

Goal 1: The contribution of early life management to pig robustness, sociability and welfare outcomes in the growing pig



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BE WHAT THE WORLD NEEDS

Expectations

Societal

- Happy, healthy pigs
- Rearing animals in line with their means
 - Natural behaviour
- Safe and affordable food
- Environmental considerations
 - Not harming the planet

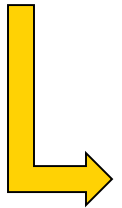
Industry

- Meet customer expectations
- Efficient production
- Reduce antibiotic use
- Improved product quality
- High animal welfare

System comparisons



Understanding beneficial pathways within existing systems needed



Sustainable intensification

So why explore early life management?

Sensitive periods of time postnatal:

Birth to four weeks

Birth to 12 weeks.

Influence the pig in a sensitive window of development:

Produce long lasting effects – enable the pig to respond to challenges effectively for lifetime.

Early life: Covers what period?

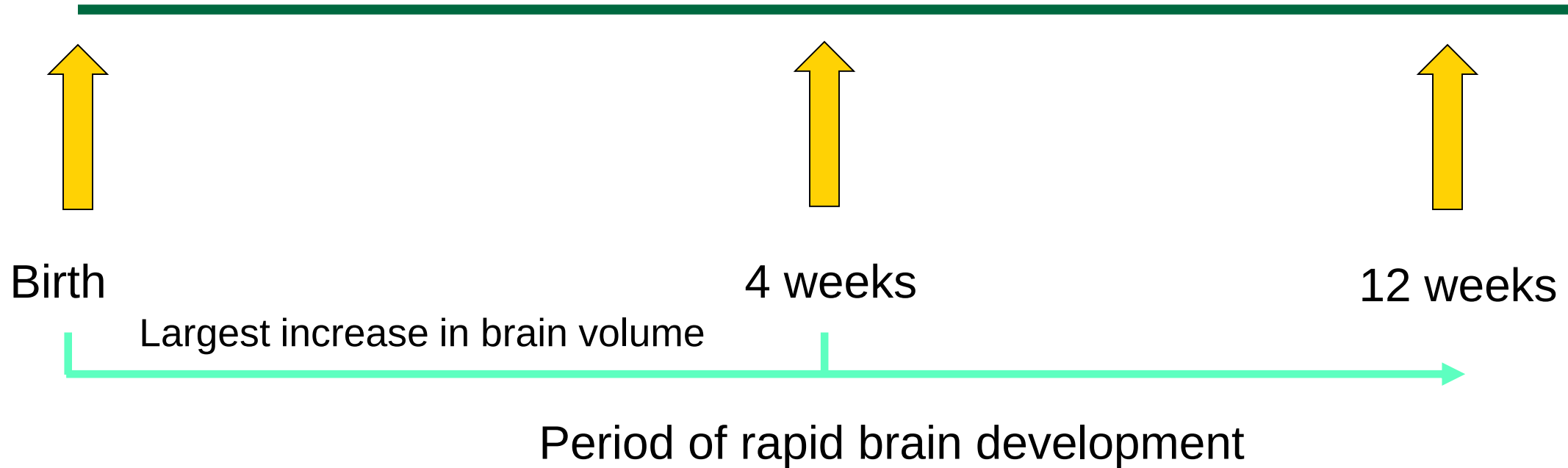
Early life can cover:

- ❖ Preconception: Gamete maturation - point of fertilization
- ❖ Prenatal: Gestation – conception to birth
- ❖ Early postnatal: birth – four weeks of age / birth – 12 weeks of age.



