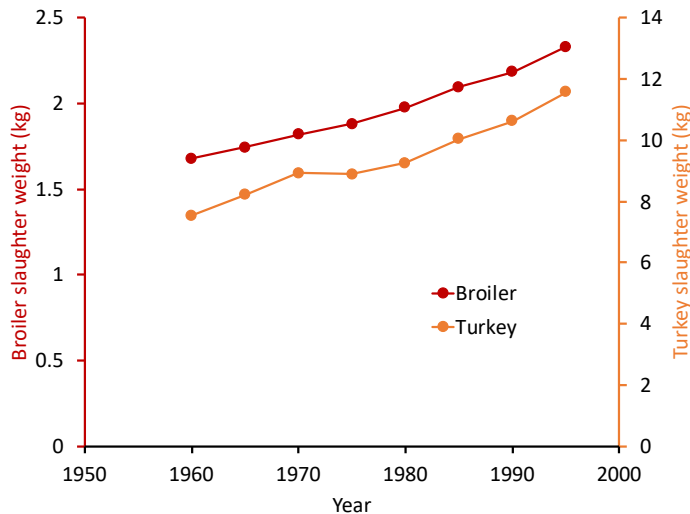


Undesirable side effects of selection for high production efficiency in farm animals: a review

W.M. Rauw^{a,*}, E. Kanis^b, E.N. Noordhuizen-Stassen^c, F.J. Grommers^c

Livestock Production Science 56 (1998) 15–33

Without knowledge about the underlying physiological processes on which genetic selection acts, selection is essentially a black box technique.



A dramatic consequence of long-term selection for increased muscle in turkeys is the damage made to the back of the hens by the heavy males with natural mating. One hundred percent artificial insemination allowed for the continuation of intense selection for body weight in male lines

Broiler breeders selected for high body weight produced a higher number of eggs than broilers selected for low body weight, but a higher percentage of defective eggs (e.g. double yolk, extra-calcified, shell-less, soft shelled)

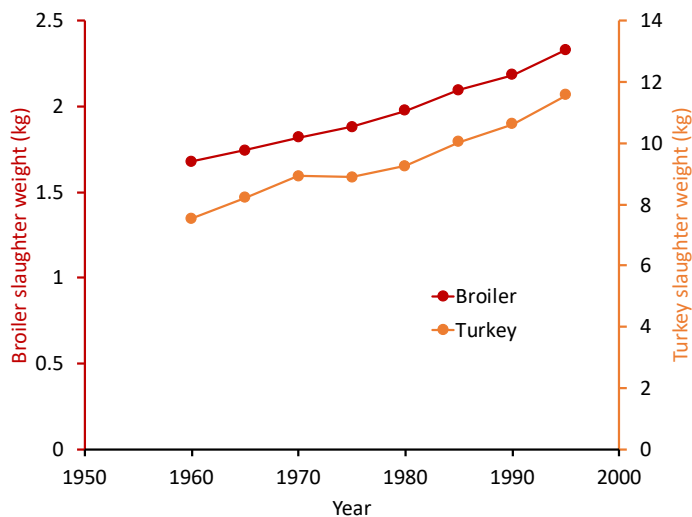


Undesirable side effects of selection for high production efficiency in farm animals: a review

W.M. Rauw^{a,*}, E. Kanis^b, E.N. Noordhuizen-Stassen^c, F.J. Grommers^c

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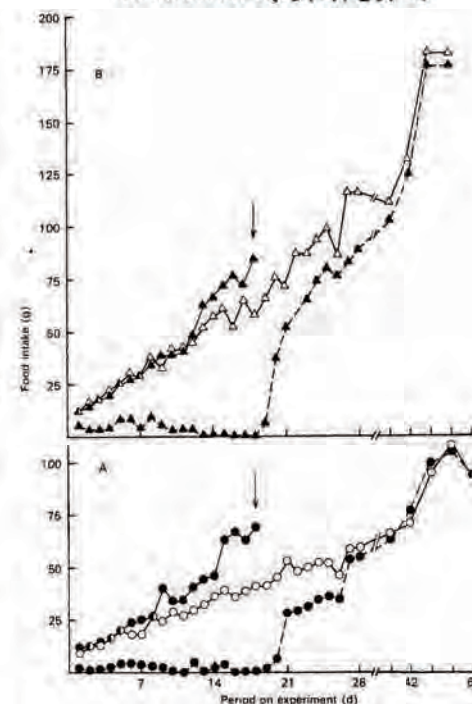
Without knowledge about the underlying physiological processes on which genetic selection acts, selection is essentially a black box technique.



Influence of overfeeding on growth, obesity and intestinal tract in young chicks of light and heavy breeds*

I. NIR

Br. J. Nutr. (1978), 39, 27



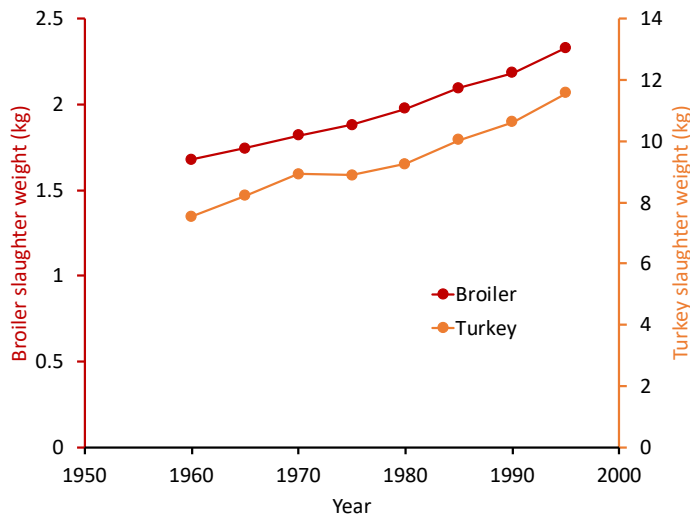


Undesirable side effects of selection for high production efficiency in farm animals: a review

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Livestock Production Science 56 (1998) 15–33

Without knowledge about the underlying physiological processes on which genetic selection acts, selection is essentially a black box technique.



Genetic Selection for Growth Rate Alters Hypothalamic Satiety Mechanisms in Chickens

C. A. Burkhardt,¹ J. A. Cherry,¹ H. P. Van Krey,¹ and P. B. Siegel¹

Behavior Genetics, Vol. 13, No. 3, 1983

Lesioned adult chickens from the low-weight line exhibited the expected obesity syndrome, while lesioned high-weight-line chickens exhibited neither increased feed consumption nor increased body weight. The results suggested that artificial selection for increased body weight resulted in a diminution of hypothalamic satiety mechanisms.



Selective Breeding for Aggressiveness in Chickens¹

A. M. GUHL, J. V. CRAIG AND C. D. MUELLER²

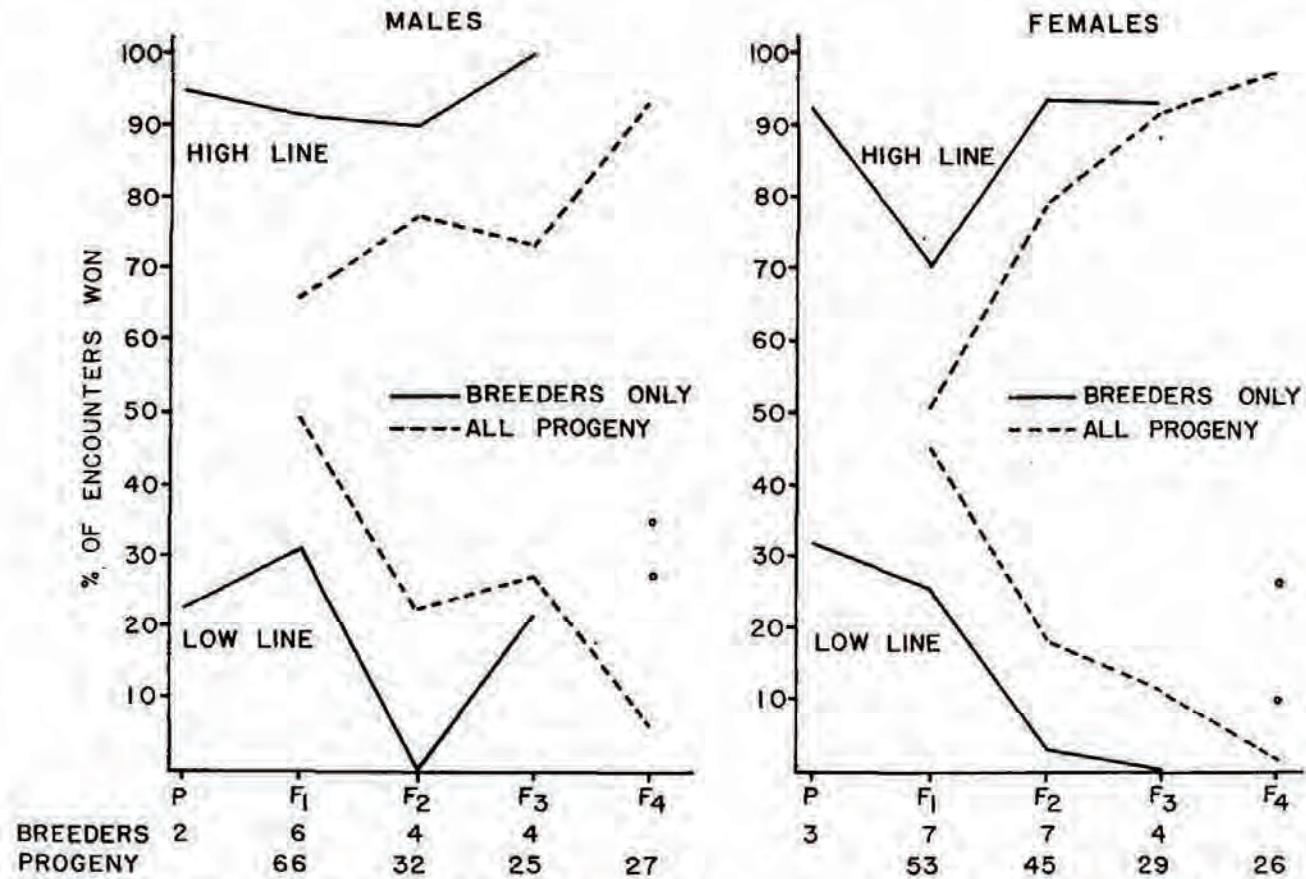


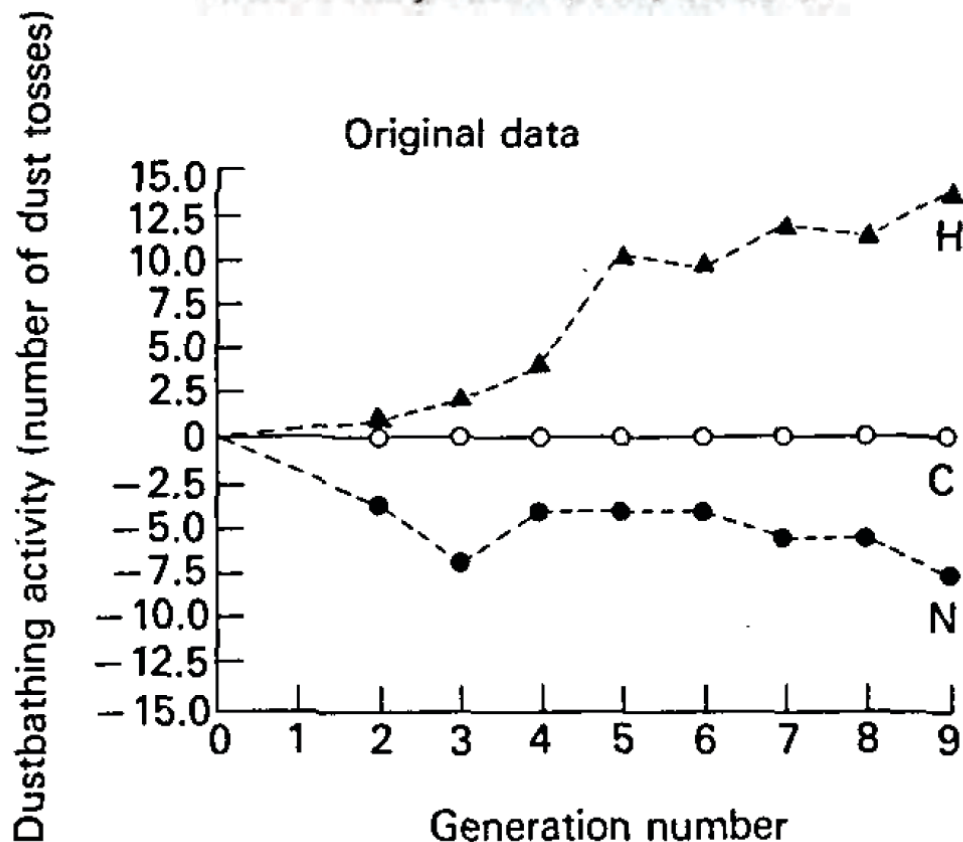
FIG. 1. Mean percentages of initial paired encounters won in each generation and by the individuals selected for breeding. (see text)



BIDIRECTIONAL SELECTION FOR DUSTBATHING ACTIVITY IN JAPANESE QUAIL (*COTURNIX COTURNIX JAPONICA*)

MARTINA GERKEN AND J. PETERSEN

British Poultry Science (1987) 28: 23-37



are in progress (Bacon *et al.*, 1983). Thus, if attempts are made to evaluate the need of animals to perform certain behavioural patterns this should be done in the light of the previous history of selection of the stocks under consideration.



Chicken and egg production



William G. Hill*
Lutz Büniger*

Inferences on the Genetics of Quantitative Traits from Long-term Selection in Laboratory and Domestic Animals

Plant Breeding Reviews, Volume 24, Part 2, Edited by Jules Janick
ISBN 0-471-46892-4 © 2004 John Wiley & Sons, Inc.

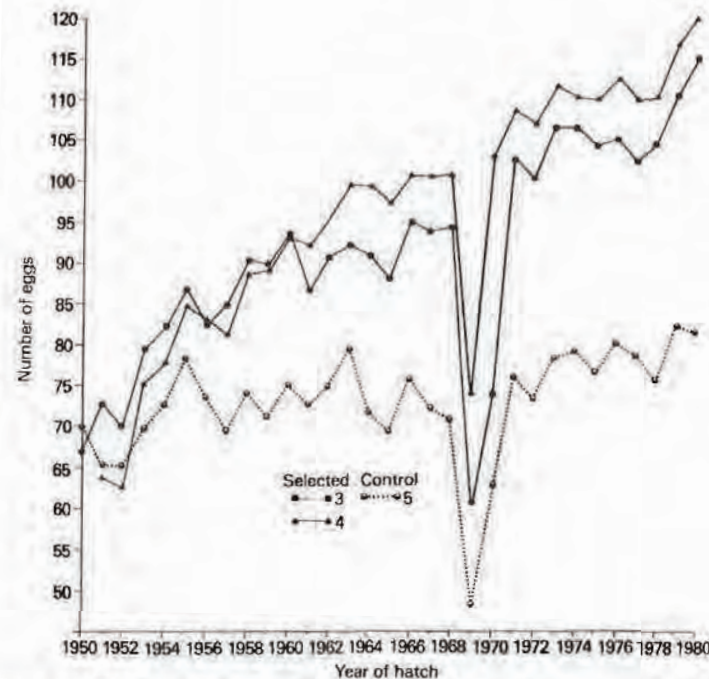


Fig. 6.0. Response to long-term selection for egg number in chickens: mean hen housed egg production to 273 days (HHP273d) of two lines of chicken selected mainly for HHP273d, together with a contemporary control (note: severe Marek's disease incidence ca. 1969). [Source: Gowen and Fairfull 1985]





Group Selection for Adaptation to Multiple-Hen Cages: Selection Program and Direct Responses^{1,2}

W. M. MUIR

1996 Poultry Science 75:447-458

ABSTRACT A selection experiment was initiated with a synthetic line of White Leghorns in 1982 to improve adaptability and well-being of layers in large multiple-bird cages by use of a selection procedure termed "group selection". With this procedure, each sire family was housed as a group in a multiple-bird cage and selected or rejected as a group. An unselected control, with approximately the same number of breeders as the selected line, was maintained for comparison and housed in one-bird cages.

Annual percentage mortality of the selected line in multiple-bird cages decreased from 68% in Generation (G)2 to 8.8% in G6. Percentage mortality in G6 of the selected line in multiple-bird cages was similar to that of the unselected control in one-bird cages (9.1%). Annual days survival improved from 169 to 348 d, eggs per hen per day (EHD) from 52 to 68%, eggs per hen housed

from 91 to 237 eggs, and egg mass (EM) from 5.1 to 13.4 kg, whereas annual egg weight remained unchanged. The dramatic improvement in livability demonstrates that adaptability and well-being of these birds were improved by group selection. The similar survival of the selected line in multiple-bird cages and the control in one-bird cages suggests that beak-trimming of the selected line would not further reduce mortalities, which implies that group selection may have eliminated the need to beak-trim. Corresponding improvements in EHD and EM demonstrate that such changes can also be profitable. The most surprising finding was the rate at which such improvement took place, with the majority of change in survival occurring by the third generation. However, EHD continued to improve at the rate of 4% per generation.





