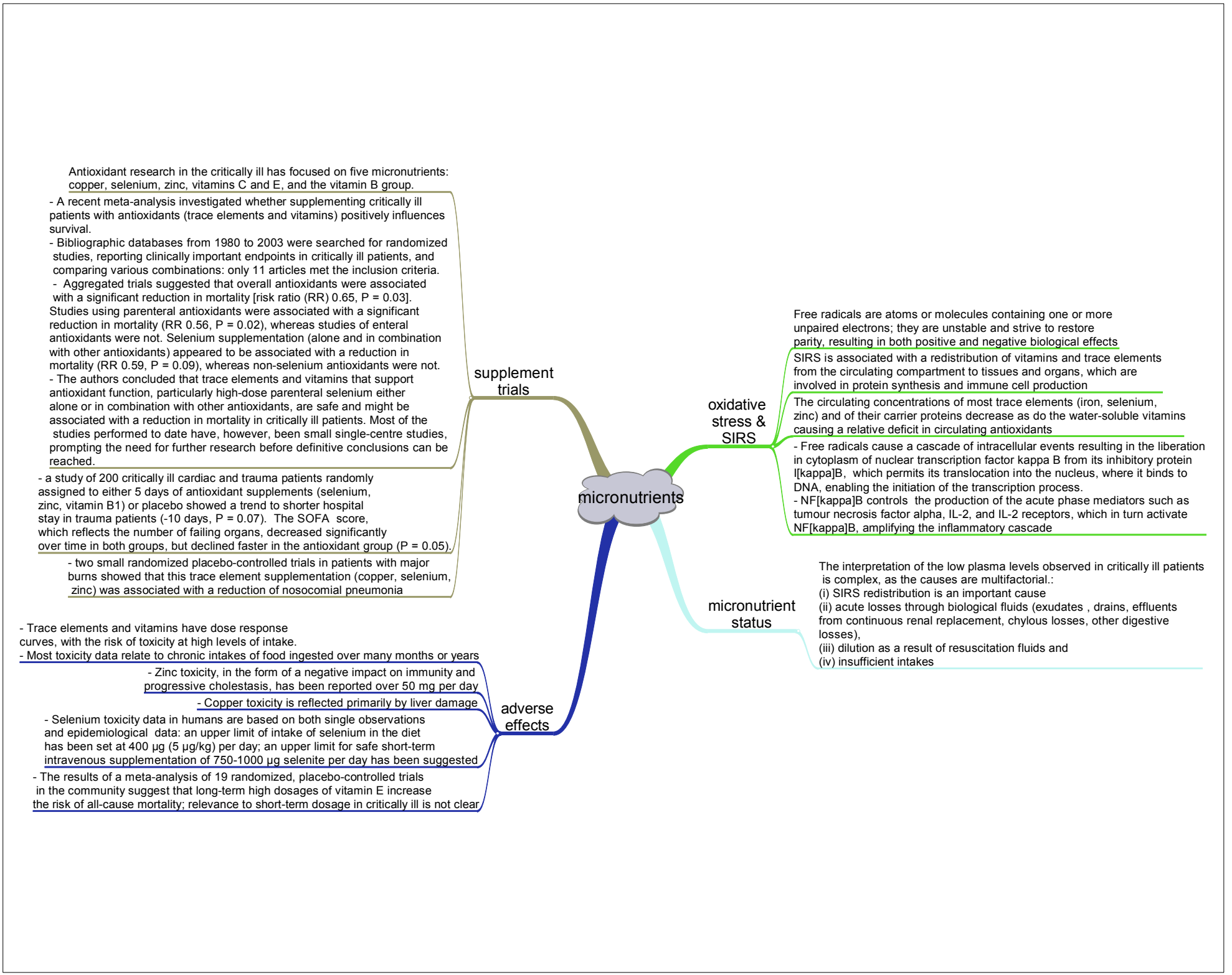
micronutrients
supplement trials
Antioxidant research in the critically ill has focused on five micronutrients: copper, selenium, zinc, vitamins C and E, and the vitamin B group.