Early life developmental stages

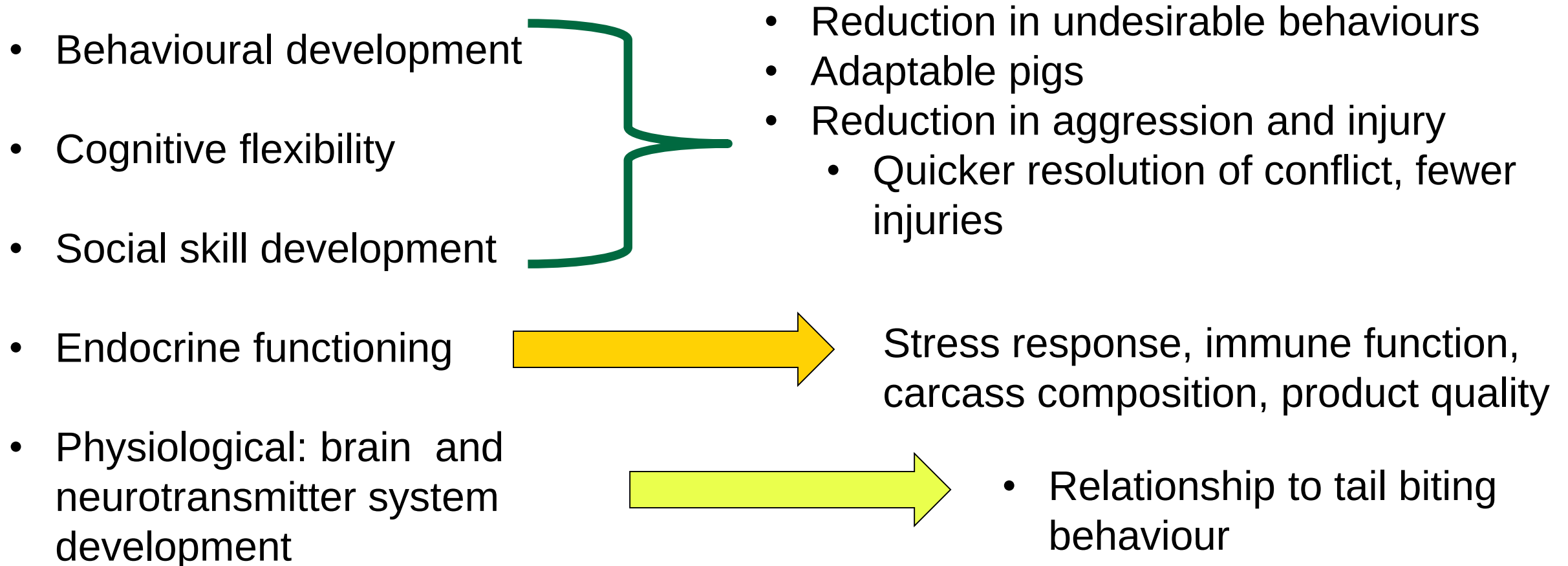
Developmental processes occurring here: long lasting effects on brain structure



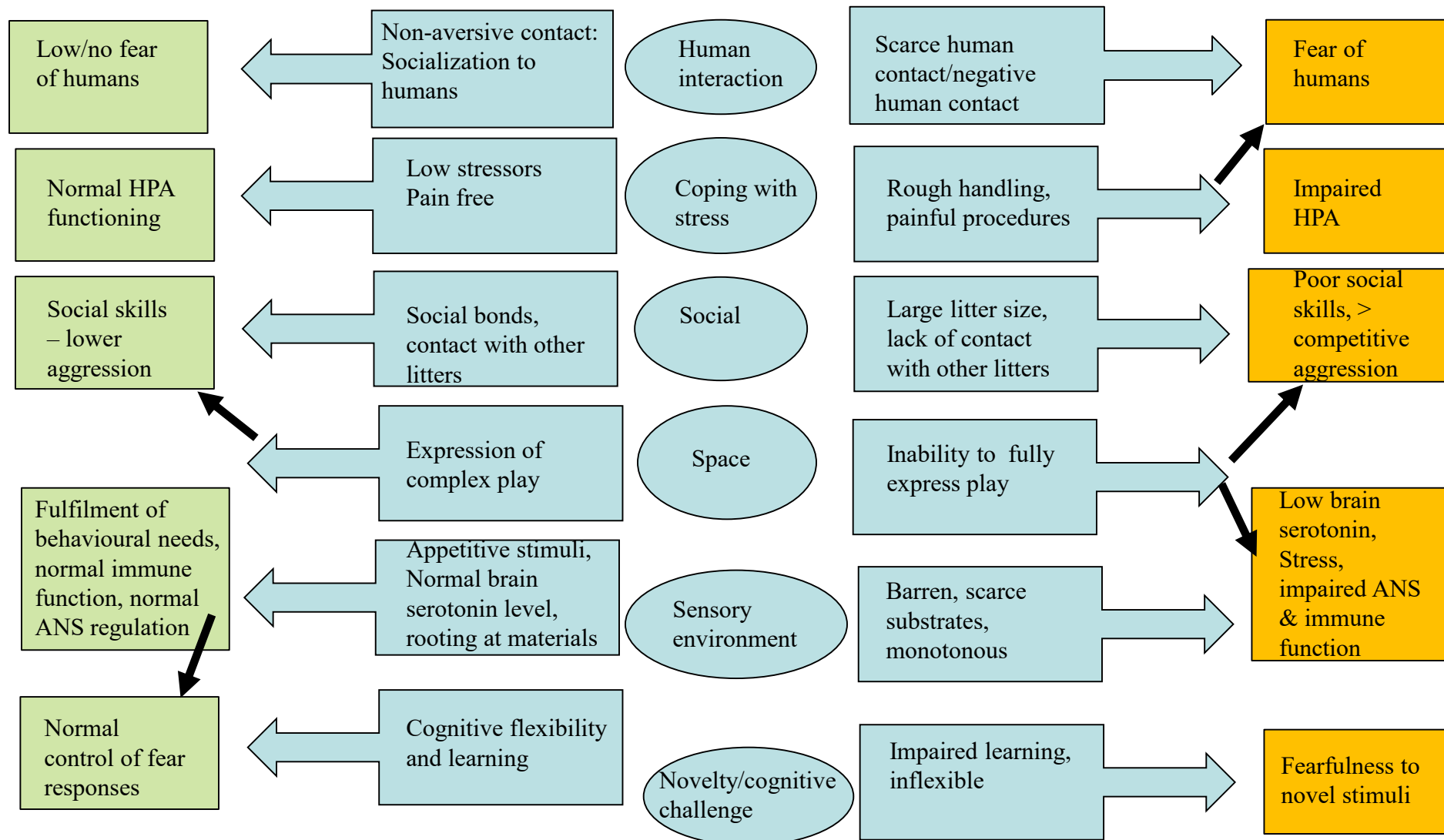
Neural circuit development occurring within this period: mediates expression of behaviour, emotion, response to stress (autonomic and endocrine response regulation).