Pigs and meat production



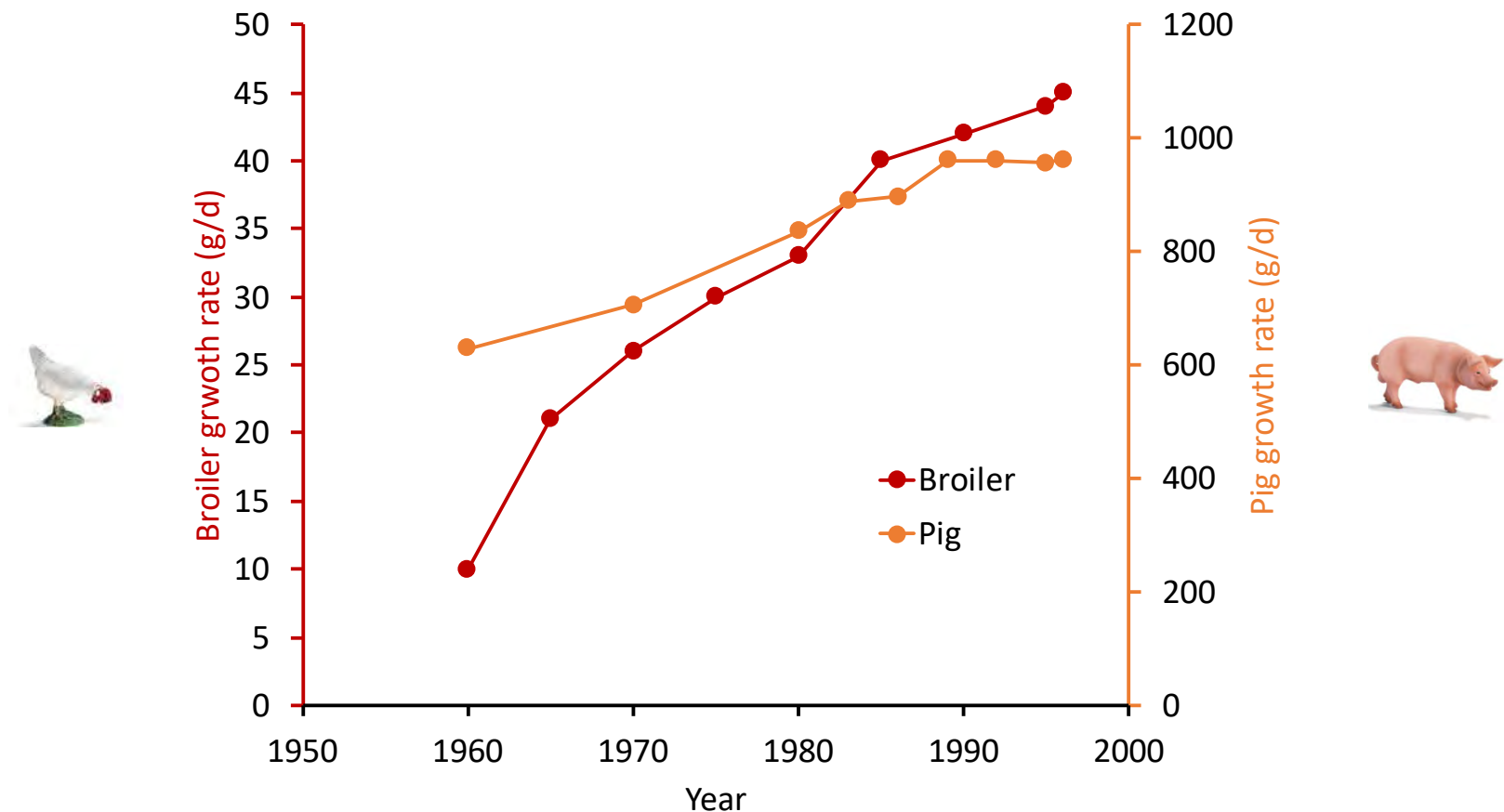


Undesirable side effects of selection for high production efficiency in farm animals: a review

W.M. Rauw^{a,*}, E. Kanis^b, E.N. Noordhuizen-Stassen^c, F.J. Grommers^c

Livestock Production Science 56 (1998) 15–33

Without knowledge about the underlying physiological processes on which genetic selection acts, selection is essentially a black box technique.





Sheep and wool





Selection response to fleece weight, wool characteristics, and heritability estimates in yearling Romney sheep

T. Wuliji^{a,b,*}, K.G. Dodds^a, R.N. Andrews^a, P.R. Turner^a

Livestock Science 135 (2011) 26–31

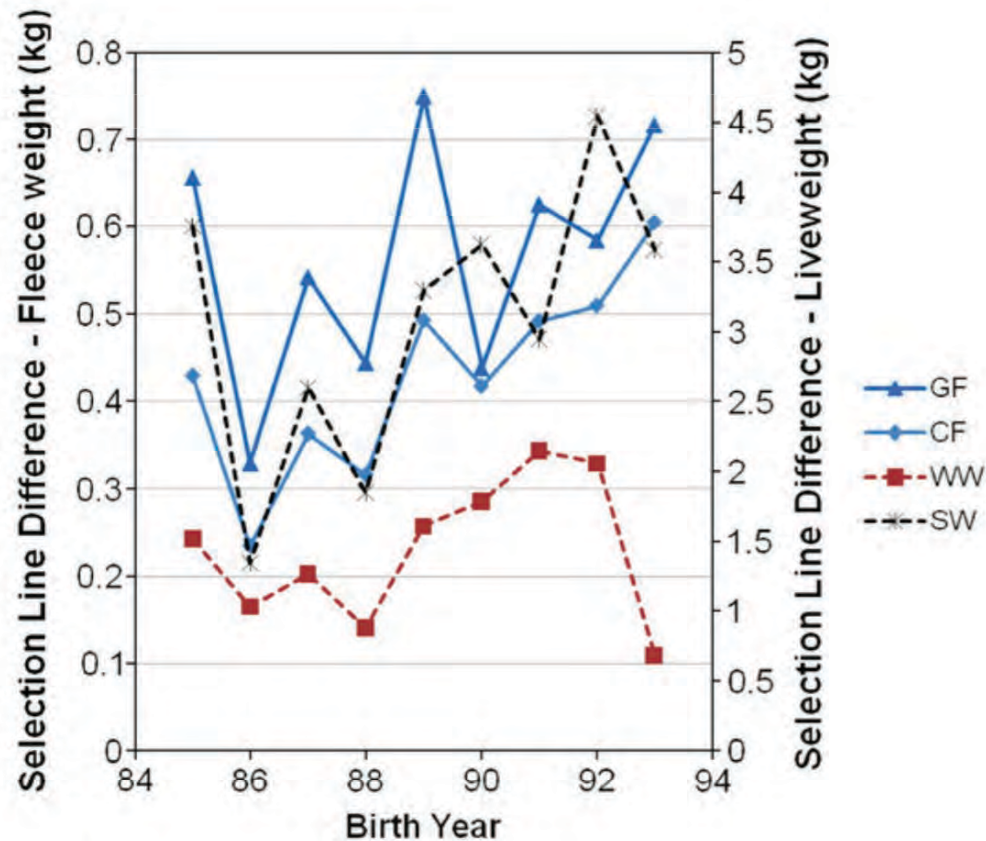


Fig. 1. Selection line differences (high fleece weight line minus control line) by birth years for greasy and clean fleece weight and for weaning and spring live weight (average SEs for the differences are: 0.083 kg for GF; 0.066 kg for CF; 0.48 kg for WW and 1.0 kg for SW).



Mink fur quality





Selection for Litter Size, Body Weight, and Pelt Quality in Mink (*Mustela vison*): Experimental Design and Direct Response of Each Trait

Gabrielle Lagerkvist, K. Johansson, and N. Lundeheim
J. Anim. Sci. 1993. 71:3261-3272

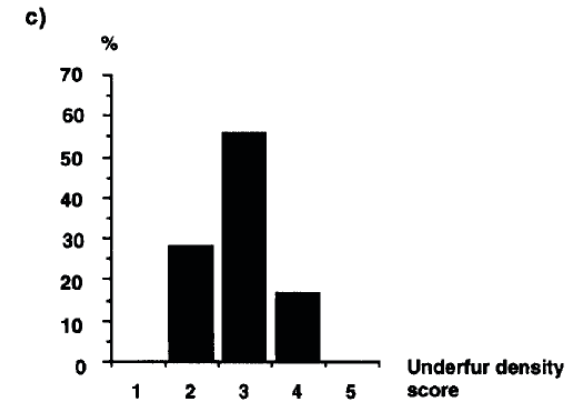
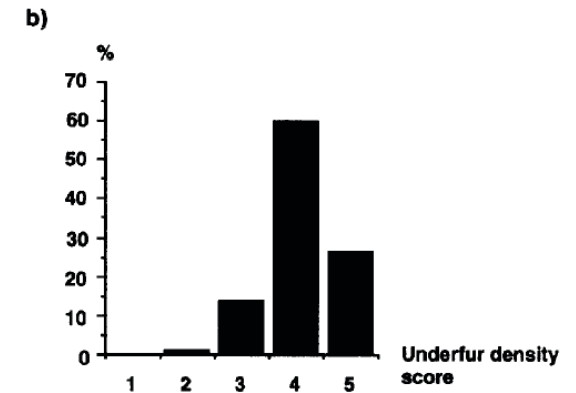
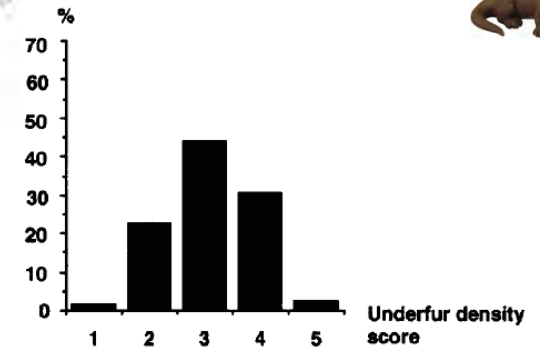



Figure 2. Frequency distribution of scores for underfur density in the: a) foundation stock (1984) b) underfur density line (Generation 5, 1989), and c) control line (Generation 5, 1989).



Selection against stereotypic behaviour may have contradictory consequences for the welfare of farm mink (*Mustela vison*)

Pernille Maj Svendsen^a, Bente Krogh Hansen^b, Jens Malmkvist^c,
Steffen Werner Hansen^c, Rupert Palme^d, Leif Lau Jeppesen^{a,*}

Applied Animal Behaviour Science 107 (2007) 110–119

The present study aimed to examine if divergent selection for stereotypic behaviour in mink influences the welfare of the animals. Two breeding lines were used, a high stereotyping line (HSL, $N = 139$) and a low stereotyping line (LSL, $N = 132$). Their welfare was assessed on the basis of adrenocortical activity (faecal cortisol metabolites, FCM), confident versus fearful temperament, growth and reproduction. The results showed that the LSL performed less stereotypic behaviour and were less active than the HSL. Furthermore, the results demonstrated that: (1) the LSL had lower concentrations of FCM, indicative of better welfare; (2) there was no clear difference in temperament between the lines, however, within the HSL a positive correlation was found between the frequency of stereotypy and the frequency of confident temperament; (3) there was no difference in reproduction; (4) there was no failure to grow in any line, but on average the body weight in the LSL was higher than that in the HSL. The correlation between stereotypy and confidence in the present study supports earlier findings showing a higher proportion of fearful animals in groups of low stereotyping mink. So, although the selection against stereotypic behaviour clearly reduced the FCM it may have contradictory consequences for the welfare of the mink.



Dogs and herding



Measuring herding behavior in Border collie—effect of protocol structure on usefulness for selection

Per Arvelius^a, Sofia Malm^a, Kenth Svartberg^b, Erling Strandberg^a



Journal of Veterinary Behavior (2013) 8, 9-18

Out-run	How wide circle the dog takes when moving from the handler to the balance point. Assessed at a position mid-between handler and balance point.	0: No circle, straight through flock. 5: Makes a very wide circle, of the magnitude 35 m.
Eye	How intensively the dog visually focuses the livestock.	0: Never fixates using eye. 5: Fixates, locks up until livestock move.
Lift	How the dog behaves when the livestock start to get affected by the dog, that is, when at effective working distance.	0: Increases speed, goes through the flock. 5: Stops, thereafter moves slowly toward the flock, alternatively has troubles moving again.
Natural ability	The dog's ability to foresee and counteract the livestock's movements and thereby keep the flock together.	0: Often loses individual animals or the whole flock even if reminded when it is about to happen. 3: Never loses any animals, but places itself in the correct position in time to prevent this.
Effective working distance	The distance where the livestock become affected by the dog and start to move away.	0: 0-1 m. 5: >10 m.



Horses and speed





Racehorses are getting faster

Patrick Sharman and Alastair J. Wilson

Cite this article: Sharman P, Wilson AJ. 2015
Racehorses are getting faster. *Biol. Lett.* **11**:
20150310.

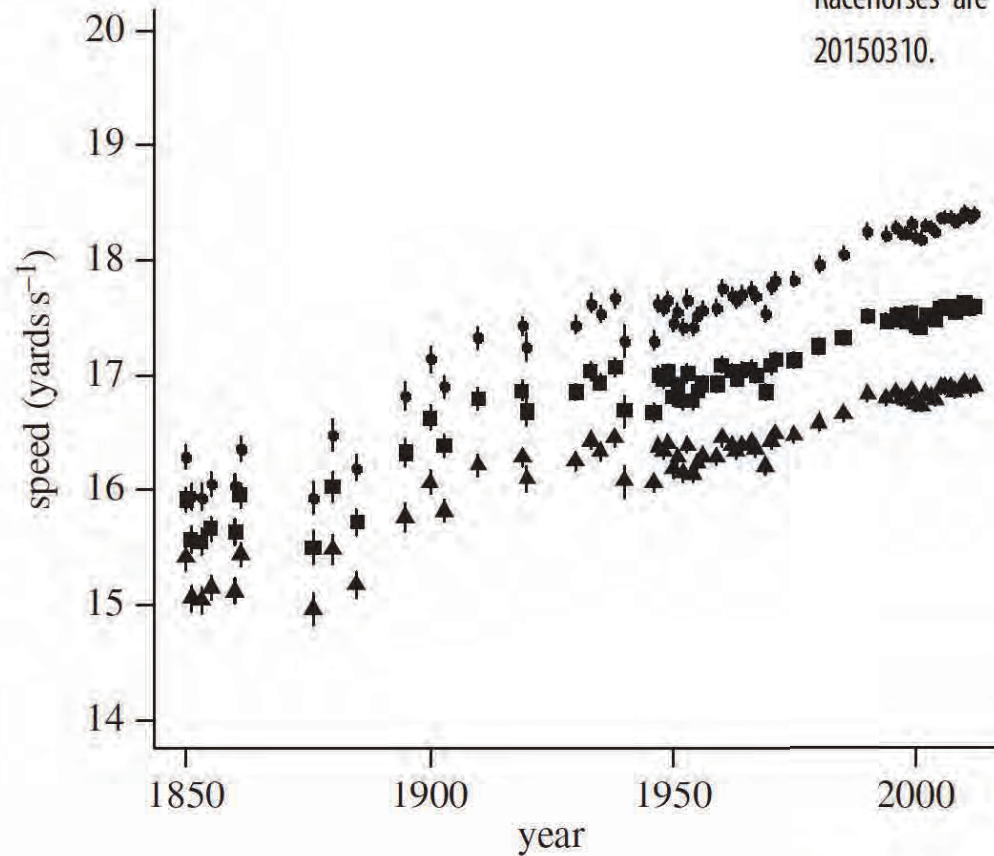


Figure 1. Patterns of temporal change in speeds of elite race winners since 1850. Circles, squares and triangles represent average speed predicted from model 2 at 6, 10 and 17 furlongs, respectively (bars indicate ± 1 s.e.).



Trends and asymptotic limits for racing speed in standardbred trotters



Th. Árnason*

Livestock Production Science 72 (2001) 135–145

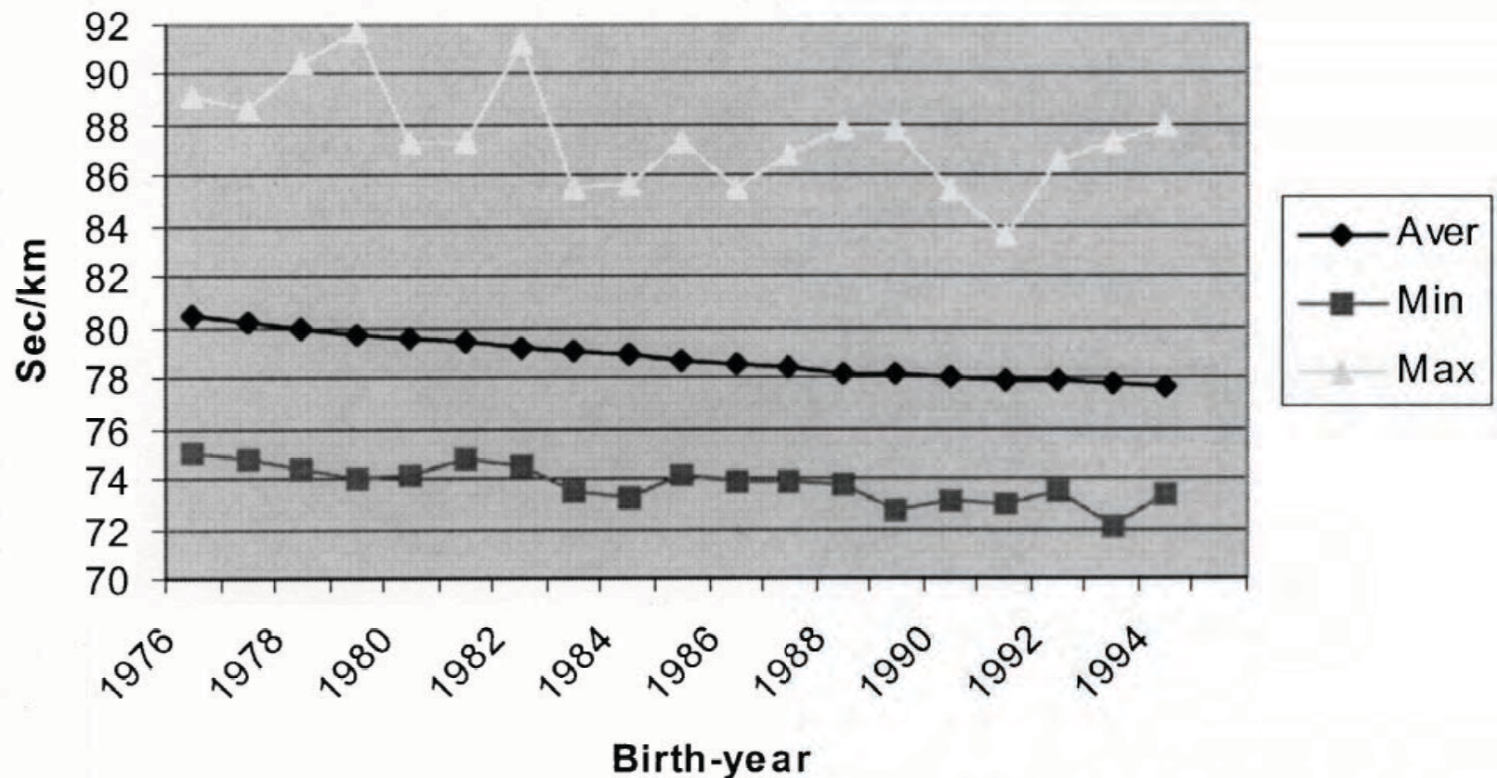


Fig. 1. Observed trend in racing time (k_i = sec/km) in Swedish Standardbred trotters (males).



