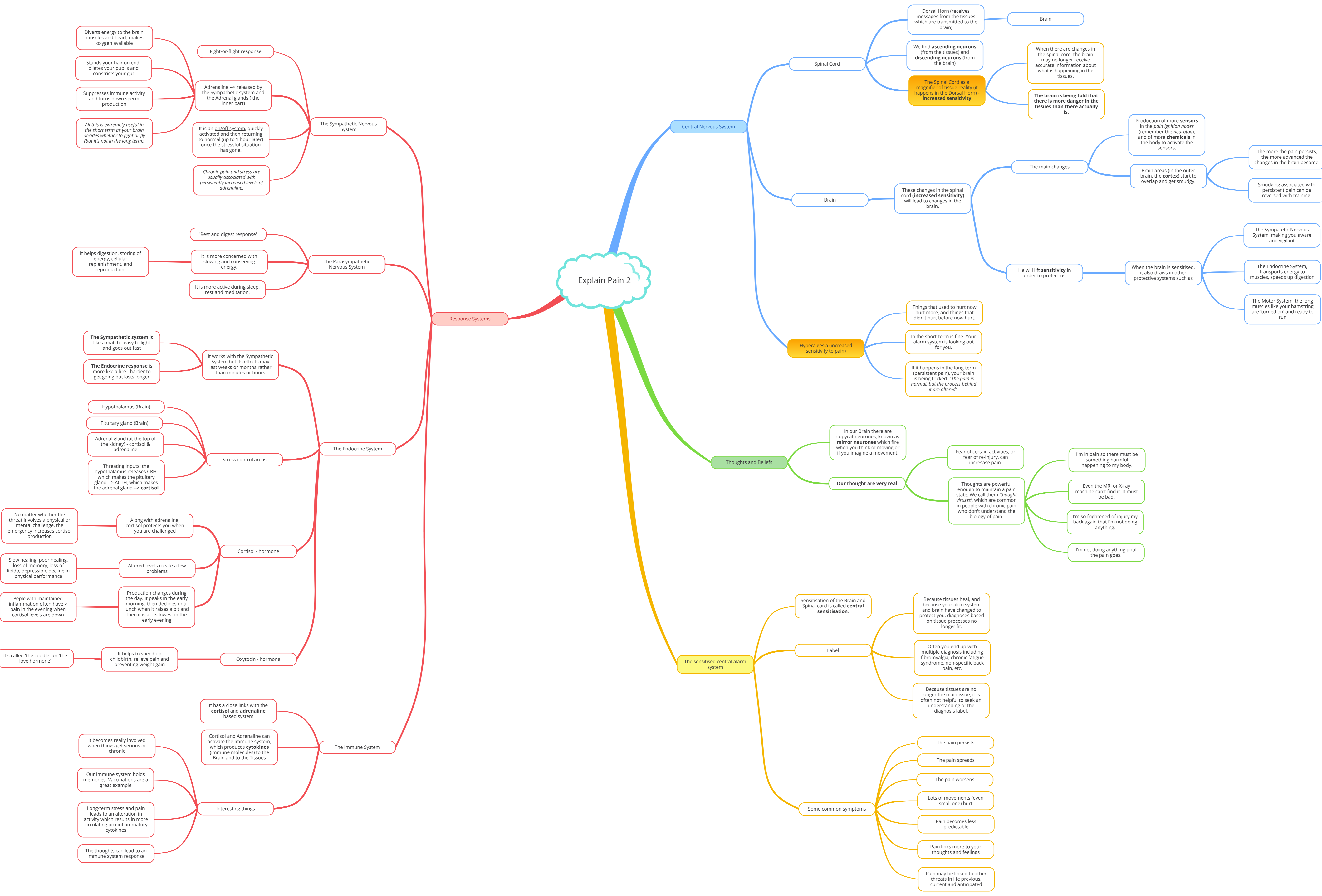


# Explain Pain 2



## Response Systems

### The Sympathetic Nervous System

- Fight-or-flight response
- Adrenaline -> released by the Sympathetic system and the Adrenal glands (the inner part)
- It is an on/off system, quickly activated and then returning to normal (up to 1 hour later) once the stressful situation has gone.
- Chronic pain and stress are usually associated with persistently increased levels of adrenaline.
- Diverts energy to the brain, muscles and heart; makes oxygen available
- Stands your hair on end; dilates your pupils and constricts your gut
- Suppresses immune activity and turns down sperm production
- All this is extremely useful in the short term as your brain decides whether to fight or fly (but it's not in the long term).