Early life effects: Current Knowledge

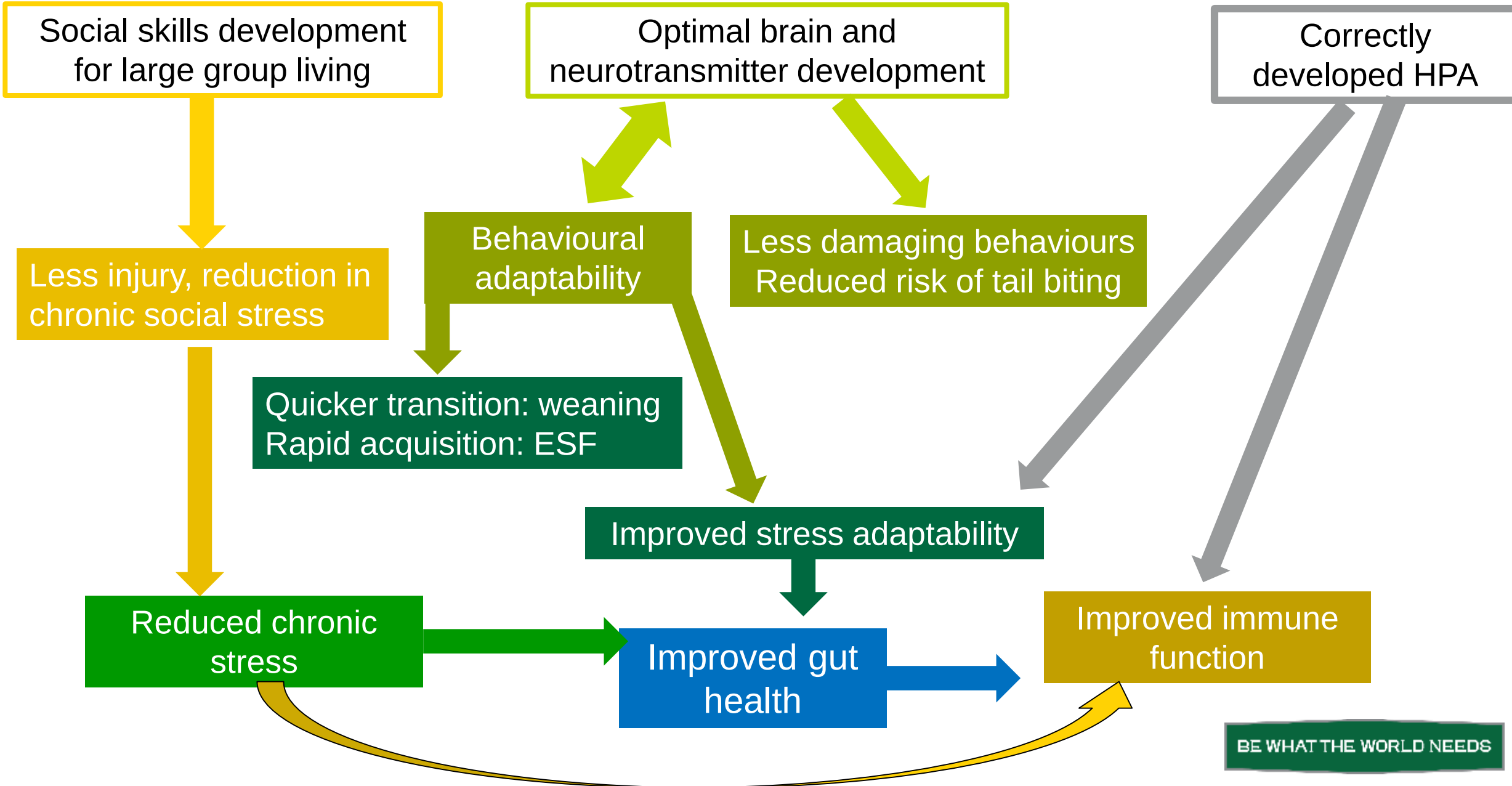
Early social and physical environment shapes:



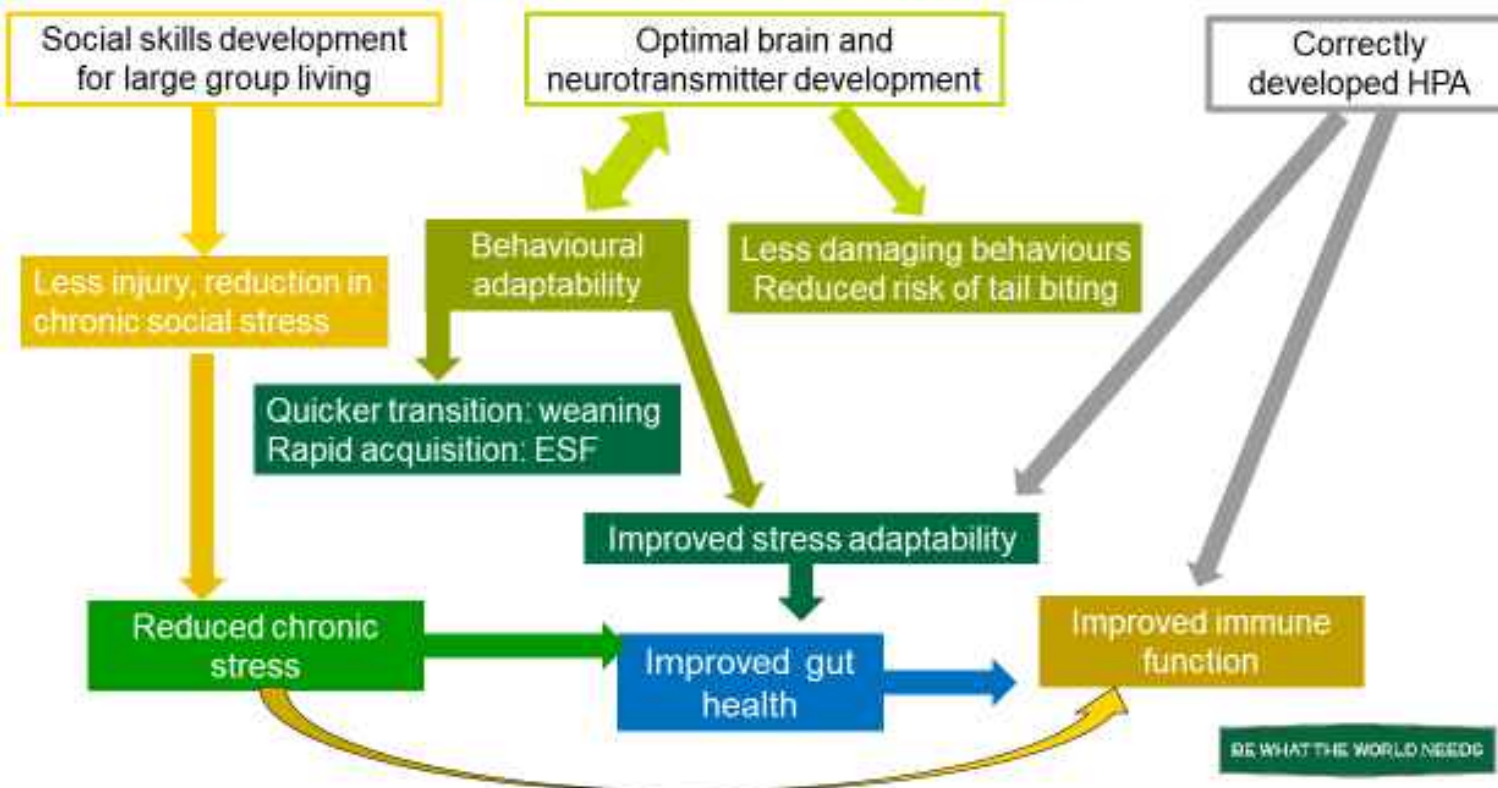
Early life experiences: Positive & Negative consequences