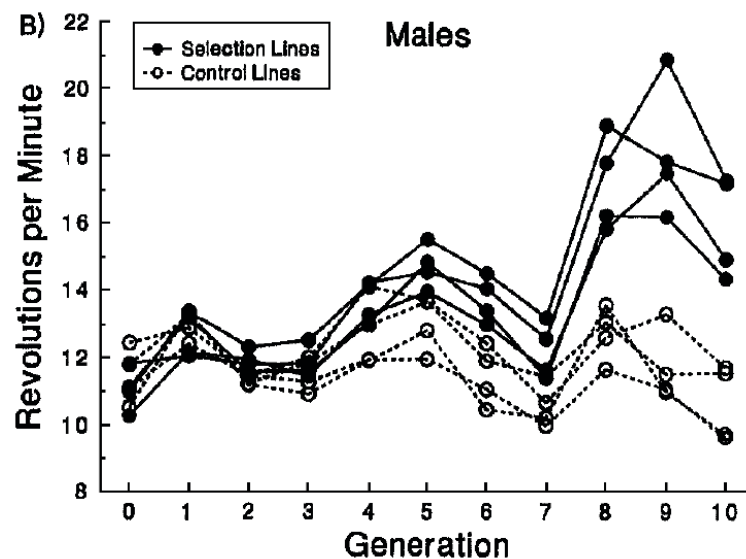
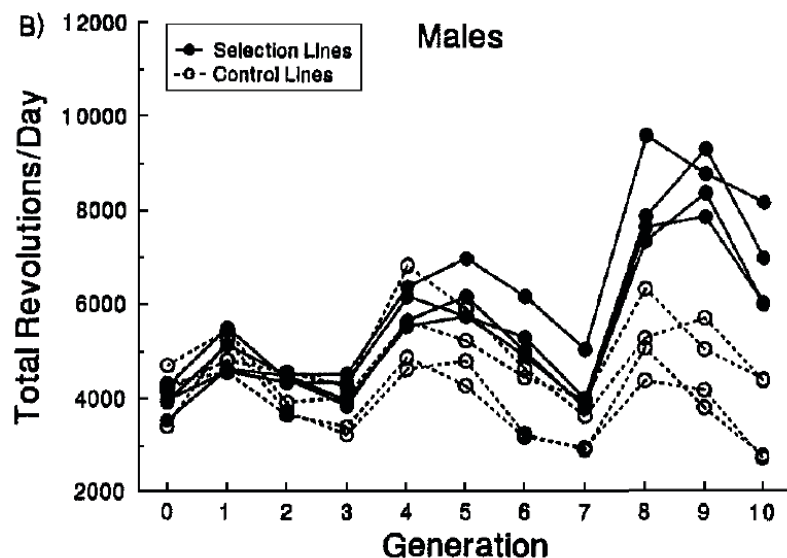
Mice



Artificial Selection for Increased Wheel-Running Behavior in House Mice

John G. Swallow,¹ Patrick A. Carter,^{1,2} and Theodore Garland, Jr.^{1,3}

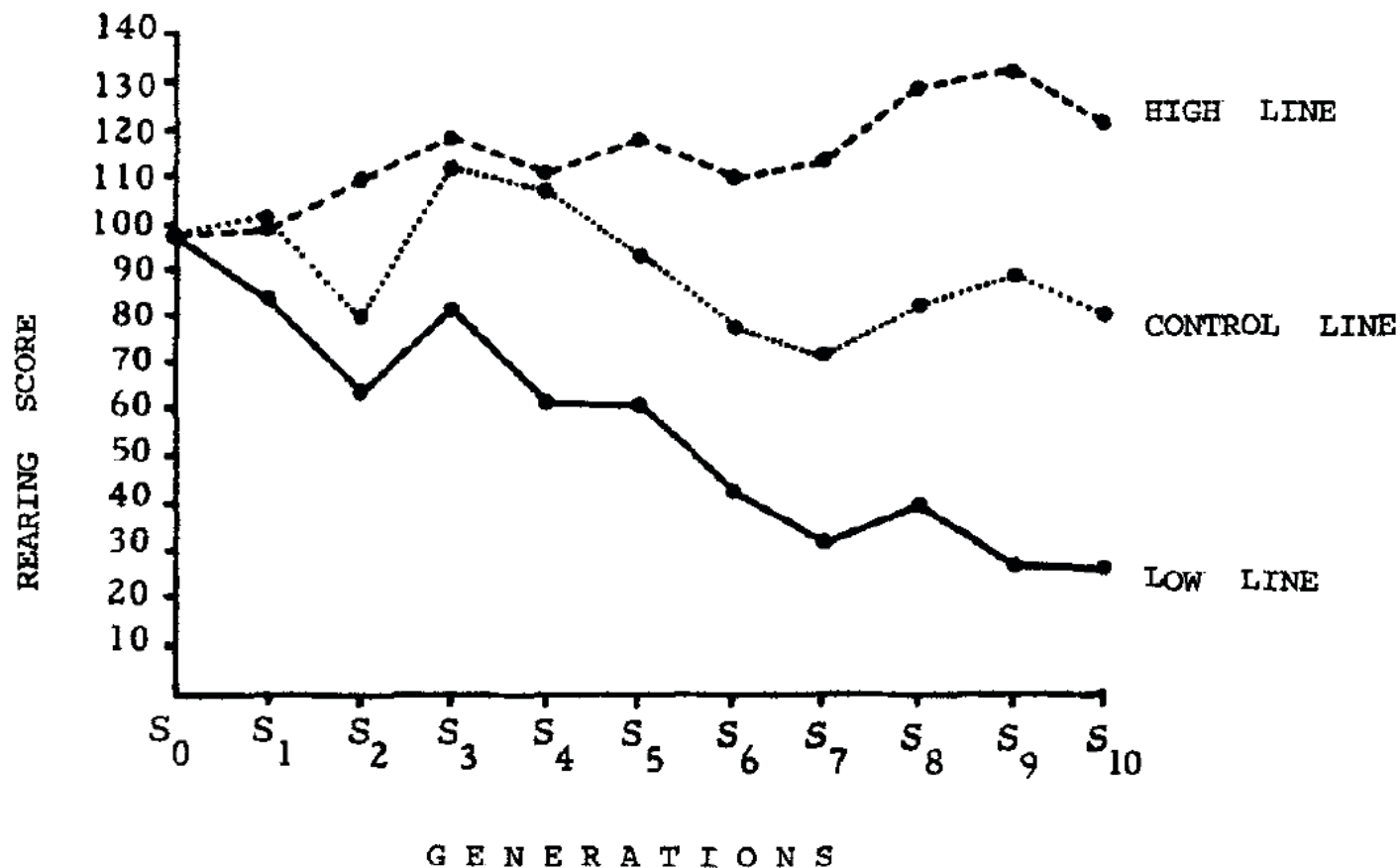
Behavior Genetics, Vol. 28, No. 3, 1998



The Bethlem Lines: Genetic Selection for High and Low Rearing Activity in Rats

David C. Sanders^{1,2}

Behavior Genetics, Vol. 11, No. 5, 1981





Domestication (selection) can
achieve a large variety of changes in
animal characteristics

-

often at unknown costs



Evolutionary principles



A priori conditions and their consequences

Life requires input of resources.

Life starts simple (non-complex).

Life means reproduction.

- spontaneously occurring yet heritable variability



Probabilistic directionality I: towards non-stasis



A priori conditions and their consequences

Life requires input of resources.

Life starts simple (non-complex).

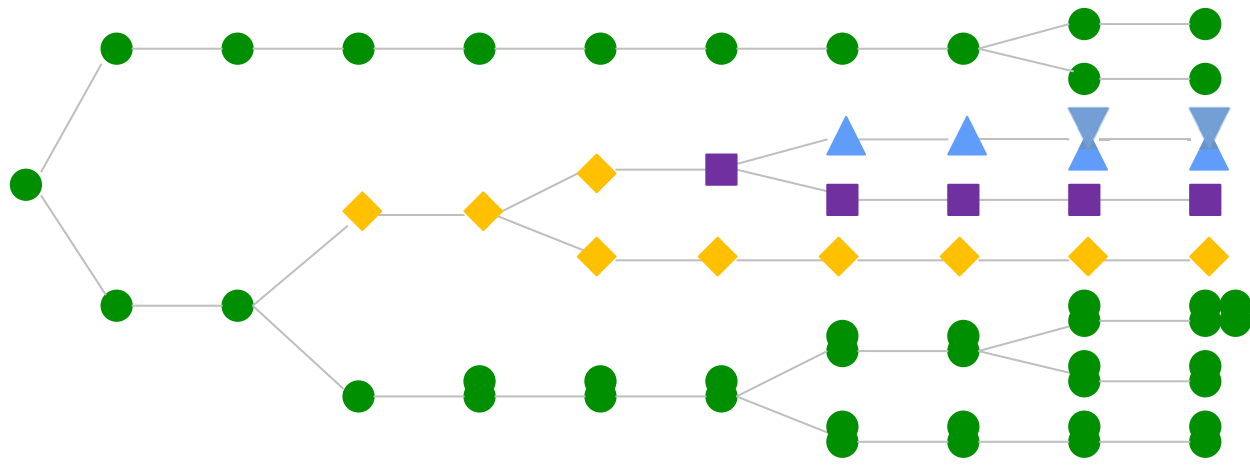
Life means reproduction.

- spontaneously occurring yet heritable variability

- not only replacement but multiplication



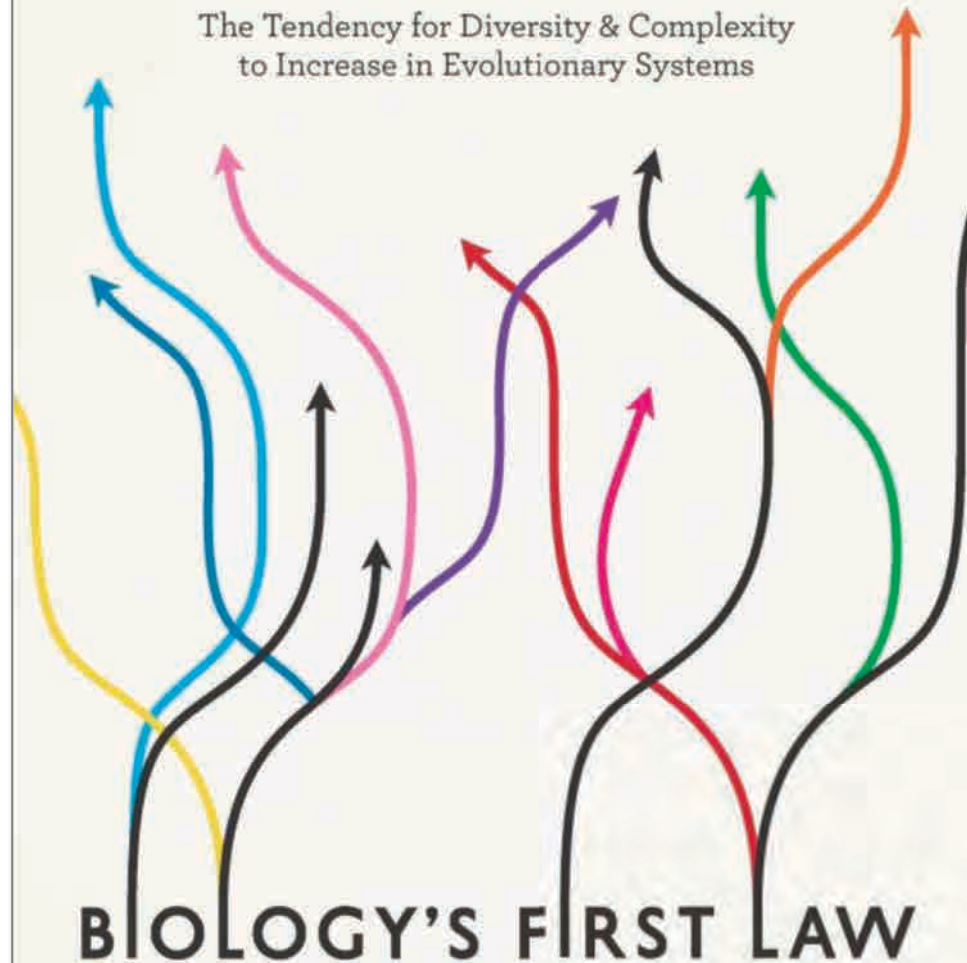
Probabilistic directionality I: towards non-stasis



Probabilistic directionality III: more diversity & complexity



The Tendency for Diversity & Complexity
to Increase in Evolutionary Systems



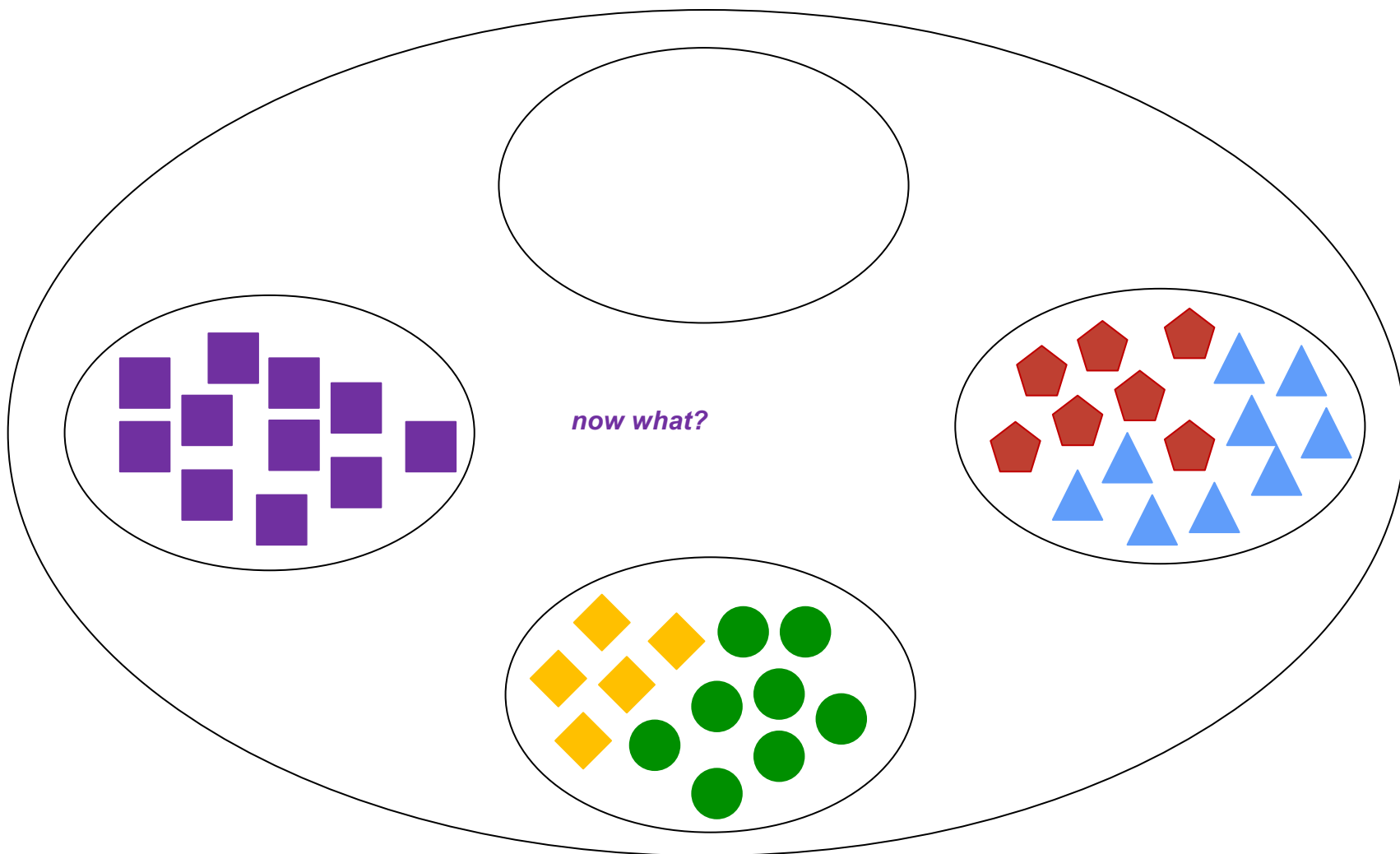
BIOLOGY'S FIRST LAW

DANIEL W. McSHEA & ROBERT N. BRANDON



A priori conditions and their consequences

Resources are finite.



