

What happens to children's growth when the hypothalamus isn't functioning right?

The hypothalamus is a little known but fascinating and vital part of the human body. Dr Helen Spoudeas has spent over 20 years providing endocrine care in renowned UK children's clinics, including the famous Great Ormond Street Hospital. This has involved working with children with a range of hypothalamic dysfunctions.

Learn from Dr Spoudeas about what the hypothalamus is and why it's critically important. She also highlights how hypothalamic dysfunction has the potential to affect many aspects of children's lives.



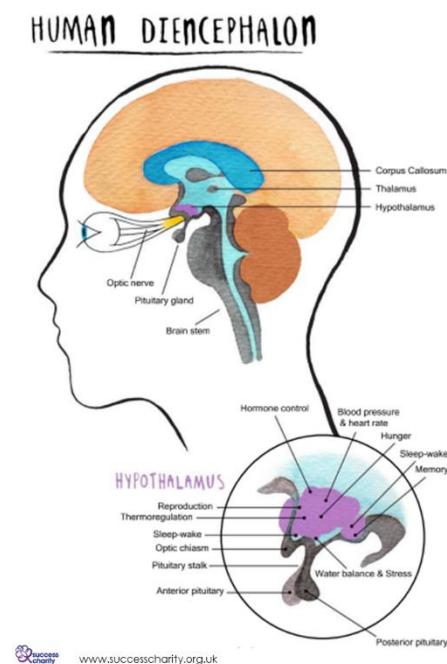
What is the hypothalamus?

The [hypothalamus](#) is the most primitive organ in our body. This is because, in essence, it controls life itself. It's a small area of our brains that is located in the mid-brain, right under the thalamus above the pituitary and behind the eyes. This means that it is very deep-seated, and difficult to access and see with MRI scans, making it complex to fully understand.

Nature has evolved to protect it: it's hard wired and difficult to disrupt, but it's also very dangerous to intercept because when things go wrong, the outcome can be devastating: the consequences of unbalanced hormones in the body's messages can take many forms. As we can't easily measure the hypothalamus or all its pulsative hormones, it has tended to get forgotten. The importance of the hypothalamus has only really become clearer as we treat children with brain tumours or maldevelopment in this area.

The hypothalamus is a tiny gland, deep in the midbrain, close to our eyes and barely visible on an MRI scan. It is connected by a stalk to the pituitary gland. Together they form the 'Hypothalamo-Pituitary Axis' (HPA) - a central 'post office' receiving and delivering the body's 'letters'.

The hypothalamus processes stimuli, (light and dark, temperature, danger, stress, hunger, thirst, emotion), sending hormones (blood-borne messages) in a downstream waterfall, through the pituitary gland and onwards to each of the body's glands (letterboxes).



What does the hypothalamus do?

The hypothalamus controls vital regulatory functions that we often take for granted. It regulates the body's endocrine system by sending hormone messages to the **pituitary gland**. **Together they makeup** a vital regulatory unit called the Hypothalamus Pituitary Axis or HPA which in turn sends hormone messages to a variety of glands all over the body. **The** endocrine system, through this at just the right time and for the right amount performs a large range of vital functions:

- Temperature control
- Memory
- Growth and puberty
- Sex drive in adults
- Our ability to regulate sleep and being awake
- Our "fight or flight" response
- Childbirth and breastfeeding
- Our ability to control our appetite and metabolism

- Our ability to feel emotions and manage our behaviour
- Regulating blood pressure
- Our severe thirst liability to control water regulation

The HPA is a tight messaging system. Think of it like the body's post office:

1. The hypothalamus receives signals from the body for outside world and sends hormones (messages) through to the pituitary (the messenger)
2. Then, the pituitary passes the message on to the rest of the body's glands (the recipients of the messages).
3. Once these glands receive the (messages) they send a message receipt back to the hypothalamus. Thus the "see-saw" remains in perfect balance, resulting in a fully functioning body.
4. Too much or too little of a hormone upsets the balance scales and causes symptoms.

What are the signs and symptoms of hypothalamic dysfunction?

Children with hypothalamic dysfunction may experience one or more of a wide range of symptoms. As the hypothalamus controls so many aspects of living, the array of can be vastly different from each other and depend on whether there is deficiency or excess hormone.

