Trace Mineral Function

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What are Trace Minerals?

- They are metals common in soils that are also essential for life.
- Animals and plants cannot live without them
- Sometimes not at sufficient concentration to maximize performance
- They play a central role in mediating many of the functions of the body's cells
- Involved in almost all areas of cell metabolism.

Trace Minerals for Cattle

- Some important trace minerals in ruminant nutrition are:
- Zinc (Zn)
- Manganese (Mn)
- Copper (Cu)
- Iron (Fe)
- Selenium (Se)
- Cobalt (Co)
- Iodine (I)
- Chromium (Cr)

The Role of Trace Minerals in Ruminant Nutrition

1. Zinc (Zn)

Functions:

- Carboxyeptidase enzymes – protein synthesis
- Keratinase – skin formation bone formation, wound healing.
- Hoofs – hoofs contain keratin
- Immune system

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2. Manganese (Mn)

Functions:

- Bone growth – important in connective formation (collagen)
- Enzyme cofactor – many metabolic enzymes, reproduction
- Energy metabolism – isocitrate dehydrogenase (TCA Cycle)

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3. Copper (Cu)

Functions:

- Haemoglobin synthesis – enzyme cofactor
- Energy metabolism – cytochrome oxidase
- Anti-oxidant system – superoxide dismutase
- Other enzyme systems
- Coat colour

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4. Iron (Fe)

Functions:

- Haemoglobin – essential component of the haem molecule; deficiency causes anaemia.
- As a cofactor in a number of dehydrogenase enzymes
- In mitochondrial electron transport chain – energy release – Cytochrome P450
- Almost never deficient in cattle
- Lots of iron in P supplements – care must be taken to not add too much

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5. Selenium (Se)

Functions:

- Anti-oxidant system – Glutathione peroxidase
- Thyroid function – Converts Thyroxine (T4 – inactive) to tri-iodo thyronine (T3 – active thyroid hormone)
- Thioredoxin reductase – reduced thioredoxin: DNA synthesis; disulphide reduction; immunomodulation; pregnancy; birth; central nervous system
- Selenoproteins – 8 or more different selenium proteins isolated with largely unknown functions

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6. Cobalt (Co)

Functions:

- Central to vitamin metabolism in that it is contained in Vitamin B12 (cyanocobolamin)
- The rumen bacteria make vitamin B12 using dietary cobalt.
- Vitamin B12 is an essential co-factor in enzymes associated with energy metabilism and recycling of the essential amino acid methinione

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7 Iodine (I)

Functions:

- Iodine is a component of the thyroid hormone which is responsible for regulation of metabolic rate.
- Deficiency of I results in goitre (enlargement of the thyroid gland).
- This in turn results in slow growth

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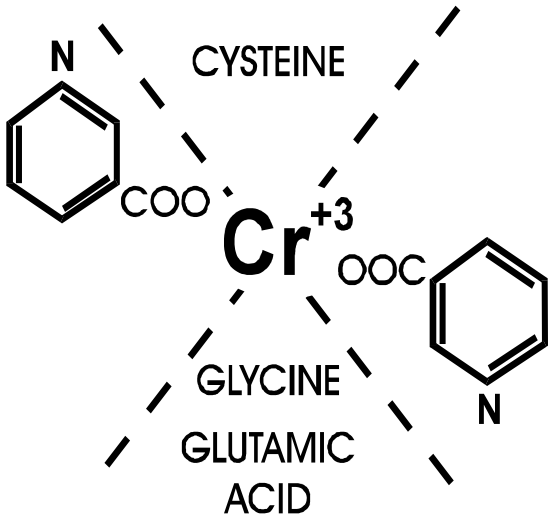
8 Chromium (Cr)

Functions:

- Part of glucose tolerance factor which helps bind insulin to body cells
- Glucose transport
- Stress
- Reproduction