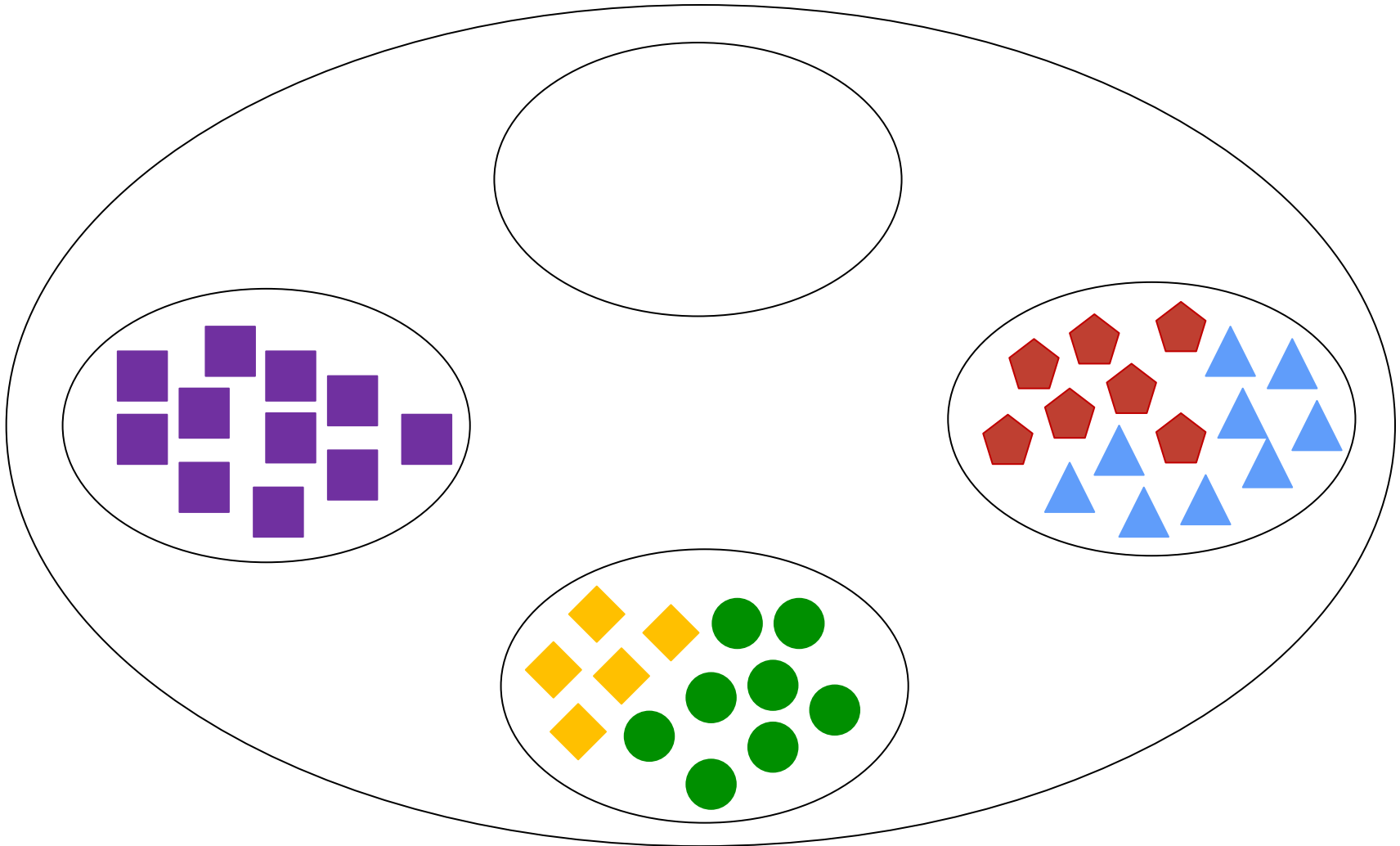
Competition for limited resources





A priori conditions and their consequences

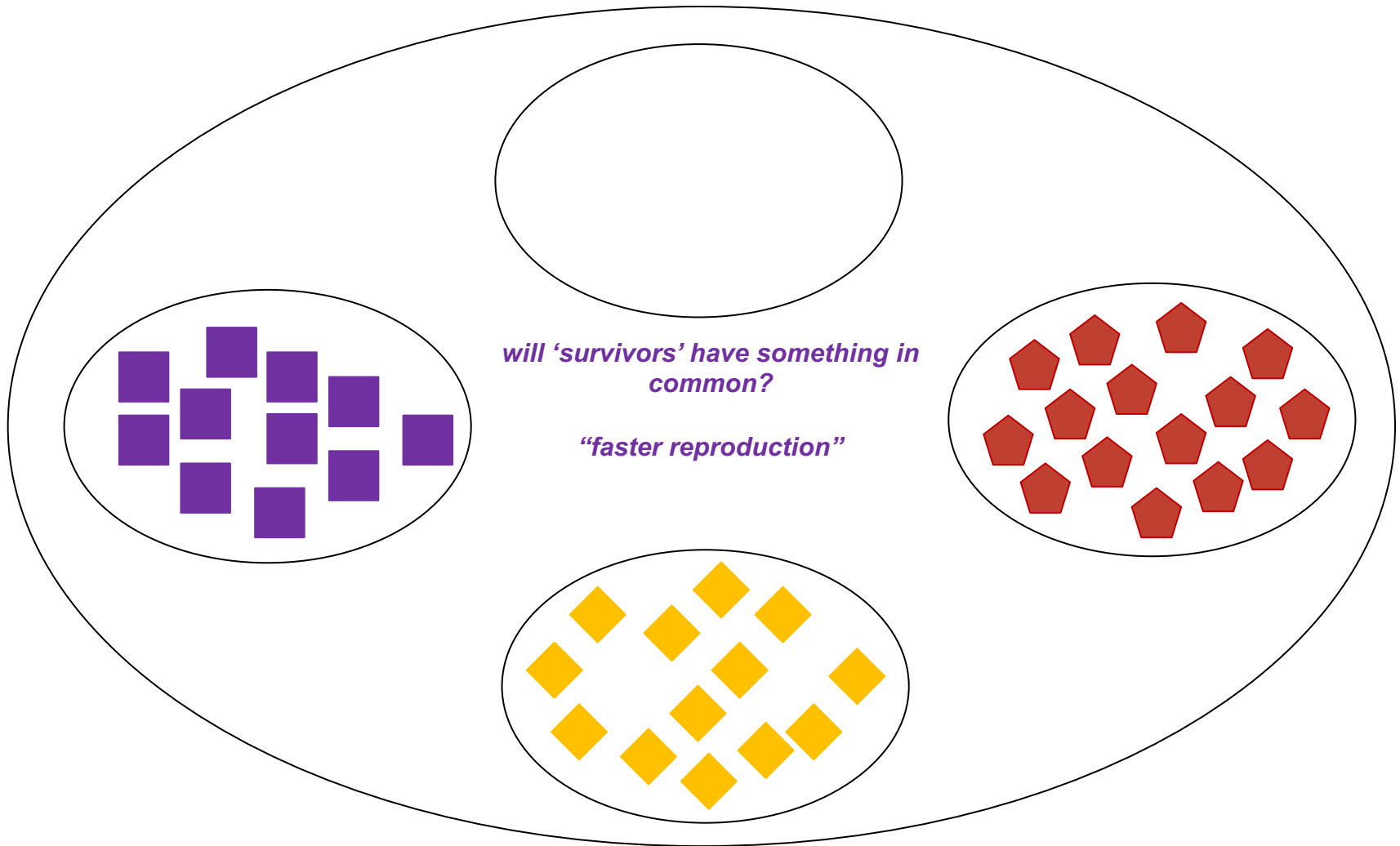
Resources are finite.





A priori conditions and their consequences

Resources are finite.





'Evolutionary progress' – directional evolution

Biol. Rev. (1987), **62**, pp. 305–338

PROGRESS AND COMPETITION IN MACROEVOLUTION

By MICHAEL J. BENTON

It is merely a tautology to identify the later animal (the 'winner') as a 'superior competitor' in the absence of any other evidence (Schopf, 1979).

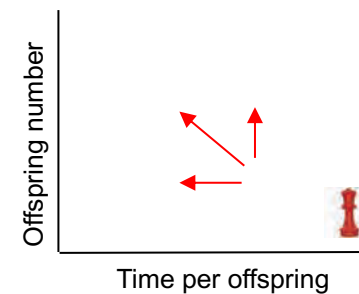
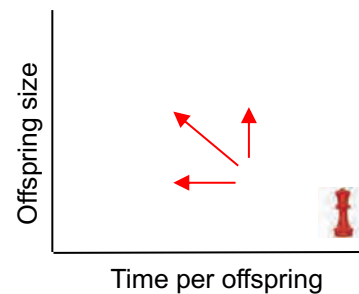
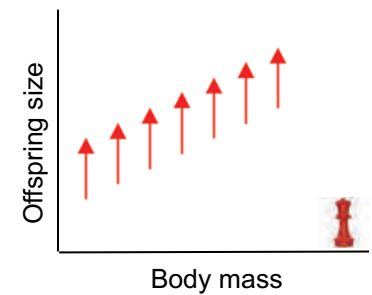
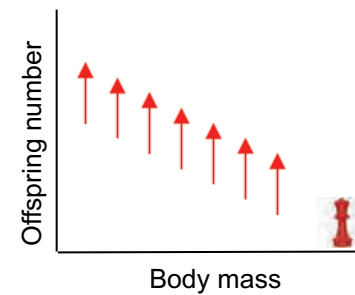
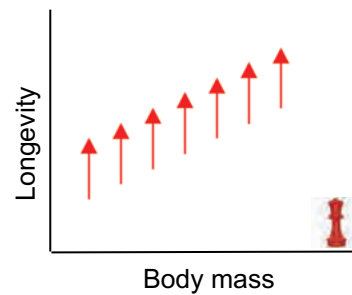
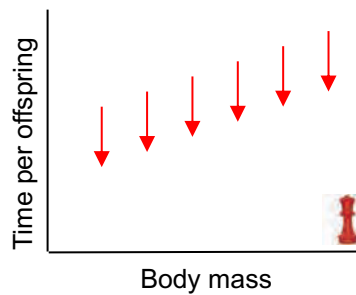
it is hard to envisage a constant competitive advantage that lasted so long and persistently favoured all of the species of one large taxon against all of the species of another in all environments.



Darwinian demon



An organism that starts reproducing directly after birth, producing a large number of surviving offspring at extreme speed without ever dying.



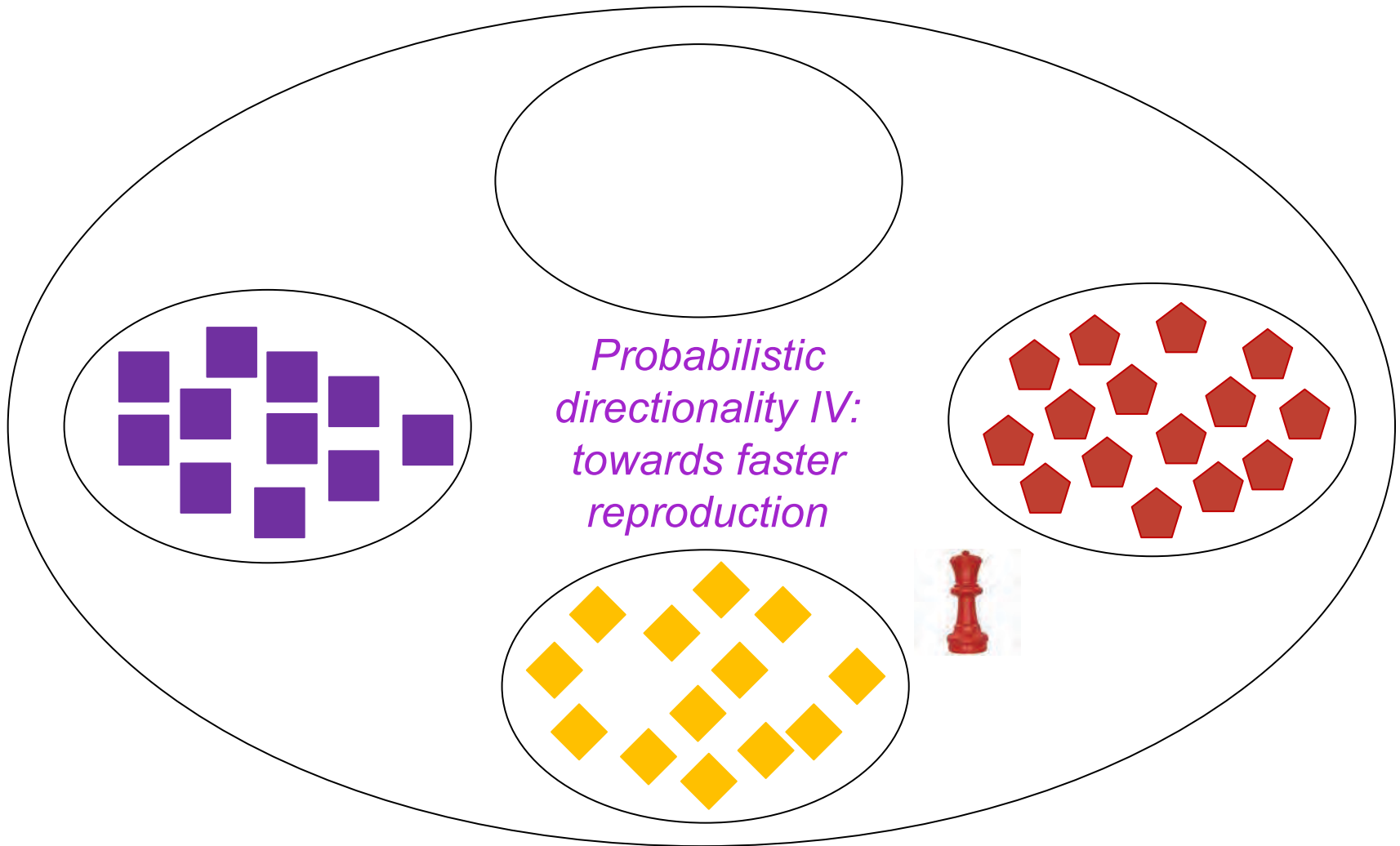
FASTER





A priori conditions and their consequences

Resources are finite.





Assessing *'directionality'/escalation/progress* in life history

using the PanTheria dataset
(Jones et al. 2009)



Niche-specific assessment

Because niche space is less diverse at larger body sizes, large herbivores may be a particularly fruitful area of research for 'directed evolution'.



Herbivore
basic™



Herbivore
2.0™



Herbivore
professional™

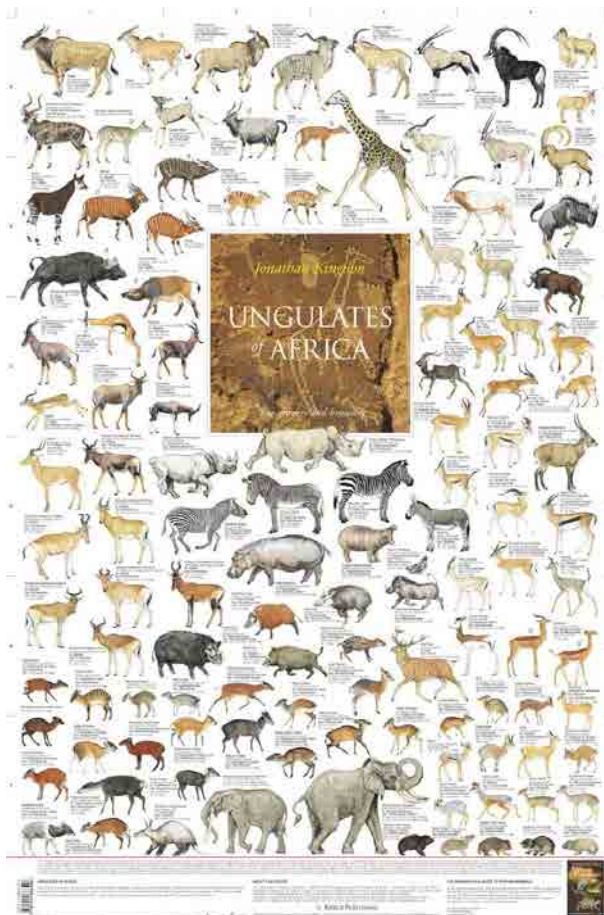


Herbivore
ultimate™



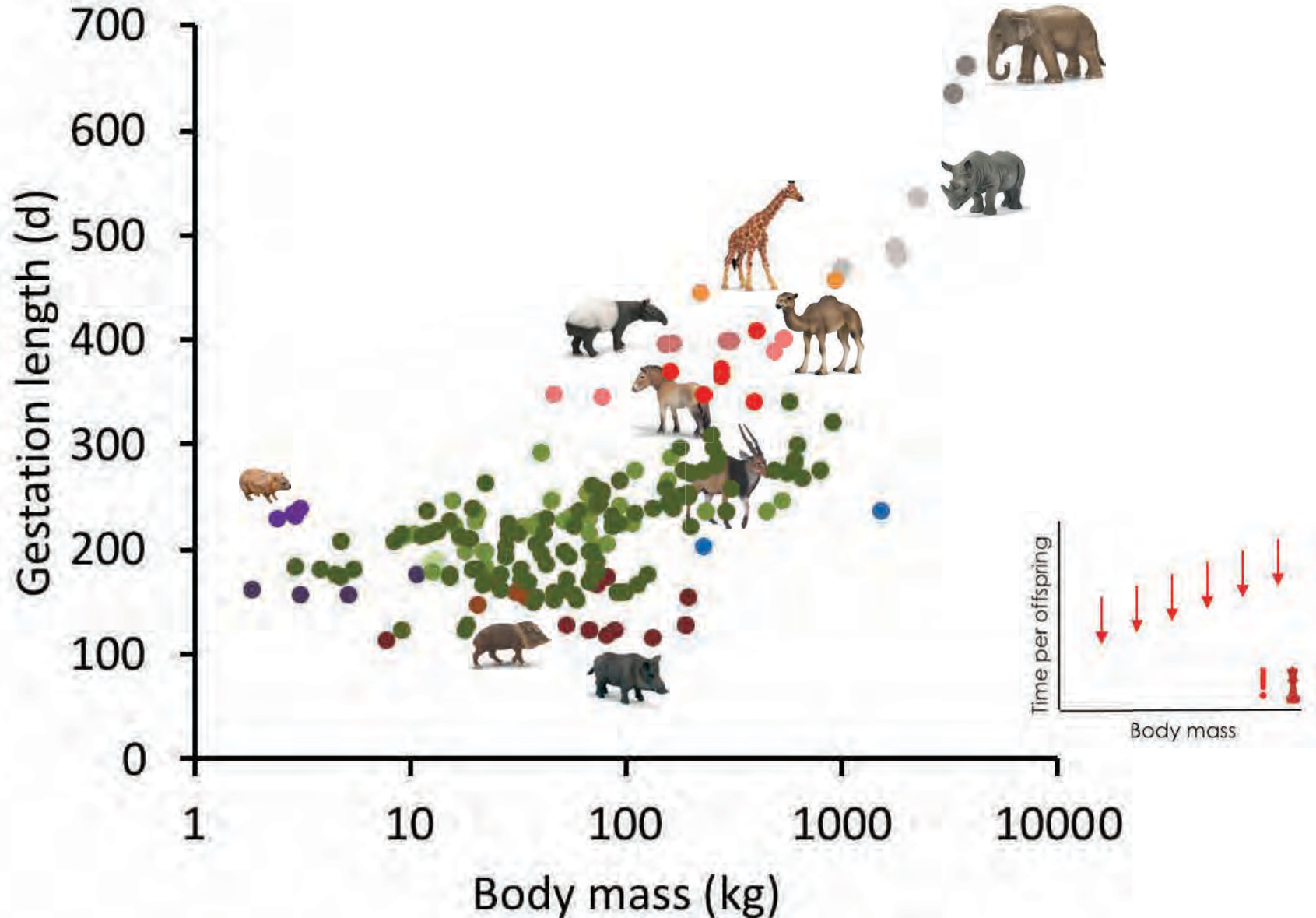
Niche-specific assessment

Because niche space is less diverse at larger body sizes, large herbivores may be a particularly fruitful area of research for 'directed evolution'.