- Unexplainable laughing or crying or seizures
- [Temperature disorders \(hypo and hyperthermia\)](#)
- [Sleep disorders](#)
- [Behavioural problems](#)
- [Precocious puberty](#) [when a child's body enters puberty too soon and pubertal delay/arrest (which leads to infertility)]
- Severe early [childhood obesity](#) or severe Cachexia (a disorder that causes extreme weight loss and muscle wasting), growth excess or deficiency
- [Diabetes insipidus or SAIDH \(syndrome of inappropriate anti diuretic hormone\)](#), which causes an excessive drive to drink water and excessively urinate. (Inappropriate thirst suppression and water retention)

Sometimes, children with hypothalamic dysfunction get what we call dancing eye syndrome (also called opsoclonus), when the eyes make unusual and uncontrollable eye movements, which may herald a tumour in the optic and hypothalamic pathways.

Is childhood obesity often caused by hypothalamic dysfunction?

Hormone dysfunction is one thing, but [childhood obesity](#) is another. It's rare that a child's obesity is caused by hormone abnormalities or hypothalamic disorder syndromes. For a detailed explanation, see my other article "[Diet, hormones, genes and the risks of childhood obesity](#)".

How serious is hypothalamic dysfunction?

The level of seriousness depends on **what's causing the dysfunction** and **how severe the hormone disruption or hypothalamic abnormalities are**. It's very variable e.g. from minimal problems to devastating consequences.

In my article "[Understanding hypopituitarism's effect on your child's health](#)", I explain more about the hypothalamus and how a lack of one or more hormones (hypopituitarism) is treated to restore children's quality of life.

Are you concerned about your child's hormonal development and growth? Learn how Dr Spoudeas can help you care for your child's health - visit her [profile](#).

Understanding hypopituitarism's effect on your child's health

Hypopituitarism ("hypo-" meaning "under") happens when the pituitary gland is not active enough. While it can be difficult to diagnose, it's incredibly important that people of all ages, particularly children, receive treatment to get their hormones back in balance.

Dr Helen Spoudeas is a leading UK paediatric endocrine subspecialist who has worked with children with hypopituitarism for many years. She provides you with a thorough guide so that you can understand what having hypopituitarism means for your child, as well as the life-long (and safe) treatment involved.



What is hypopituitarism?

To understand hypopituitarism, often resulting from hypothalamic dysfunction, I recommend that you quickly catch up on the basics of the hypothalamus. I explain what the hypothalamus is and its function in my other article: [What happens to children's growth when the hypothalamus isn't functioning right?](#)

As a result, the gland does not make enough pituitary hormones. There are eight hormones produced by the pituitary gland and **hypopituitarism can result in the deficiency of one hormone, growth excess and growth failure, some hormones or all eight of these hormones.** Usually, when the pituitary gland isn't functioning at all and none of the eight hormones is being produced, we call it panhypopituitarism ("pan" meaning "all" in Greek).

If the pituitary gland is underactive in children, growth hormone (from the front of the pituitary) tends to be affected first, although may be diagnosed later. Then puberty and later thyroid hormones. The

most serious hormone to lack, is the stress response hormone (cortisol) , which is usually the most robust but the most life-threatening. Lacking “anti-diuretic hormone” (ADH) from the back of the pituitary, is also potentially life threatening if thirst is masked (e.g. by coma or sedation).

What’s the link between the hypothalamus and the pituitary gland?

The hypothalamus regulates the body’s endocrine system by sending hormones to the pituitary gland. The endocrine system is a variety of glands that secrete hormones all over the body so that it can perform a large range of functions.

At the beginning of my **video looking at [pituitary gland disorders and their treatment](#)**, I provide a detailed but comprehensive explanation on how the pituitary gland works using diagrams.

The pituitary gland consists of the **anterior pituitary** and the **posterior pituitary**. The hypothalamus and pituitary gland are connected by the **pituitary stalk**, which allows hormones to pass to the pituitary, through the bloodstream.