The interactive effects



The interactive effects



Improved animal welfare

Increased resilience

Sociability development in swine

- Improved group living

Improved performance: expression of genetic potential

Reductions in antibiotic use

Improved product quality

Goal 1: Current knowledge

Practical consequences:

- Birth-wean environment: role in growth rates expected in finish environment
- Enriched environments – improved growth and meat quality
 - Enhanced immune response
- Breeding animals: possible links to sow longevity



Scientific Knowledge Gaps

- Well known: Early life stimuli produce immediate phenotypic changes in the pig.

Knowledge gap: Long-term and additive benefits: Interaction

- Long-term changes on pig:
 - a) Adaptability; b) Health; c) Welfare;
- Combined benefit on productivity and resilience in the face of challenge
- The cost-benefit of making early life management changes

Promising relationships to explore

- Piglets seek cues from sow
- Identify what is safe food
- Develop ingestive behaviours preweaning

**Vertical
transfer of
information
Sow:piglets**

- Behavioural development
- Weaning transition
- Stress response
- Tail biting

**Physical
environment**

Pain management

- Reduce fear of humans
- Positive human-animal relationship

**Human-
Animal
Relationships**

**Social
environment**

- Quicker resolution of conflict
- Less injury
- Reduced social stress

Early life effects: What is known #1

Consistently found: ***A complex pre-weaning environment supports:***

- Transition to weaning – better growth post weaning
- Reduced stress – less diarrhea post weaning
- Improved health (van Dixhoorn et al. 2018).
- Pigs reared with chewable enrichment: redirect foraging behaviours ***to the environment, not to other pigs***
 - Forage and locate post-weaning feed quicker (large group nursery performance)
 - Oral behaviours directed to pigs – reduce growth rate, reduce FCR (Camerlink et al. 2012).
 - Tail biting occurs in pens with increased pig and pen-level oral manipulations.
- Chewable enrichment: develops mastication behaviours & more feed exploration post weaning (Oostindjer et al. 2010)
- Provision pre-weaning: results in increased feed intake postweaning (Middlekoop et al. 2019).



Early life effects: What is known #2

Consistently found: ***Pre-weaning socialization***: Exposure to unfamiliar piglets (e.g. adjacent litter) pre-weaning

- Develops social skills and cognition related to social development:
 - Subsequent contests: fights of shorter duration, quicker contest resolution (Camerlink et al. 2019).
 - Commonly studied: up to end of nursery period.



Unknown: Effects on i) long-term social skills; ii) chronic social stress.

- **Implications:** Group well-being, longevity in sows
- The role of social learning post weaning on development of social skills.

Psychosocial stress

- Plays a major role in disease susceptibility & gastrointestinal health
- Chronic social stress in growing pigs alters:
 - Growth & FCR – feed intake not reduced
 - Nutrient transport
 - Gut barrier function (Li et al. 2017)

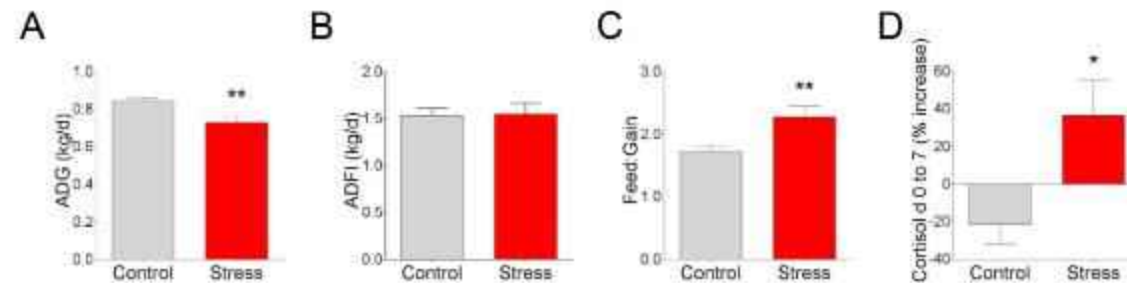


Fig 1. Effects of chronic social stress on growth performance and serum cortisol in pigs. Pigs (22 ± 0.54 kg, Yorkshire cross breed) were subjected to 7 d of chronic social stress by reducing floor space ($0.17 \text{ m}^2/\text{pig}$) and mixing with new pigs. Control pigs were housed at a floor space allowance of $0.33 \text{ m}^2/\text{pig}$ without mixing pigs. **(A)** Average daily gain (ADG). **(B)** Average daily feed intake (ADFI). **(C)** The feed:gain ratio. **(D)** Serum cortisol calculated as a % change between d0 and d7 of the study. Values are means $\pm$ SE ($n = 6$ per treatment). ** indicates significant difference, $P \leq 0.01$; * indicates significant difference, $P \leq 0.05$ by Student's t-test.