A clear picture for gestation length





(Precocial) Mammal gestation period

For any mammal, achieving the same degree of neonatal development in a shorter gestation period – if not associated with higher costs – should be advantageous (higher fecundity due to shorter generation times).

Days of gestation period (to apparently similar level of precociality)

Cattle: app. 280 days

Horse: app. 340 days

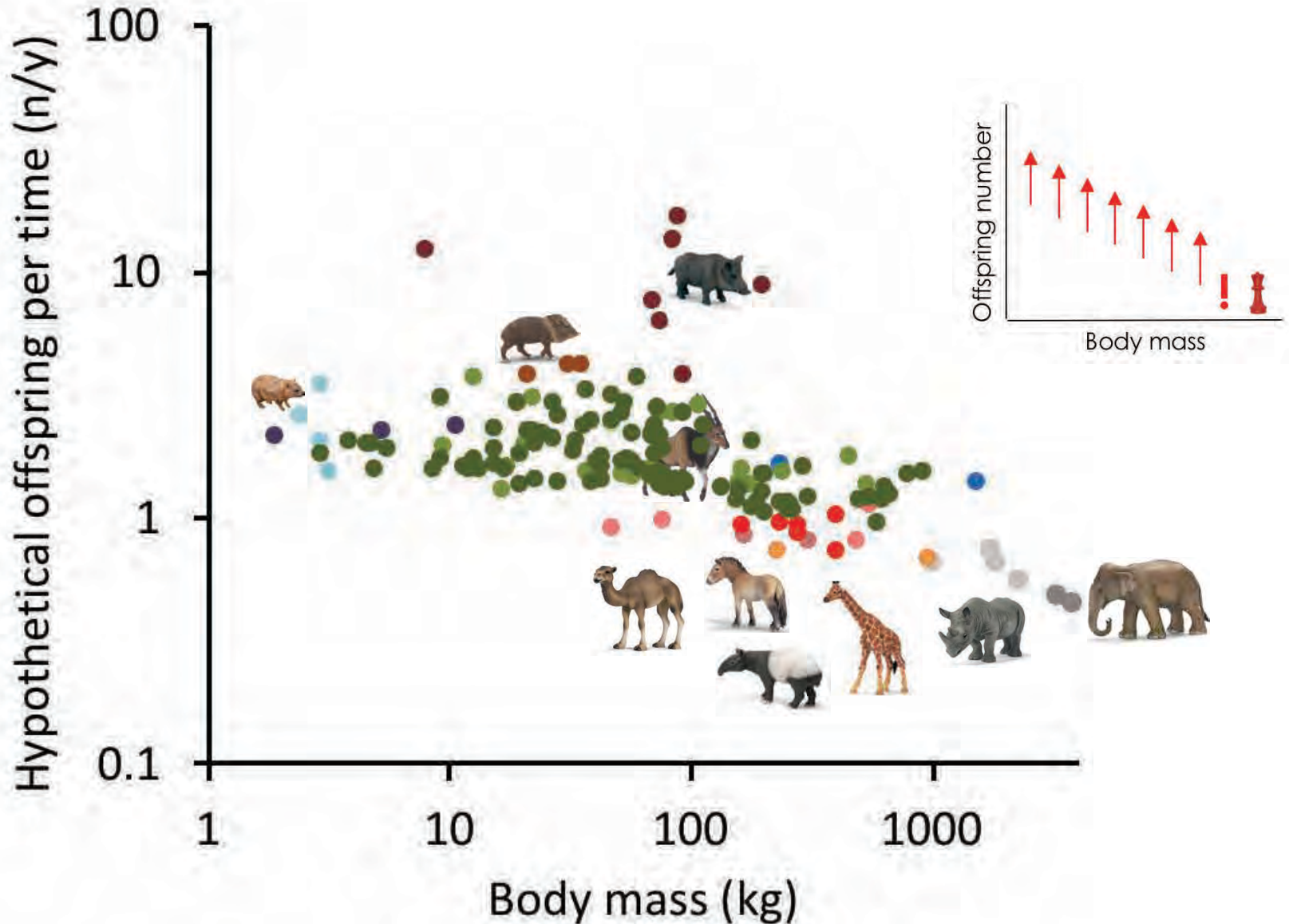
Dromedary: app. 390 days

Okapi: app. 440 days

The difference cannot be due to body size!

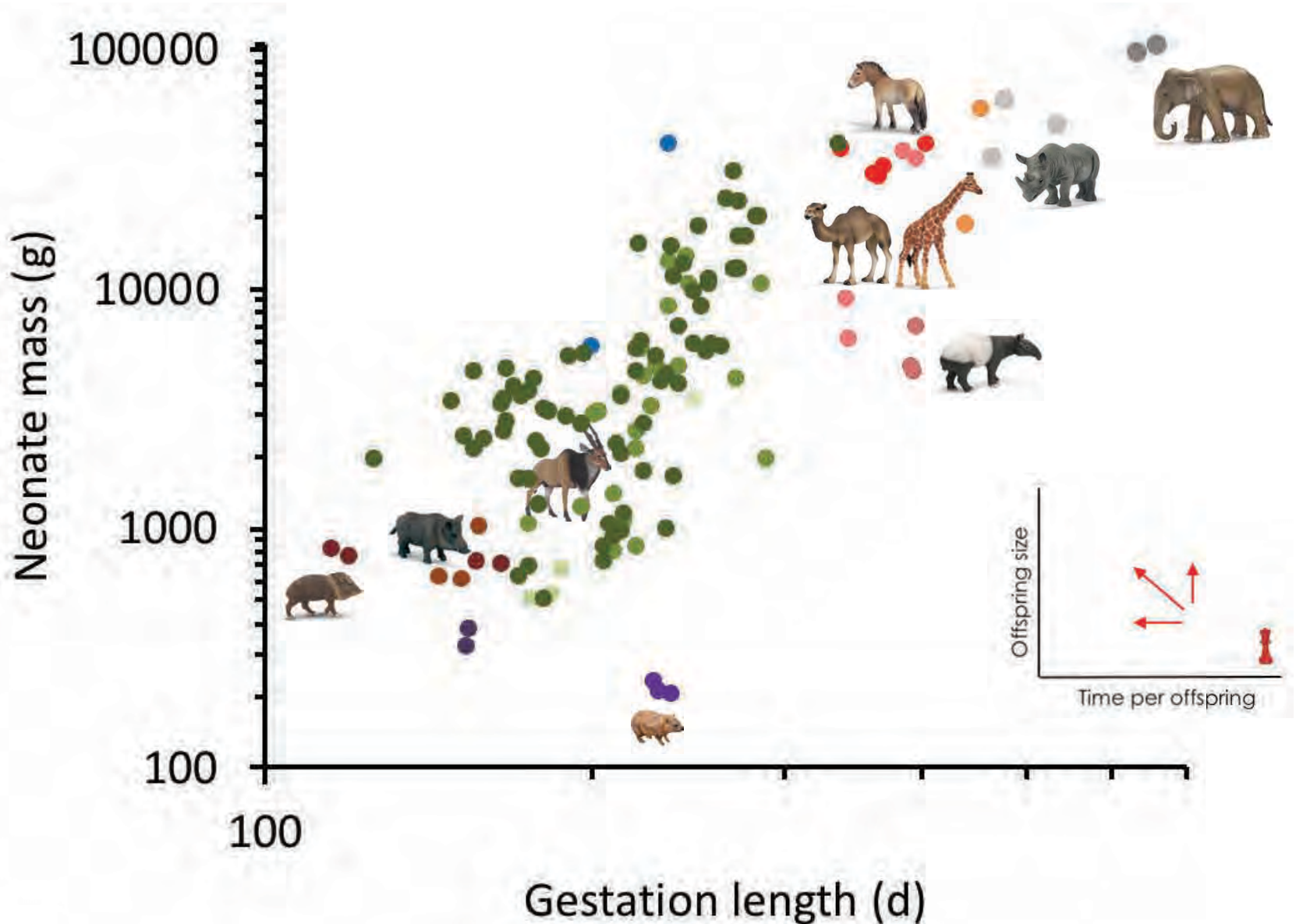


Clear effect for yearly offspring



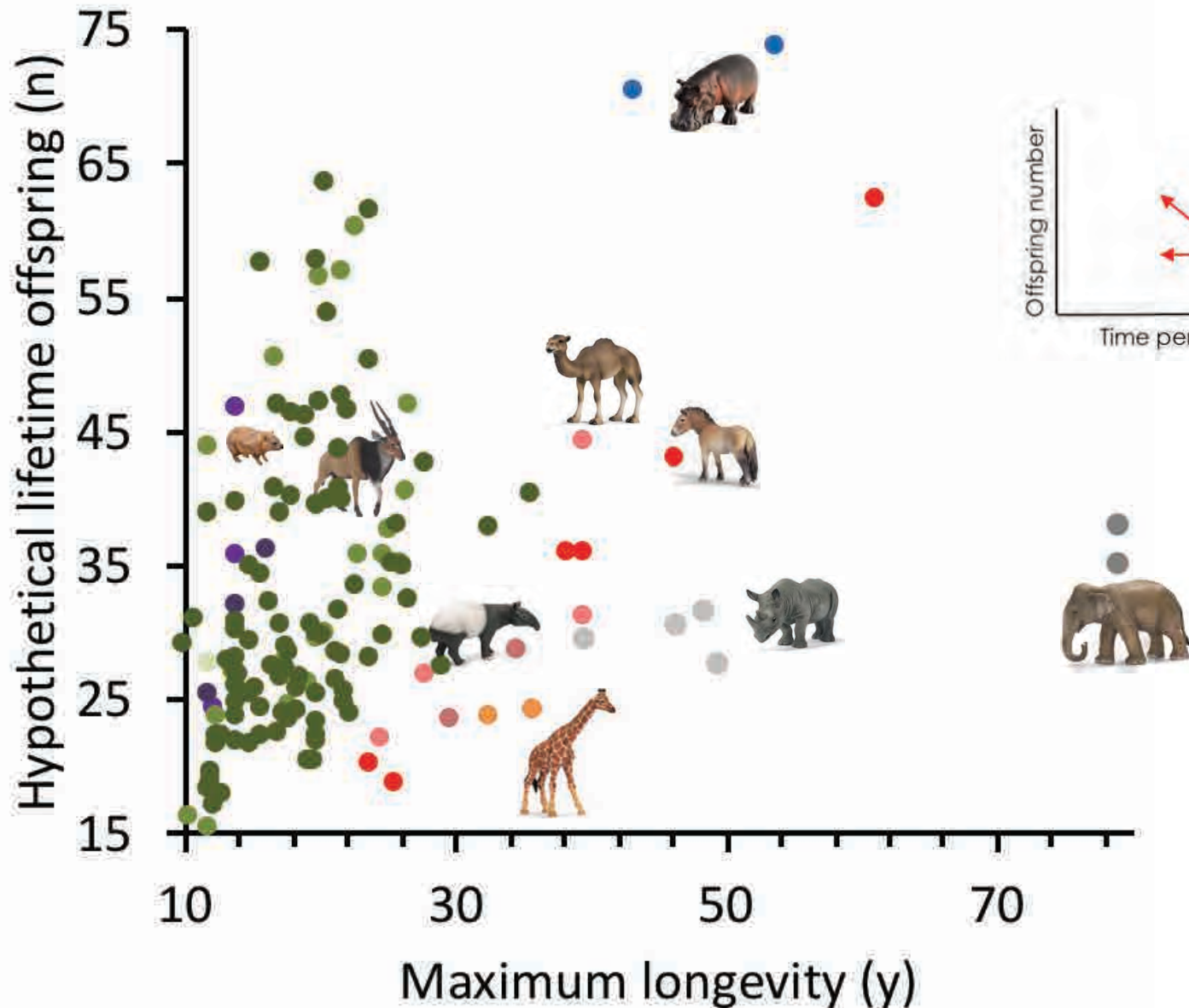


A clear picture for intrauterine growth





A clear picture for lifetime offspring production





How can domestication change life
history ?



Domestication and reproduction

B.P. Setchell

Animal Reproduction Science, 28 (1992) 195–202

Darwin (1875) stated that “domestic animals breed oftener in the year and produce more young at a birth than wild animals of the same species; they, also, sometimes breed at an earlier age.”



Domestication and reproduction

B.P. Setchell

Animal Reproduction Science, 28 (1992) 195–202

There is some evidence that domesticated sheep are less seasonal than wild sheep, but most domestic breeds still retain a significant seasonal pattern. Domestic cattle show no seasonal effect on their reproduction, but wild breeds do. Wild pigs in Europe have a seasonal pattern of reproduction, in contrast to most domestic pigs, reach puberty later and have a longer gestation; although embryonic mortality is lower, so is ovulation rate, and consequently litter size is smaller. Rodents which were adapted from the wild to laboratory life showed similar litter sizes, but the length of their reproductive life doubled, because of earlier puberty and delayed senescence.



Mice and reproduction

Effects of domestication on reproduction of mice

- No difference in litter size (Setchell, 1992)
- Difference in reproductive development in female mice
 - Earlier initiation of puberty

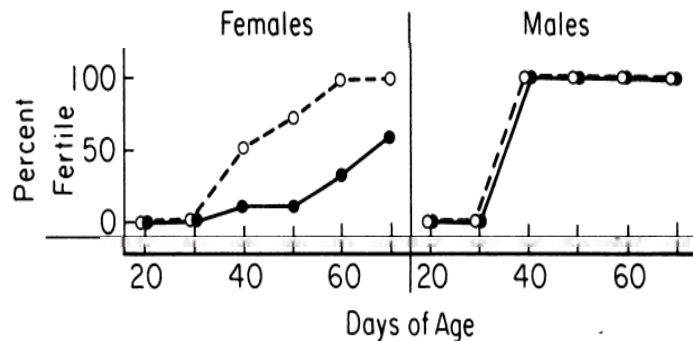


TABLE 1. Mean weight (mg \pm SEM) of uteri of wild vs. CF-1 mice at different ages.