Trace Minerals in Reproduction

- Proposed structure of glucose tolerance factor



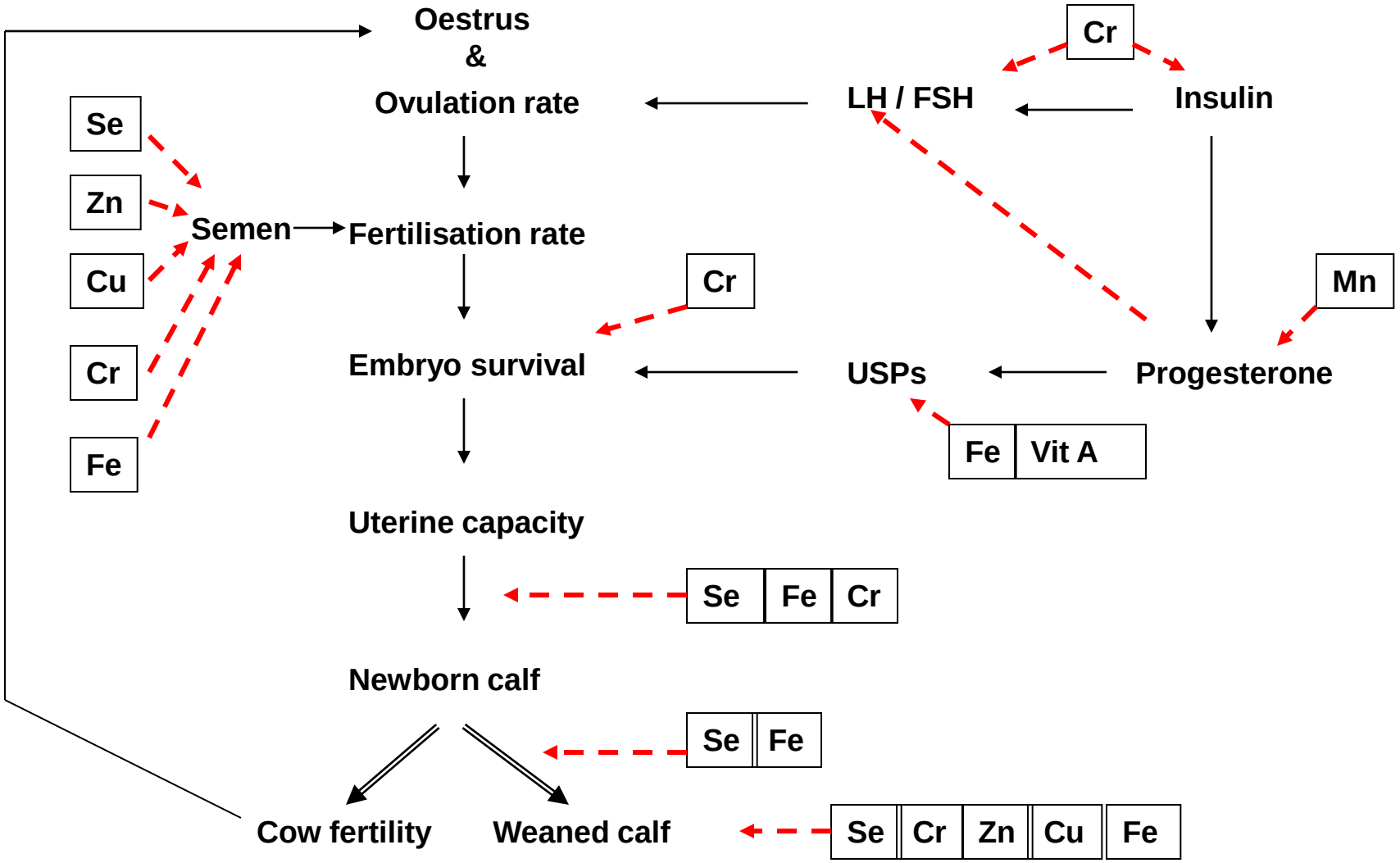
Minerals and reproduction

Fe	Enzymes, haemoglobin, placenta, uteroferrin, immunoglobulin
Se	Prolonged calving, milk let-down, mastitis, weak
Cr	Insulin, LH/FSH, progesterone, stress
Cu	Enzymes, fertility in many species, iron mobilisation
Zn	Enzymes, LH/FSH, uterine involution, milk synthesis, testicular sperm development
Mn	Enzymes, CL, anoestrus, abortion, still-births

Modified from Close W.M., 2004

Components of Cow Productivity

Role of trace elements



Trace Minerals

- Many soils in Australia are deficient in various trace minerals
- They must be consumed in the diet from plants or supplements
- You may not or may not know the status of your area
- Extremely small amounts are required
- The safe way is to supplement eg, via a lick