Developing social skills has a role because...

- Strategies to reduce aggression at mixing
 - Does it fully reduce or just delay aggression? Would it delay social structure formation?
- Pigs showing avoidance of aggressive behaviour at grouping have been observed to have:
 - Reduced lesions following 24hrs of grouping, but increased lesions at three weeks post-grouping (Turner et al. 2017).
- Regrouping aggression maintains a function
- Reducing the intensity of the aggression at mixing will not likely prevent it happening

Early life effects: What is known #3

Consistently found: ***Sows teach piglets what is safe to eat***

- Piglets show a preference to consume the same food the sow is eating
- Piglets that can eat with the sow, or observe her eating show
 - Reduction in food neophobia
 - Increase feed intake (Oostindjer et al. 2011)
- Sows and piglets eating from same family feeder
 - Pre-weaning growth increased by 6% (Oostindjer et al. 2014).
- Smooth transition at weaning
 - Build in nutritional benefits

Early life effects: What is known #4

Consistently found: ***Human handling:***

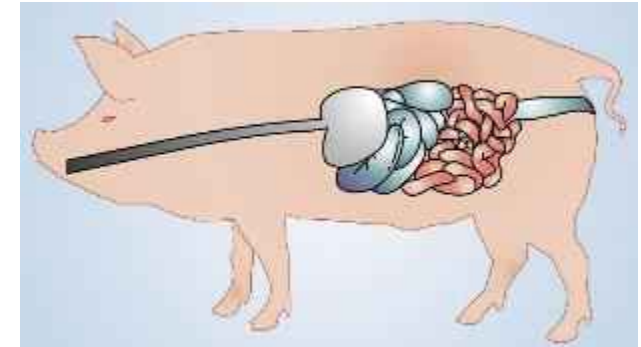
- Painful husbandry procedures shape the response of piglets to humans (Tallet et al. 2013, 2019)
 - More fearful of humans – conditions negative association
- Positive association: stroking – results in immediate change in behaviour (Muns et al. 2015)
 - Influenced social interactions between pigs (Zupan et al. 2016)
 - Increased oxytocin levels (Lurzel et al. 2020)
- Early positive handling – retained reduced fear 24 weeks of age (Hemsworth et al. 1986)
- Links to reduced piglet mortality in sows



Links to gut health:

Stress regulation and gut health

- Time off feed at weaning: influences gut health
 - Villi and crypt depth – long term nutrient absorption
- Psychological stress influences gut bacteria and health
- Cross-talk in gut: brain axis
 - Gut health influences behaviour
 - Gut: major role in manufacturing neurochemicals (Neuman et al. 2015)
- Gut health, stress, tail biting links



Early life effects: Knowledge gaps

- Relative contribution of separate factors
 - Effects are additive? Or some are more powerful than others?
 - The power of the interactive effects
- Short term – to long term effects
- Biologically relevant stimuli most commonly explored:
- Unknown: Do non-biologically relevant enrichment have the same benefits, or benefits when given in the pre-weaning period?
- Understand the strengths and limitations of methods.
- The changes in physiological pathways that develop.