	Days of age					
	20	30	40	50	60	70
Wild	8 \pm 1	12 \pm 2	17 \pm 4	25 \pm 6	39 \pm 9	50 \pm 12
CF-1	16 \pm 1	41 \pm 3	82 \pm 12	133 \pm 17	130 \pm 17	135 \pm 18

Bronson, 1984

Conclusion: “Length of their [female domestic mice] reproductive life of domestic mice doubled because of earlier puberty and delayed senescence.” (Setchell, 1992)



Two high-fertility mouse lines show differences in component fertility traits after long-term selection

Marion Spitschak^A, Martina Langhammer^B, Falk Schneider^C, Ulla Renne^B and Jens Vanselow^{A,D}

Reproduction, Fertility and Development, 2007, **19**, 815–821



Table 1. Mean bodyweight of dams at mating, mean litter size, litter weight and index units at birth in the high-fertility FL1 and FL2 lines and the unselected control line Fzt:DU

Data are the mean \pm s.e.m. with *n* given in parentheses. Values within columns with different superscript letters differ significantly ($P < 0.05$, *t*-test). BWm, bodyweight of the dam at mating; LS0, litter size; LW0, litter weight; IU, index units (where the index = $1.6 \times \text{LS0} + \text{LW0}$)

Line	BWm (g)	LS0 (no. pups)	LW0 (g)	Index (IU)
FL1	33.13 \pm 0.39 ^b (60)	17.28 \pm 0.39 ^b (60)	27.80 \pm 0.59 ^b (60)	55.45 \pm 1.19 ^b (60)
FL2	36.09 \pm 0.36 ^a (73)	18.72 \pm 0.57 ^a (71)	31.89 \pm 0.96 ^a (71)	61.84 \pm 1.85 ^a (71)
Fzt:DU	31.57 \pm 0.24 ^c (200)	11.03 \pm 0.18 ^c (183)	19.30 \pm 0.30 ^c (183)	39.56 \pm 0.70 ^c (183)

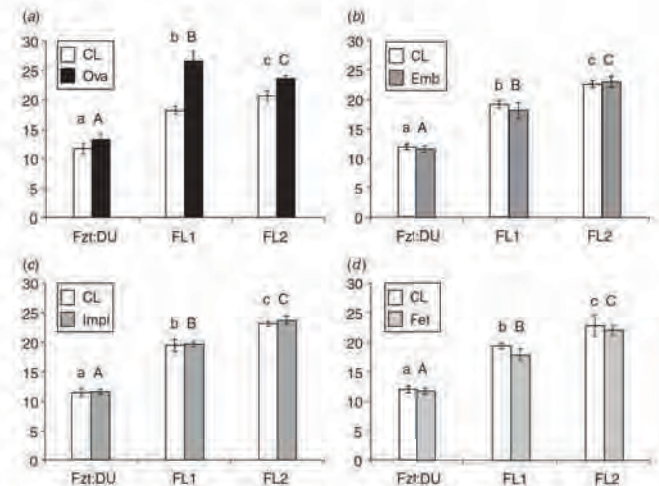


Fig. 1. Mean (\pm s.e.m.) number of corpora lutea (CL), ova, intact preimplantation embryos (Emb; morulae + blastocysts), implantation sites (Impl) and living fetuses (Fet) at Day 1 (a), 4 (b), 5 (c), and 17 (d) of pregnancy in the non-selected control line (Fzt:DU) and two mouse lines selected for an index fertility trait (FL1, FL2). Different lowercase letters indicate statistically different mean numbers of CL ($P < 0.05$). All data were derived by analysing 10–12 individuals in each line at the indicated stage of pregnancy.



High-fertility phenotypes: two outbred mouse models exhibit substantially different molecular and physiological strategies warranting improved fertility

Martina Langhammer^{2,*}, Marten Michaelis^{1,*}, Andreas Hoeflich³, Alexander Sobczak¹, Jennifer Schoen⁴ and Joachim M Weitzel¹

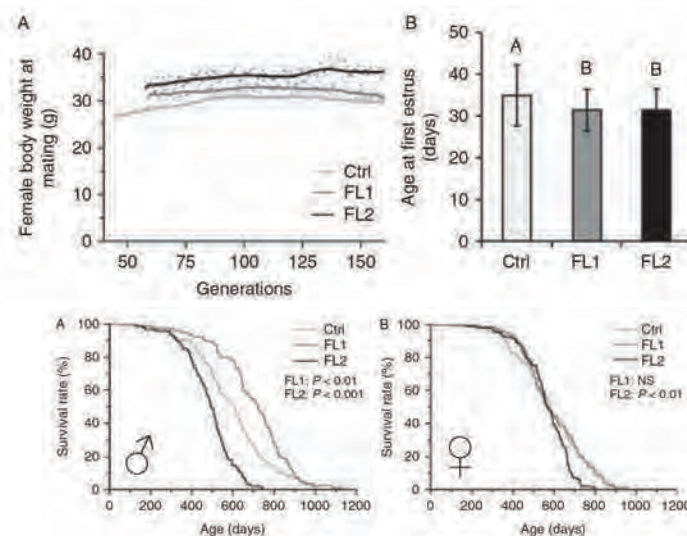
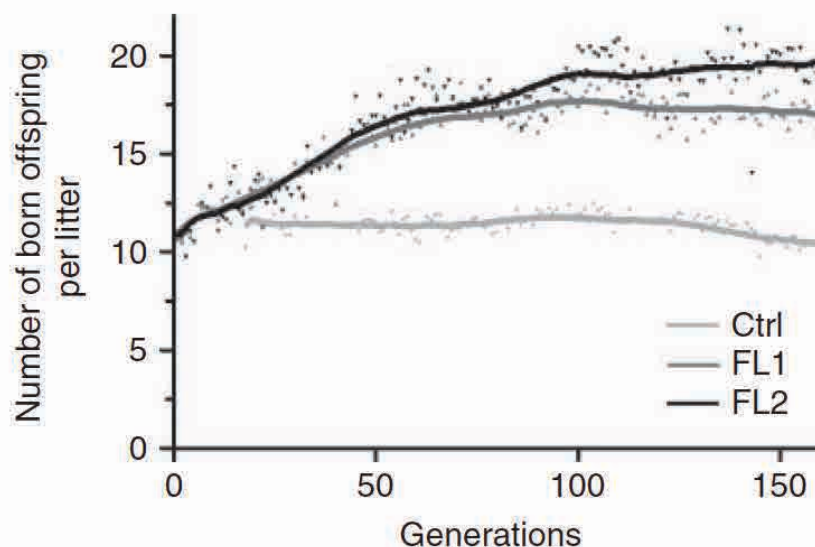


Figure 1 Selection success concerning the mean number of born offspring per litter in FL1 and FL2 during 161 generations of fertility index selection compared with the unselected control line (Ctrl). Data points represent the mean of at least 50 individual litters per generation and mouse line.



Components of litter size in mice after 110 generations of selection

M Holt, O Vangen and W Farstad¹

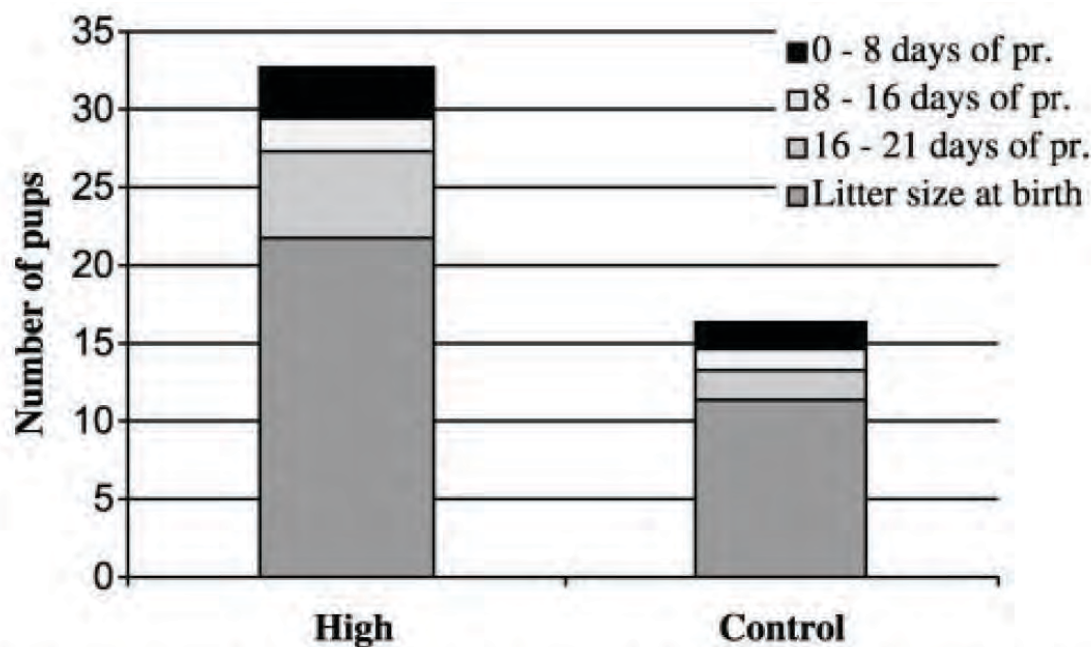


Figure 1 Losses in litter size at different periods of pregnancy (pr.) for mice in the high line and the control line.



Mink and reproduction



Selection for Litter Size, Body Weight, and Pelt Quality in Mink (*Mustela vison*): Experimental Design and Direct Response of Each Trait

Gabrielle Lagerkvist, K. Johansson, and N. Lundeheim

J. Anim. Sci. 1993. 71:3261-3272

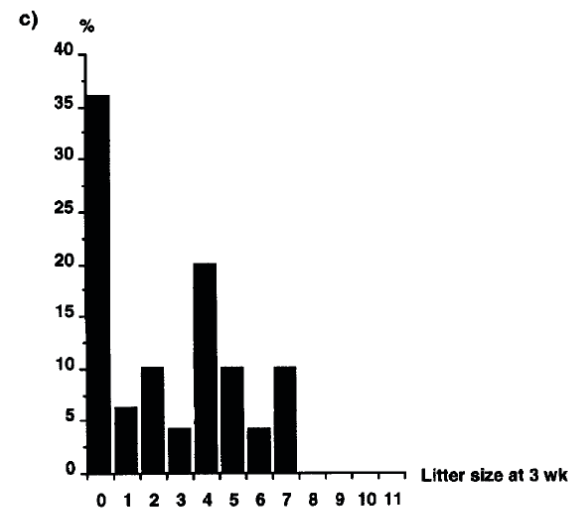
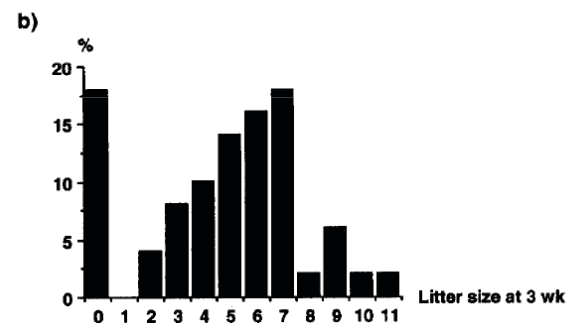
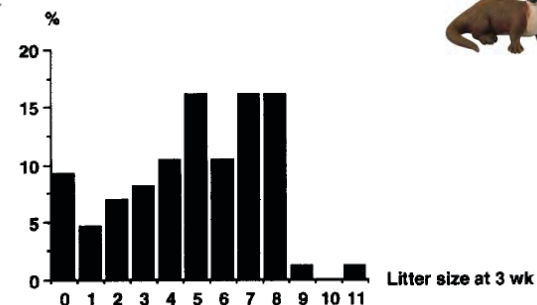


Figure 1. Frequency distribution of litter size 3 wk after birth (yearling females) in the: a) foundation stock (1984) b) litter size at 3 wk line (Generation 5, 1989), and c) control line (Generation 5, 1989).



Sheep and reproduction

Genetic and phenotypic trends and parameters in reproduction, greasy fleece weight and liveweight in Merino lines divergently selected for multiple rearing ability

S. W. P. Cloete^{A,B,E}, A. R. Gilmour^C, J. J. Olivier^D and J. B. van Wyk^A

Australian Journal of Experimental Agriculture, 2004, **44**, 745–754

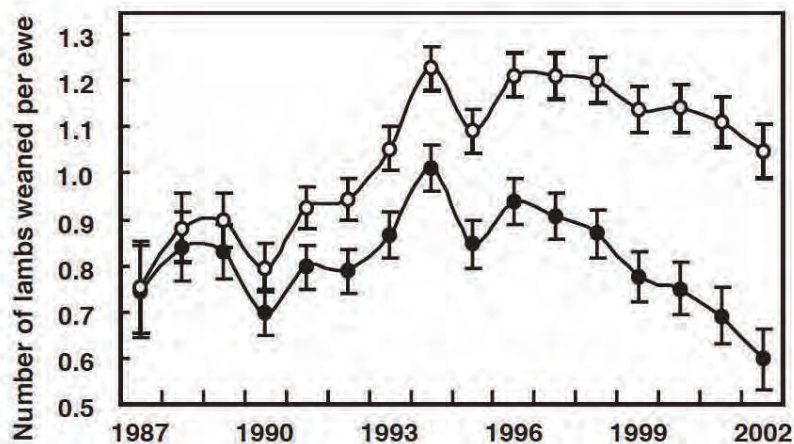


Figure 1. Phenotypic trends in the annual performance of ewes in the H (○) and L (●) lines for number of lambs weaned per ewe. Vertical lines about the mean represent standard errors.

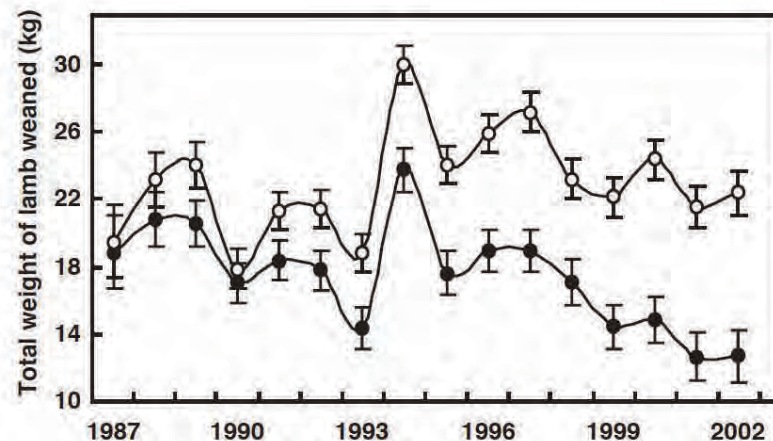


Figure 2. Phenotypic trends in the annual performance of ewes in the H (○) and L (●) lines for corrected weight of lamb weaned per ewe. Vertical lines about the mean represent standard errors.



Composite trait selection to improve reproduction and ewe productivity: a review

G. D. Snowder^A and N. M. Fogarty^{B,C}

Animal Production Science, 2009, **49**, 9–16



Abstract. Reproduction and ewe productivity are complex composite traits that are influenced by several component traits. Genetic improvement by selection for an individual component trait may not always be advantageous because adverse or neutral genetic relationships can exist among the component traits. Selection for an overall composite trait of ewe productivity, defined as litter weight weaned per ewe joined, can result in a balanced biological composite trait with favourable responses in component traits including fertility, number of lambs born, lamb survival, lactation and lamb growth.



Pigs and reproduction





Domestication and reproduction

B.P. Setchell

Animal Reproduction Science, 28 (1992) 195–202



The litter size is much lower in wild pigs in Europe (4.6 — Mauget, 1982) and in feral pigs in USA (6.2 — Hagen and Kephart, 1980), and Australia (6 — McIntosh and Pointon, 1981) than in domestic breeds (10–12 — Asdell, 1964). Embryonic mortality is lower in the wild pigs, but the difference is not sufficient to compensate for a lower ovulation rate. Gestation length appears to be slightly longer in the wild pigs (119 vs. 114 days — Mauget, 1982)

One century of genetic changes in pigs and the future needs

Jan W.M. Merks,

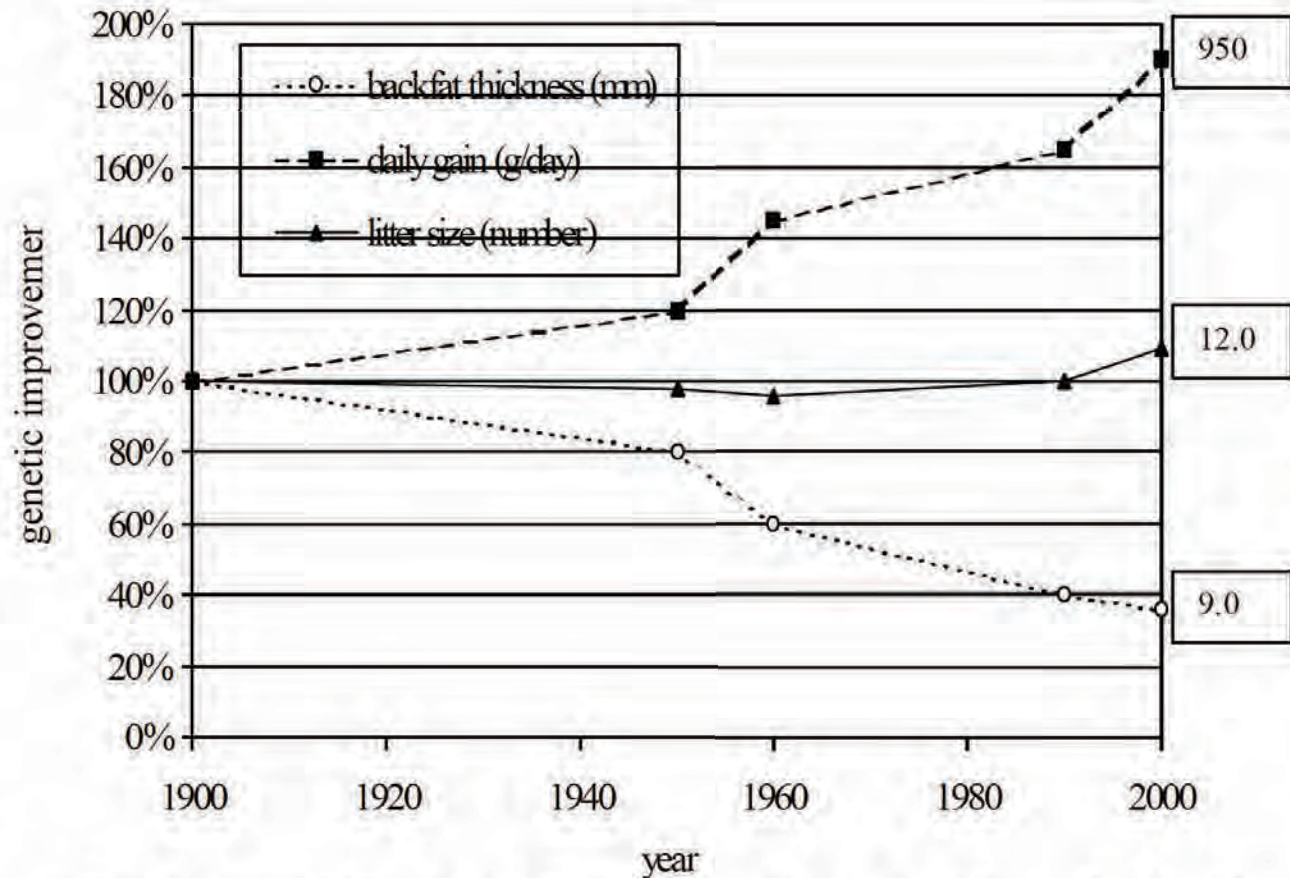


Figure 6. Schematic description of one century of genetic progress in pigs (on the right side of the figure the present absolute levels are given as an indication).