### The Parasympathetic Nervous System

- 'Rest and digest response'
- It is more concerned with slowing and conserving energy.
- It is more active during sleep, rest and meditation.
- It helps digestion, storing of energy, cellular replenishment, and reproduction.

### The Endocrine System

- It works with the Sympathetic System but its effects may last weeks or months rather than minutes or hours
- The Sympathetic system is like a match - easy to light and goes out fast
- The Endocrine response is more like a fire - harder to get going but lasts longer
- Stress control areas
  - Hypothalamus (Brain)
  - Pituitary gland (Brain)
  - Adrenal gland (at the top of the kidney) - cortisol & adrenaline
  - Threatening inputs: the hypothalamus releases CRH, which makes the pituitary gland -> ACTH, which makes the adrenal gland -> cortisol
- Cortisol - hormone
  - Along with adrenaline, cortisol protects you when you are challenged
  - Altered levels create a few problems
    - No matter whether the threat involves a physical or mental challenge, the emergency increases cortisol production
    - Slow healing, poor healing, loss of memory, loss of libido, depression, decline in physical performance
    - People with maintained inflammation often have > pain in the evening when cortisol levels are down
  - Production changes during the day. It peaks in the early morning, then declines until lunch when it raises a bit and then it is at its lowest in the early evening
- Oxytocin - hormone
  - It helps to speed up childbirth, relieve pain and preventing weight gain
  - It's called 'the cuddle' or 'the love hormone'

### The Immune System

- It has a close links with the cortisol and adrenaline based system
- Cortisol and Adrenaline can activate the Immune system, which produces cytokines (immune molecules) to the Brain and to the Tissues
- Interesting things
  - It becomes really involved when things get serious or chronic
  - Our Immune system holds memories. Vaccinations are a great example
  - Long-term stress and pain leads to an alteration in activity which results in more circulating pro-inflammatory cytokines
  - The thoughts can lead to an immune system response

## Central Nervous System

- Spinal Cord
  - Dorsal Horn (receives messages from the tissues which are transmitted to the brain)
  - We find ascending neurons (from the tissues) and descending neurons (from the brain)
  - The Spinal Cord as a magnifier of tissue reality (it happens in the Dorsal Horn) - increased sensitivity
- Brain
  - When there are changes in the spinal cord, the brain may no longer receive accurate information about what is happening in the tissues.
  - The brain is being told that there is more danger in the tissues than there actually is.

### Hyperalgesia (increased sensitivity to pain)

- Things that used to hurt now hurt more, and things that didn't hurt before now hurt.
- In the short-term is fine. Your alarm system is looking out for you.
- If it happens in the long-term (persistent pain), your brain is being tricked. "The pain is normal, but the process behind it are altered."

## Thoughts and Beliefs

- In our Brain there are copycat neurones, known as mirror neurones, which fire when you think of moving or if you imagine a movement.
- Our thoughts are very real
  - Fear of certain activities, or fear of re-injury, can increase pain.
  - Thoughts are powerful enough to maintain a pain state. We call them 'thought viruses', which are common in people with chronic pain who don't understand the biology of pain.
    - I'm in pain so there must be something harmful happening to my body.
    - Even the MRI or X-ray machine can't find it. It must be bad.
    - I'm so frightened of injury my back again that I'm not doing anything.
    - I'm not doing anything until the pain goes.

## The sensitised central alarm system

- Sensitisation of the Brain and Spinal cord is called central sensitisation.
- Label
  - Because tissues heal, and because your alarm system and brain have changed to protect you, diagnoses based on tissue processes no longer fit.
  - Often you end up with multiple diagnosis including fibromyalgia, chronic fatigue syndrome, non-specific back pain, etc.
  - Because tissues are no longer the main issue, it is often not helpful to seek an understanding of the diagnosis label.
- Some common symptoms
  - The pain persists
  - The pain spreads
  - The pain worsens
  - Lots of movements (even small one) hurt
  - Pain becomes less predictable
  - Pain links more to your thoughts and feelings
  - Pain may be linked to other threats in life previous, current and anticipated