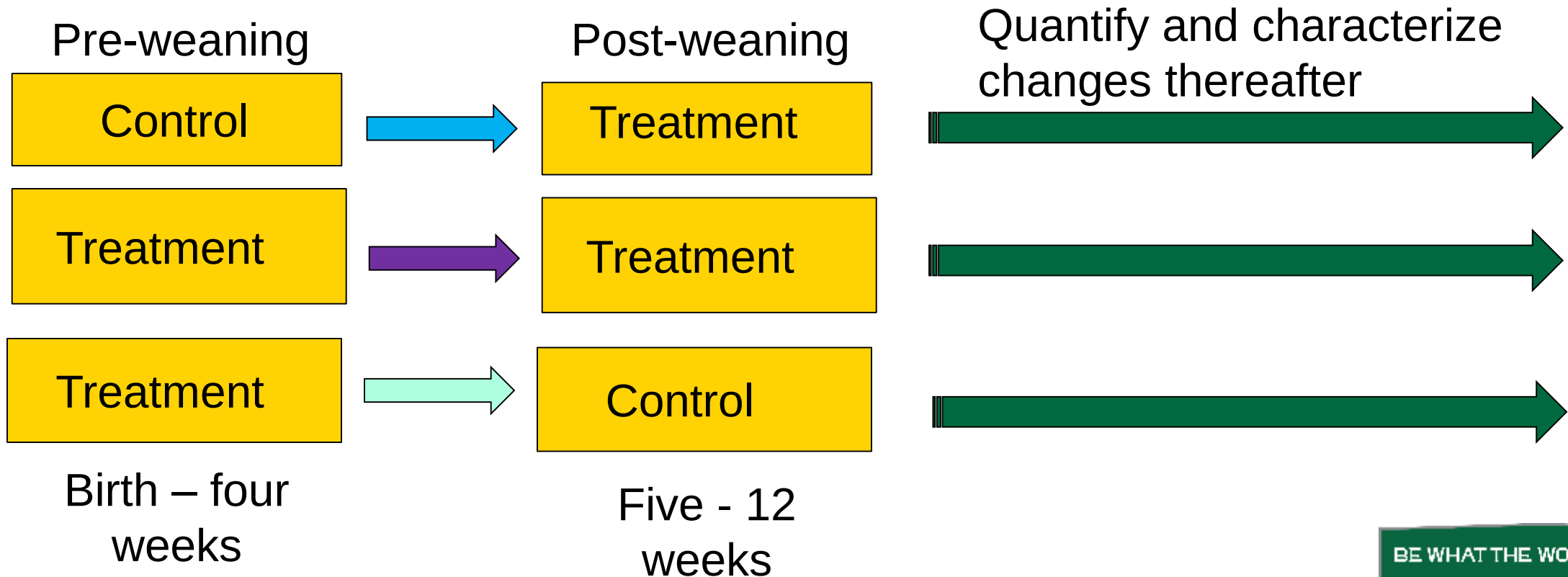
Goal 1: Gaps in knowledge

- Interlinking relationships between development, adaptation to weaning, ingestive behaviours, gut health and 'welfare outcomes'
- Understanding
 - Development of issues: birth to finish
 - Lasting effects of early life manipulations
 - In combination
- Deriving management strategies to support positive welfare outcomes and a more resilient pig