- A recent meta-analysis investigated whether supplementing critically ill patients with antioxidants (trace elements and vitamins) positively influences survival.
- Bibliographic databases from 1980 to 2003 were searched for randomized studies, reporting clinically important endpoints in critically ill patients, and comparing various combinations: only 11 articles met the inclusion criteria.
- Aggregated trials suggested that overall antioxidants were associated with a significant reduction in mortality [risk ratio (RR) 0.65, P = 0.03]. Studies using parenteral antioxidants were associated with a significant reduction in mortality (RR 0.56, P = 0.02), whereas studies of enteral antioxidants were not. Selenium supplementation (alone and in combination with other antioxidants) appeared to be associated with a reduction in mortality (RR 0.59, P = 0.09), whereas non-selenium antioxidants were not.
- The authors concluded that trace elements and vitamins that support antioxidant function, particularly high-dose parenteral selenium either alone or in combination with other antioxidants, are safe and might be associated with a reduction in mortality in critically ill patients. Most of the studies performed to date have, however, been small single-centre studies, prompting the need for further research before definitive conclusions can be reached.
- a study of 200 critically ill cardiac and trauma patients randomly assigned to either 5 days of antioxidant supplements (selenium, zinc, vitamin B1) or placebo showed a trend to shorter hospital stay in trauma patients (-10 days, P = 0.07). The SOFA score, which reflects the number of failing organs, decreased significantly over time in both groups, but declined faster in the antioxidant group (P = 0.05).
- two small randomized placebo-controlled trials in patients with major burns showed that this trace element supplementation (copper, selenium, zinc) was associated with a reduction of nosocomial pneumonia
oxidative stress & SIRS
Free radicals are atoms or molecules containing one or more unpaired electrons; they are unstable and strive to restore parity, resulting in both positive and negative biological effects
SIRS is associated with a redistribution of vitamins and trace elements from the circulating compartment to tissues and organs, which are involved in protein synthesis and immune cell production
The circulating concentrations of most trace elements (iron, selenium, zinc) and of their carrier proteins decrease as do the water-soluble vitamins causing a relative deficit in circulating antioxidants
- Free radicals cause a cascade of intracellular events resulting in the liberation in cytoplasm of nuclear transcription factor kappa B from its inhibitory protein I[kappa]B, which permits its translocation into the nucleus, where it binds to DNA, enabling the initiation of the transcription process.
- NF[kappa]B controls the production of the acute phase mediators such as tumour necrosis factor alpha, IL-2, and IL-2 receptors, which in turn activate NF[kappa]B, amplifying the inflammatory cascade
micronutrient status
The interpretation of the low plasma levels observed in critically ill patients is complex, as the causes are multifactorial.:
(i) SIRS redistribution is an important cause
(ii) acute losses through biological fluids (exudates , drains, effluents from continuous renal replacement, chylous losses, other digestive losses),
(iii) dilution as a result of resuscitation fluids and
(iv) insufficient intakes
adverse effects
- Trace elements and vitamins have dose response curves, with the risk of toxicity at high levels of intake.
- Most toxicity data relate to chronic intakes of food ingested over many months or years
- Zinc toxicity, in the form of a negative impact on immunity and progressive cholestasis, has been reported over 50 mg per day
- Copper toxicity is reflected primarily by liver damage
- Selenium toxicity data in humans are based on both single observations and epidemiological data: an upper limit of intake of selenium in the diet has been set at 400 µg (5 µg/kg) per day; an upper limit for safe short-term intravenous supplementation of 750-1000 µg selenite per day has been suggested
- The results of a meta-analysis of 19 randomized, placebo-controlled trials in the community suggest that long-term high dosages of vitamin E increase the risk of all-cause mortality; relevance to short-term dosage in critically ill is not clear