Recent advances in pig reproduction: Focus on impact of genetic selection for female fertility

Bas Kemp | Carolina L. A. Da Silva | Nicoline M. Soede



Reprod Dom Anim. 2018;53(Suppl. 2):28–36.

In the past 30 years, sows have been successfully selected for a shorter weaning-to-oestrus interval and increased litter size.

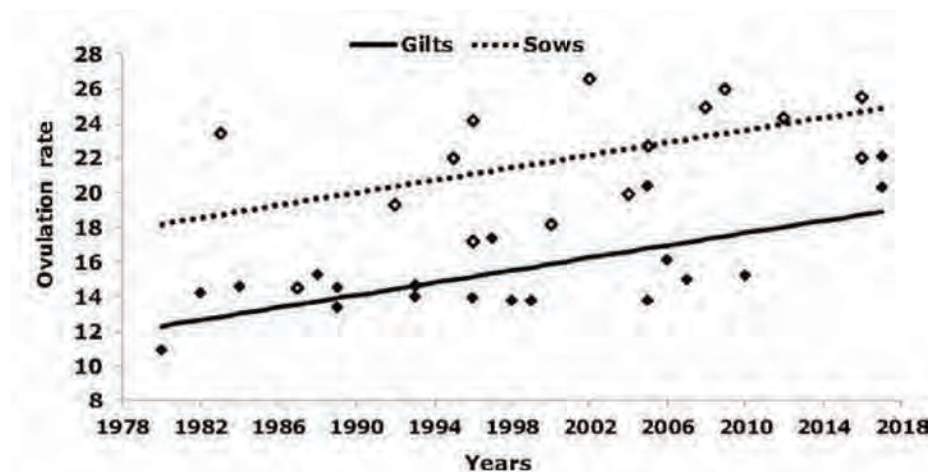


FIGURE 3 Ovulation rate as found in studies during the last 35 years, showing an increase in 0.2 ovulations per year in both gilts and sows (Da Silva, Broekhuijse, et al., 2017; Da Silva, Laurensen, et al., 2017)



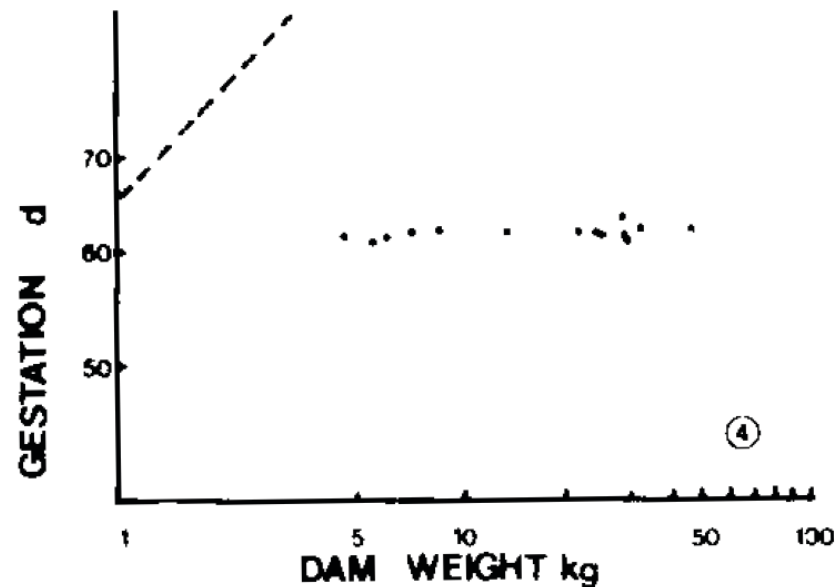
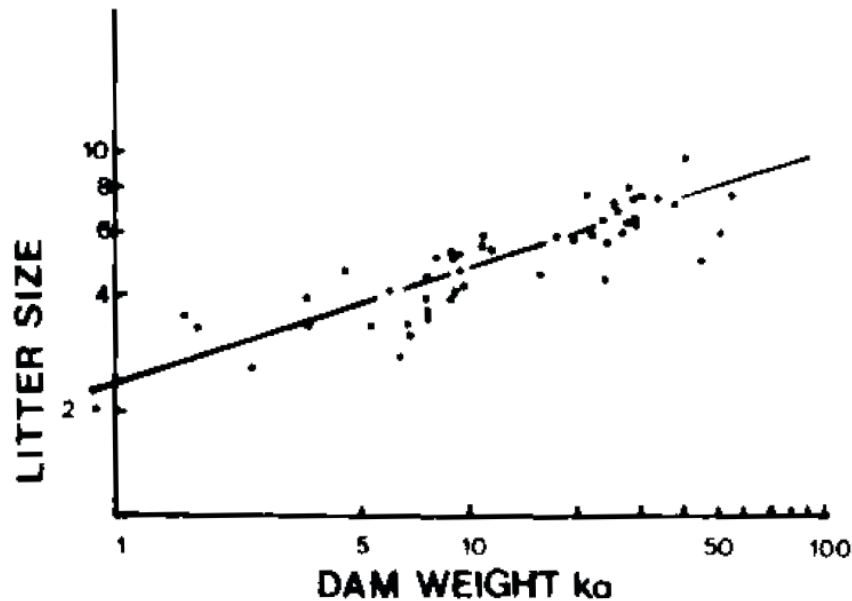
Dogs and reproduction



The influence of size on the biology of the dog

JAMES K. KIRKWOOD

J. small Anim. Pract. (1985) **26**, 97–110.





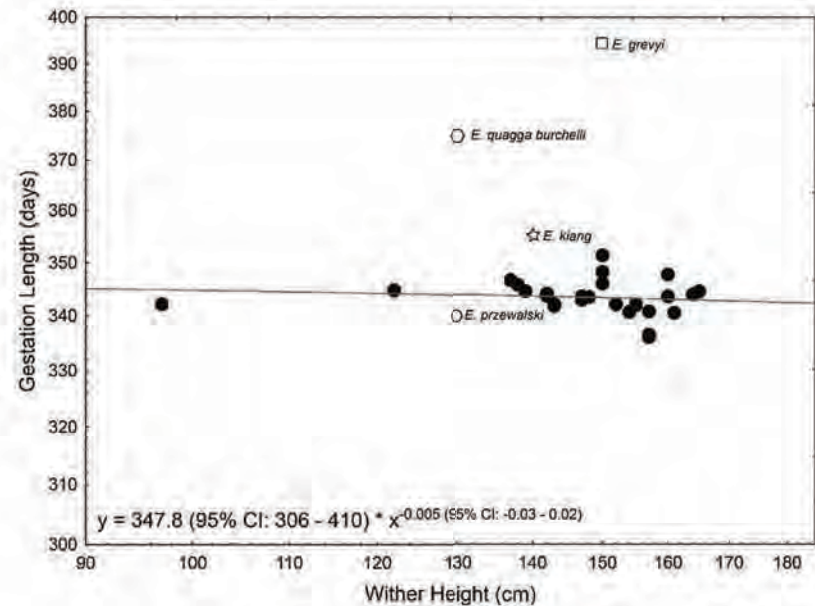
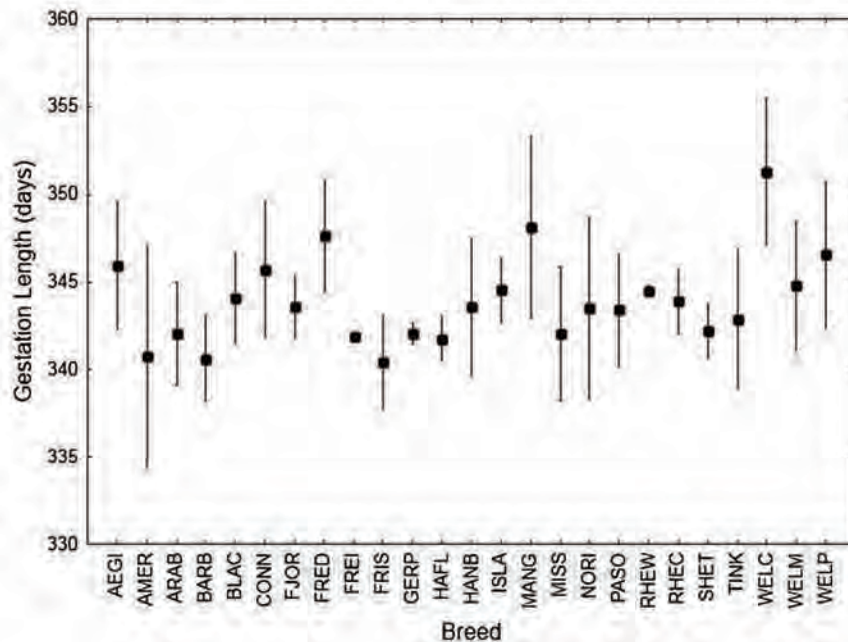
Horses and reproduction



Gestation length variation in domesticated horses and its relation to breed and body size diversity

Laura Heck^{a,*}, Marcus Clauss^b, Marcelo R. Sánchez-Villagra^a

Mammalian Biology 84 (2017) 44–51





Cattle and reproduction



HERITABILITY OF THE LENGTH OF THE GESTATION PERIOD IN DAIRY CATTLE ¹



J. C. DEFRIES, R. W. TOUCHBERRY, AND R. L. HAYS

It was predicted that the mean length of the gestation period would be decreased by almost ten days in three generations, if 5% of the male and 50% of the female calves resulting from the shortest gestations were saved as breeding stock. Experimentation is necessary to determine if any deleterious effects would be associated with this change.

Crossbreeding Dairy Cattle. I. Some Effects of Crossbreeding on the Birth Weight and Gestation Period of Dairy Cattle ¹

R. W. TOUCHBERRY and BEN BERESKIN

Crossbreeding has resulted in a small, 1.54-kg, but significant increase in birth weight, but has had little or no effect on gestation period.



Association among gestation length and health, production, and reproduction in Holstein cows and implications for their offspring

A. Vieira-Neto,*† K. N. Galvão,†‡ W. W. Thatcher,*† and J. E. P. Santos*†¹

within multiparous cows, those with SGL or LGL had greater incidence of dystocia, stillbirth, retained placenta, and metritis than cows with AGL.

Heifers from dams with GL that deviated from AGL had greater mortality postweaning (AGL = 3.2 vs. SGL = 6.5 vs. LGL = 5.4%).

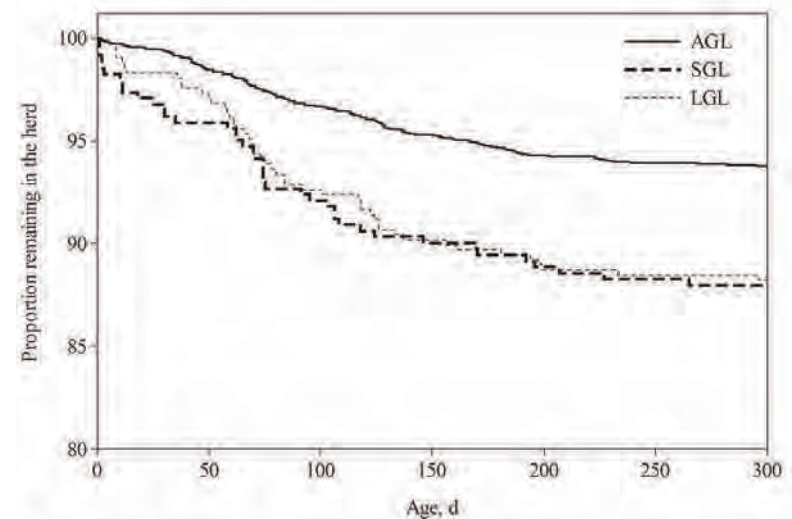


Figure 4. Survival curves for age at removal from the herd up to 300 d of age in heifers according to gestation length category of their dams. Gestation length was categorized as average (AGL; population



Summary: Reproduction

Easier to select for

- litter size
- litter weight (uterine growth: mass accretion)
- age at first reproduction (post-uterine growth)
- interbirth interval (no seasonality)

More difficult to select for

- neonate survival

Very difficult to select for

- gestation period (uterine growth: acceleration)



Humans keep animals

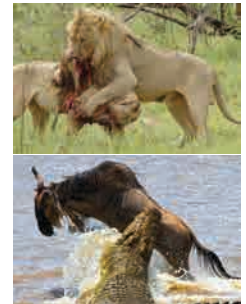
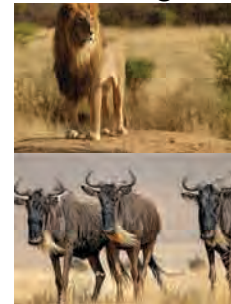
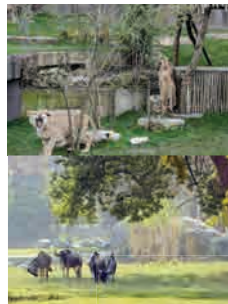
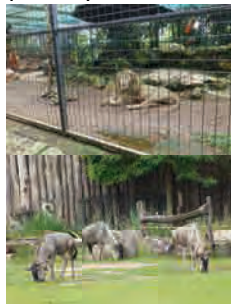
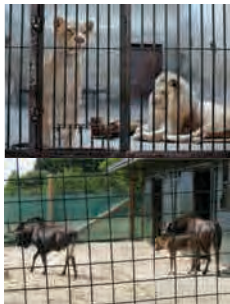
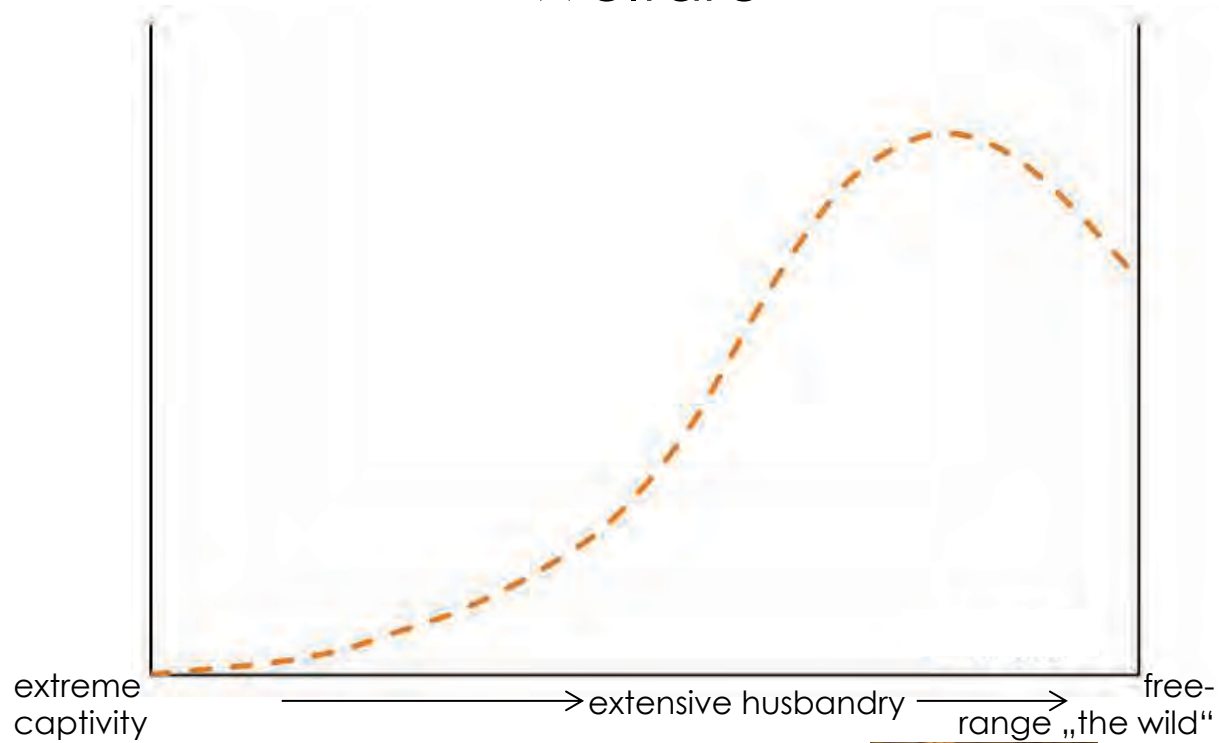




Welfare Concept

(Veasey 2017)