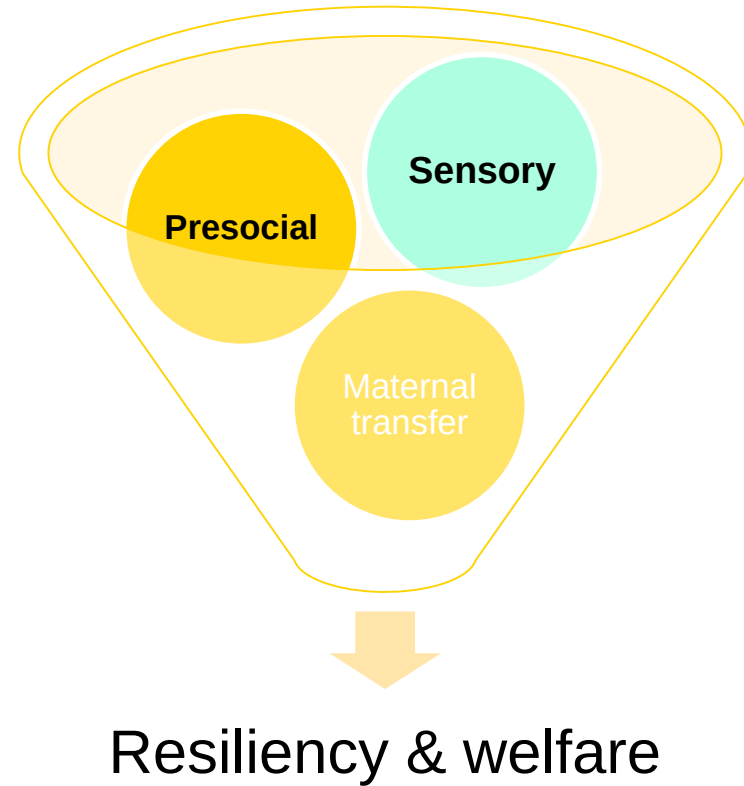
What we propose

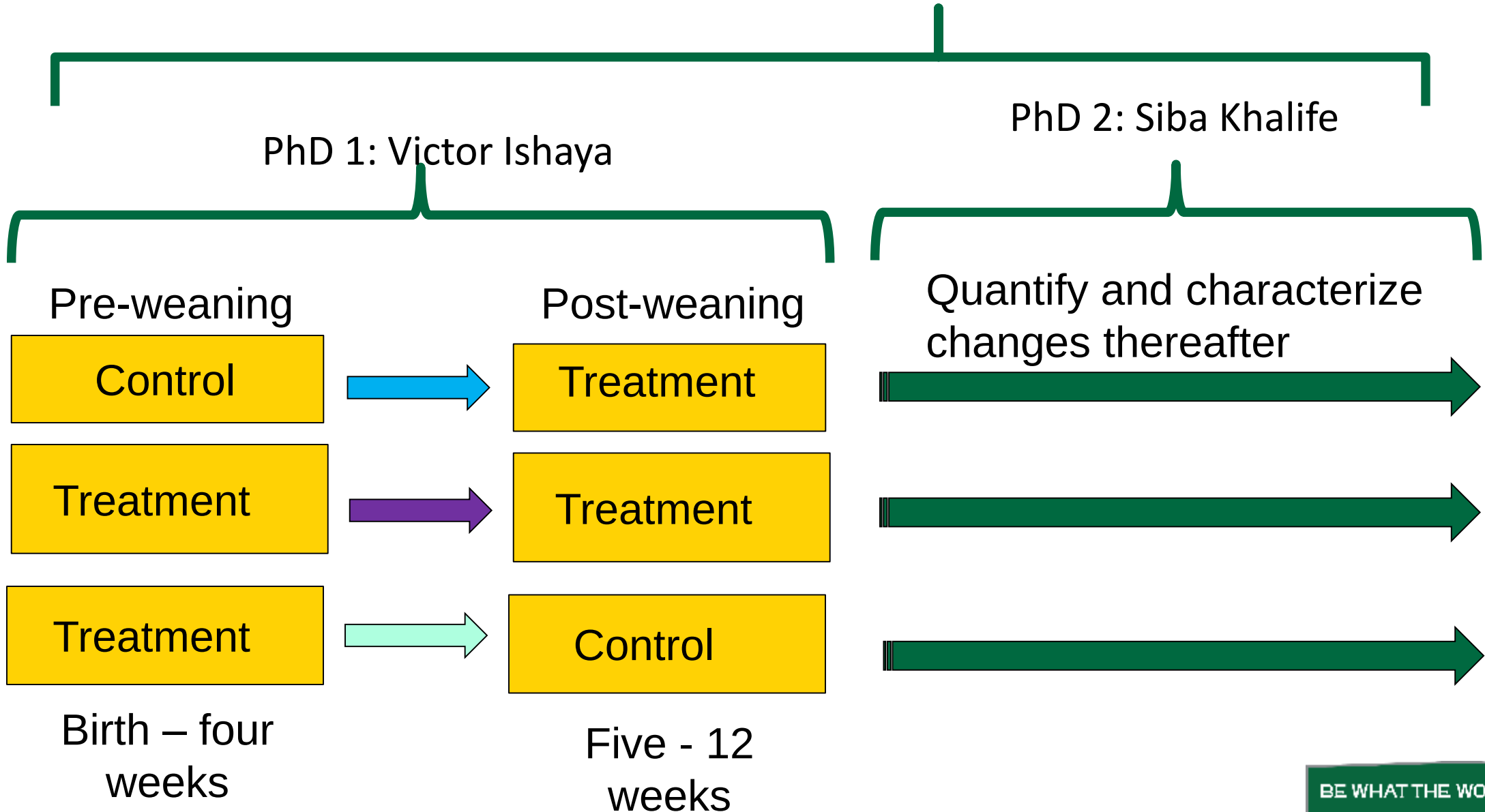
- Experiments x 2:
 - #1 Explores the separate effects of early life treatments
 - #2 Explores the interactive effects of early life treatments
 - Treatments combined
 - Interplay between early and later life environment



We can measure

- Gut health: Understand and separate nutritional from psychological effects
- Development of sociability traits
 - Long term social skills
- Resilience to stressors
 - Behavioural
 - Immunological
- Neurodevelopmental processes





Goal 1: Contribution to Science

1. Separate psychological from nutritional factors and understand their role in improving gut health
 2. Can early interventions can produce an animal that is more resilient at weaning with consequences for better gut health?
 3. Understand the relationship between behavioural resilience and gut health and the consequence for negative behaviours
 4. Understand the long-term consequences for health and behaviour
- Better understanding the causal factors behind existing welfare problems
 - Development of new types of commercially feasible production environments

Goal 1: Value to industry

Management systems that:

- Generate pigs better able to deal with challenges throughout life
- Can achieve better pig performance and require less antibiotic support
- Support better behavioural development

Role in Future Challenges

- Reducing antibiotic use
- Supportive against maladaptive behaviours
- Pigs with better stress resilience
- Efficient production
- Development of production systems that accommodate the behavioural requirements of the pig