When looking for hormone dysfunction in the pituitary gland, **we need to ask ourselves in which area is the deficiency happening** – the posterior pituitary or anterior pituitary. The importance of differentiation is because it can help us understand which diseases are more likely and which hormones are affected. For example, the posterior pituitary gland is more intimately linked to the hypothalamic part above it and a deficiency can result in classic problems like [diabetes insipidus](#), which is a life-threatening deficiency of the hormone that helps retain water (ADH). It is the most serious of the deficiencies from the posterior pituitary.

What are the signs of hypopituitarism in children?

There are several symptoms and signs of hypopituitarism in children. Some of these are “non-specific” while the sign of deficiency can evolve over time and can overlap with many other disorders.

- Growth failure
- Delayed puberty
- Tiredness and general malaise due to an absence of the stress (cortisol) or thyroid hormones

- Unexplained weight gain due to an absence of growth, thyroid or puberty hormone.
- [Diabetes insipidus](#) (an excessive drive to drink water and excessively urinate). Not due to sugar diabetes.
- Absence of menstrual periods in a girl.

What can cause hypopituitarism in children?

Several factors could cause the pituitary gland to become underactive in children. These include a [pituitary tumour](#), a **genetic condition** or **maldevelopment** (when a child's brain hasn't grown in the "normal" way).

Traumatic head injuries can also be a cause. We've found hormone dysfunction in some children who are going through rehabilitation after a serious traffic accident. A severe head injury can transect the pituitary stalk (which links the hypothalamus and pituitary gland).

Severe whiplash or head injury that results in prolonged coma are two ways of causing "invisible" damage to the stalk or hypothalamus above it.

Is hypopituitarism treatable?

Hypopituitarism is treatable. It's incredibly important to diagnose, but there is often a delay in diagnosis due to the subtle nature of symptoms and slow evolution of signs. This is definitely only hypothalamic.

Treating hypopituitarism begins with trying to understand the cause. For example, if you have a tumour that's affecting the hypothalamus or pituitary gland, we need to know how big it is, how to treat it and how to prevent further dysfunction down the HPA and target gland axis. At the same time we can replace any missing hormones.

How is hypopituitarism treated?

To recap, hypopituitarism means your pituitary gland isn't active enough. This means that a child isn't producing enough of one, several or all of the eight hormones produced by the pituitary gland. Therefore, **we need to restore balance in the hormone(s) the child is missing to treat the hypopituitarism**. At the end of the day, the most important form of treatment is **hormone replacement therapy**.

As we implement hormone replacement therapy, **associated problems with the hypopituitarism become easier to manage** e.g. growth, weight and any malaise can be improved and puberty can occur at the right time, with benefits on wellbeing. Some issues, such as weight problems, can still be difficult.

How long will my child need to be on medication?

When hypopituitarism occurs, it's usually permanent and lifelong but this should be reconfirmed before adult transition. **There is usually no cure, only treatment**. Even if the cause is a tumour (lump) which is removed or prevented from growing bigger, hormone deficiencies can still continue to evolve. Hormones must be in balance and we aim to restore this balance as naturally as possible for as long as necessary, generally this means life-long treatment.

Can hypopituitarism treatment be dangerous?

Hormone replacement therapy for hypopituitarism is entirely safe as long as patients take it at the advised daily replacement dose. There should be **no side-effects or if relevant, tumour growth**, therefore restoring normality to the child's life. We (medical specialists) that work out a dose to deliver changes to a child's growth that is as near to nature's replacement dose as possible. It does require patience and commitment working out how to mimic the hormones natural distribution, is a 24-hour task. It involves remembering a daily management timetable of several medications, and emergency protocols.

Once we overcome the challenge of figuring out the right dose and substitution of the deficient hormone(s) for that child at a particular age, we can then begin to manage the secondary problems (e.g. obesity, schooling difficulties etc.)

What specialists are involved in treating hypopituitarism?

Often, managing a primary hypothalamic problem causing hypopituitarism in a child, requires many different specialists to create a treatment plan.

- An endocrinologist
- A neurology specialist
- An ophthalmologist (eye surgeon) if vision is affected
- An oncologist (if a tumour is present)
- An educational plan with a neurodevelopmental consequences.

More research, particularly on neuro-disability, psychiatric, psychological and support, is needed. **Hormones are just one aspect. However, we are consistently learning more about the hypothalamus and hypopituitarism.**

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