Welfare

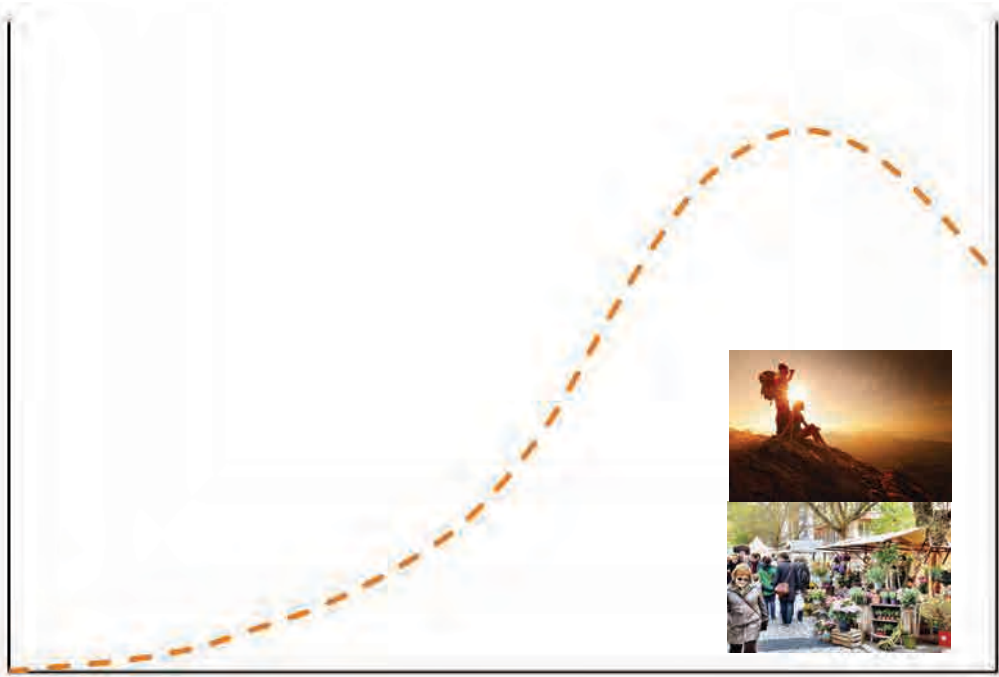




Welfare Concept

(Veasey 2017)

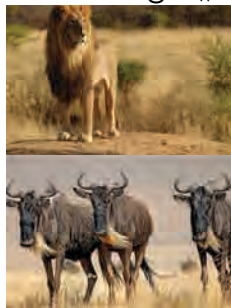
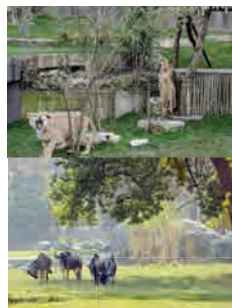
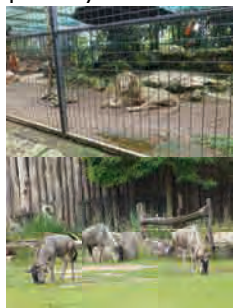
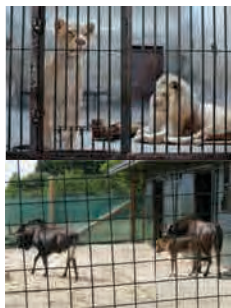
Welfare



extreme
captivity

→ extensive husbandry

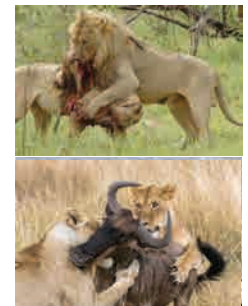
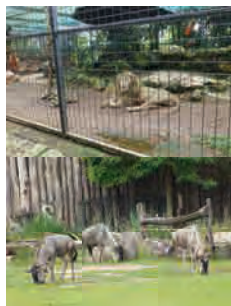
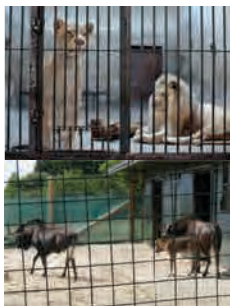
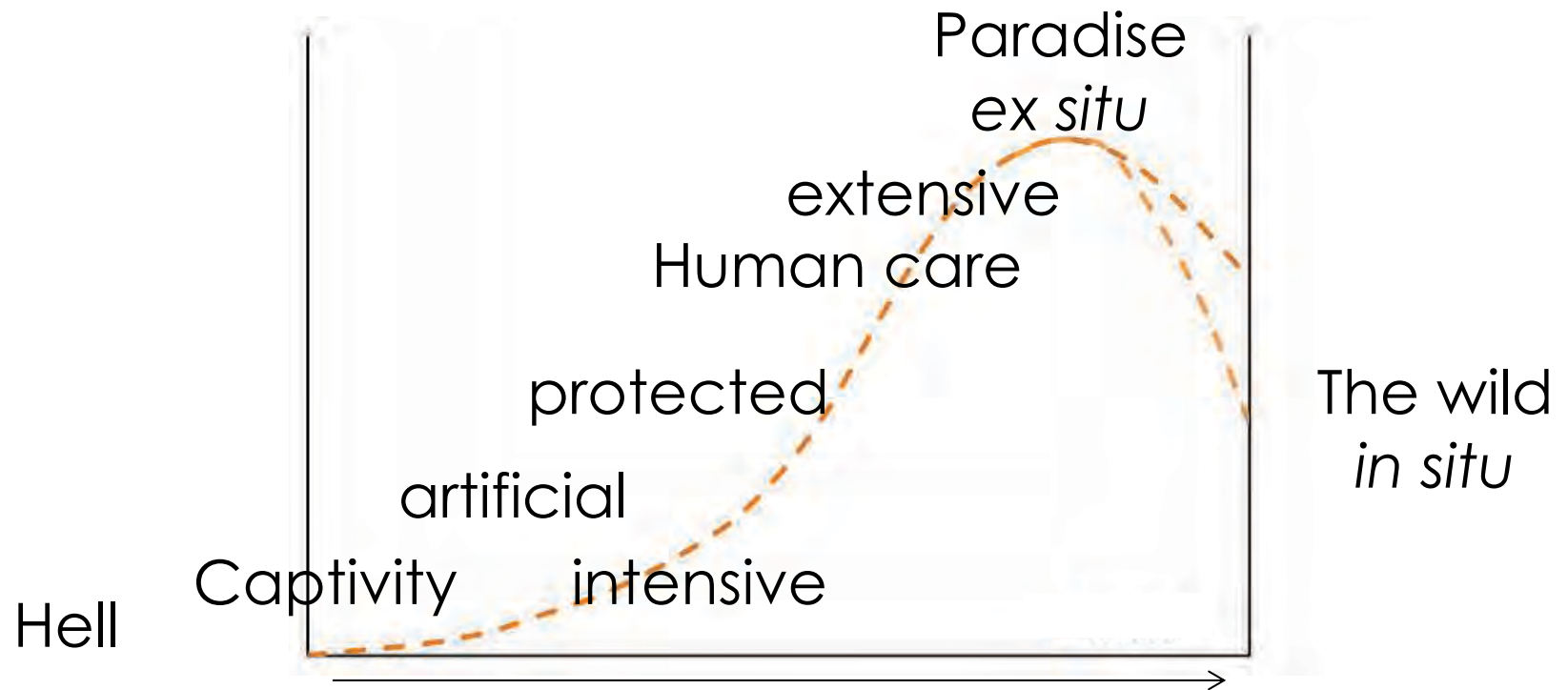
→ free-
range „the wild“





Welfare Concept

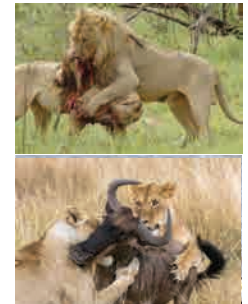
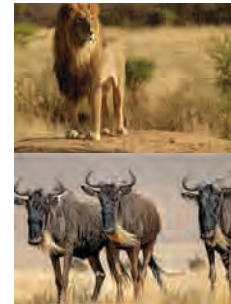
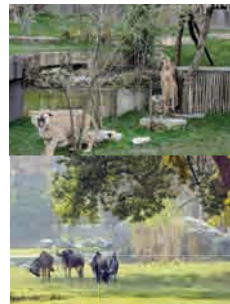
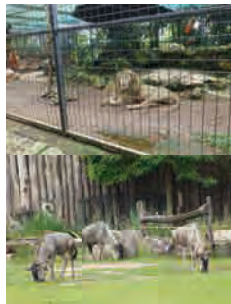
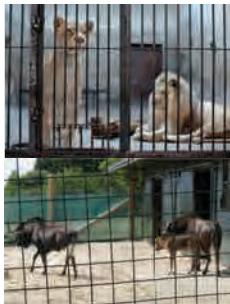
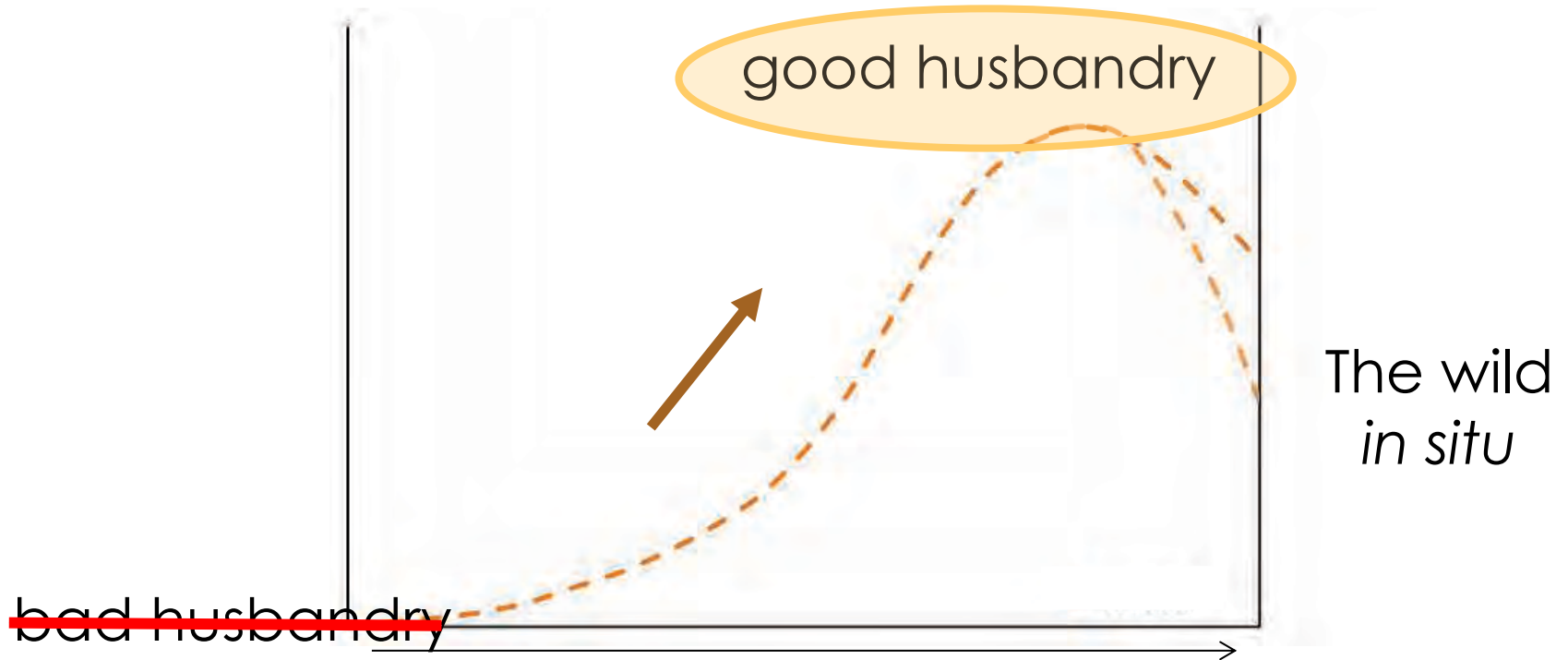
(Veasey 2017)





Welfare Concept

(Veasey 2017)





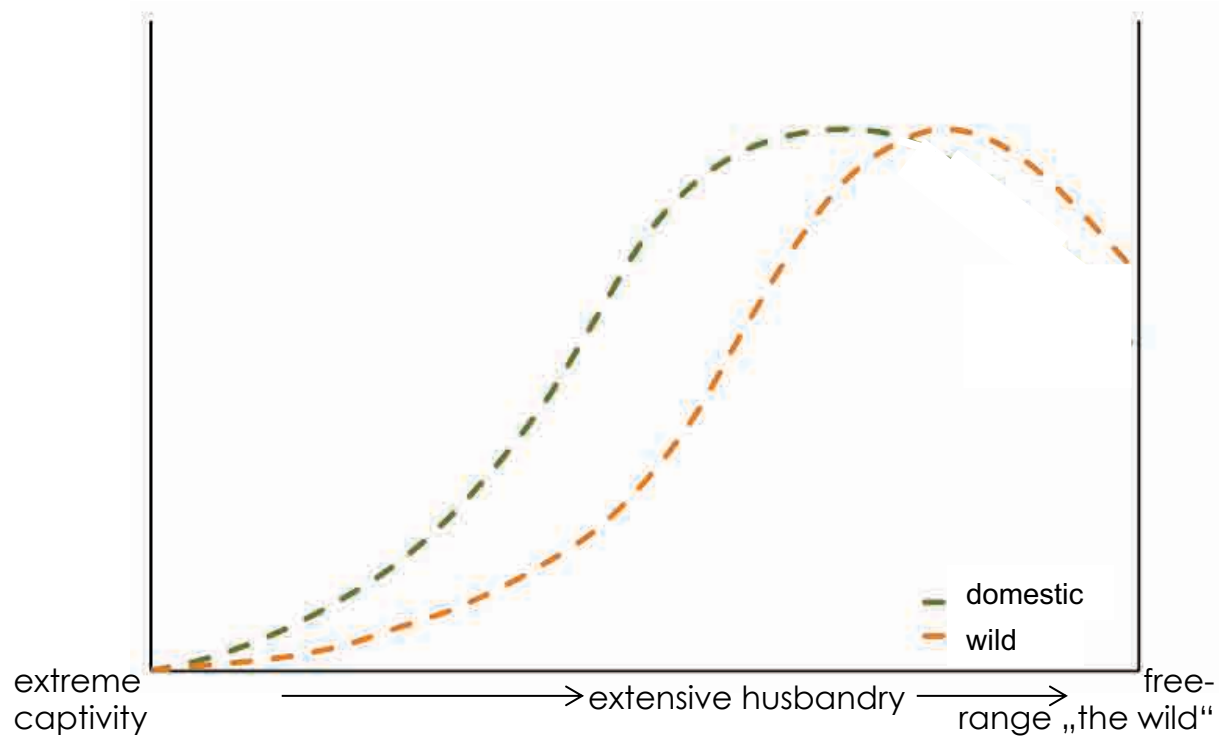
Domestic animals



Welfare Concept

(Veasey 2017)

Welfare



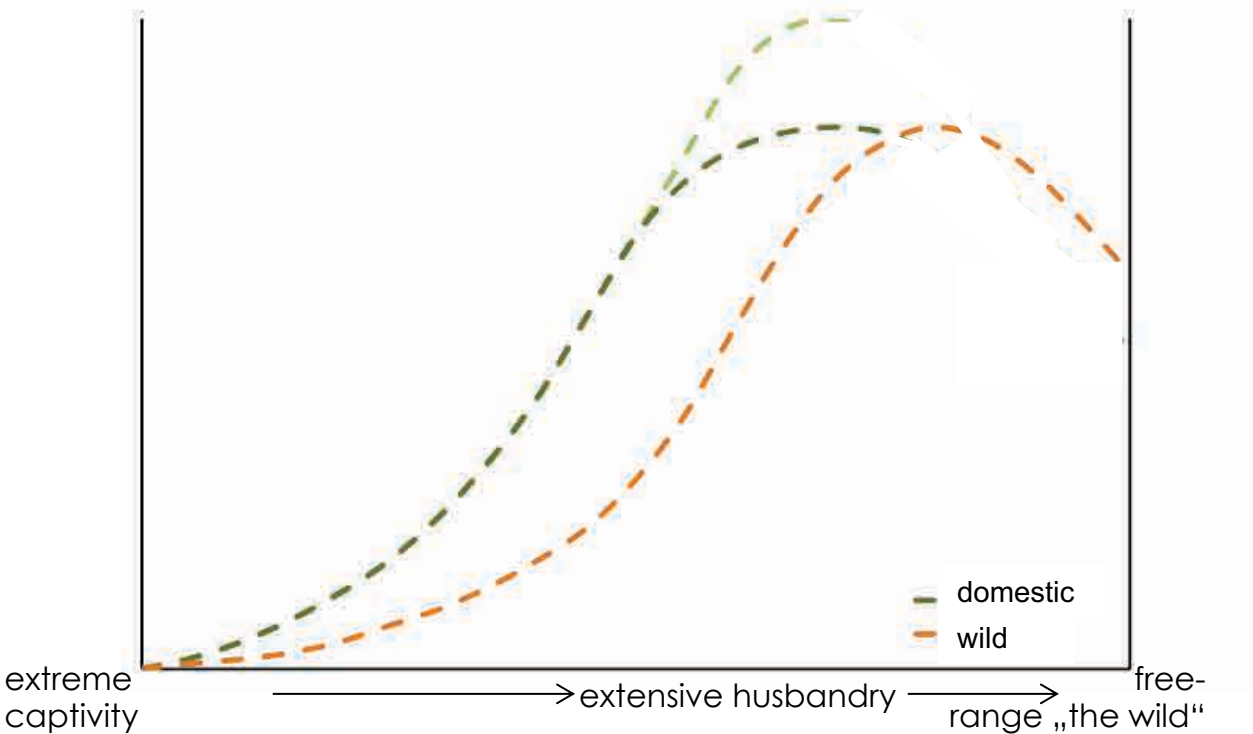
*there is no “wild”
for domestic
animals – we
cannot liberate
them;
we can only
prevent them from
existing*



Welfare Concept

(Veasey 2017)

Welfare





What story are we telling ?



Meaningful lives in an anxiety-free environment show us, and remind us of, the beauty and complexity of life.



What story are we telling ?



Meaningful lives in an anxiety-free environment show us, and remind us of, the beauty and complexity of life.



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Meaningful lives in an anxiety-free environment.



Thank you for your attention

