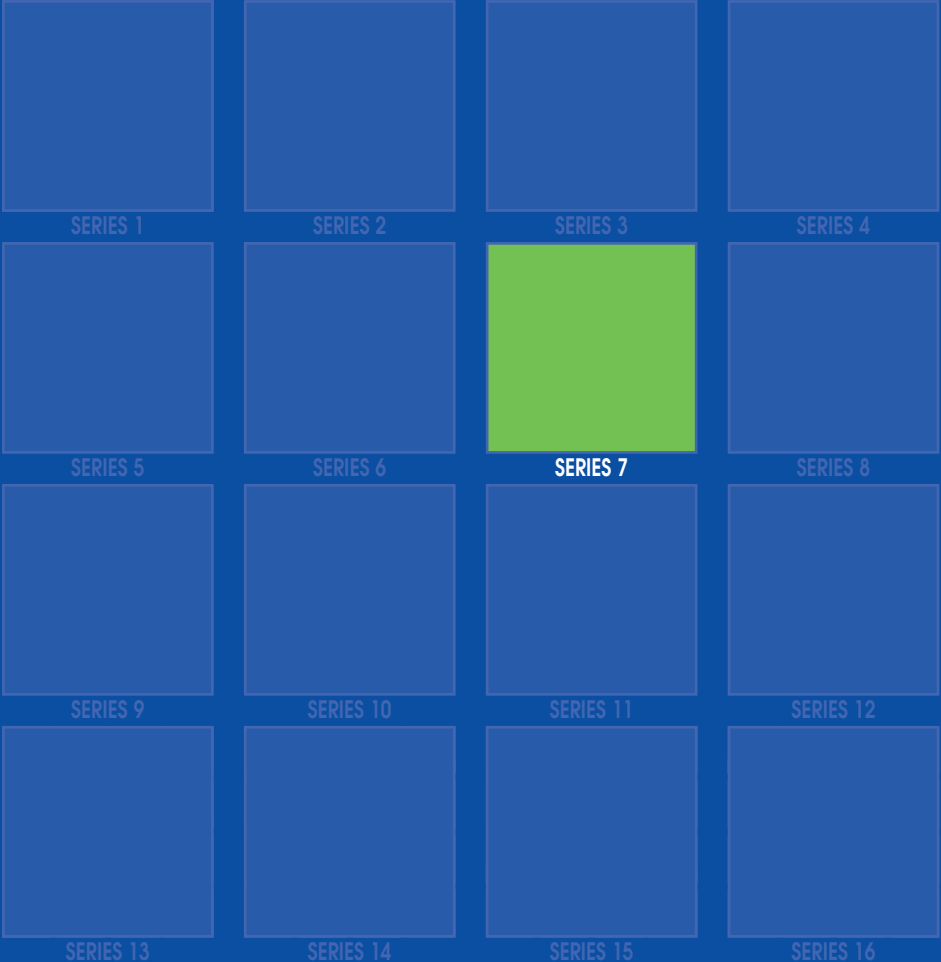




Growth Hormone Deficiency in Adults

A Guide for Patients



This booklet is intended to provide help when dealing with problems or difficulties associated with your condition and to provide information which will enable you to understand your treatment better and give you a basis for discussions with your GP or specialist when necessary.

If you require further general information about *adult growth hormone deficiency*, you can contact the Child Growth Foundation.



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GROWTH HORMONE DEFICIENCY IN ADULTS – Series 7. (Revised June 2000)

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The British Society for Paediatric Endocrinology and Diabetes (BSPED) is an association of specialists who deal with hormone disorders in children.

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Growth Hormone Deficiency in Adults: A Guide

Levels of growth hormone are normally relatively high during childhood, reaching a peak during the adolescent growth spurt. The levels then progressively decrease during adult life and in middle age the levels have become significantly lower. It is becoming increasingly evident that even these low levels may play an important role in maintaining the body's normal functions. This booklet will discuss the need for these levels to be maintained and, if the levels are deficient in adulthood, how treatment may help.

INTRODUCTION

Growth hormone has previously been used with the main aim of helping short children with a deficiency of growth hormone to grow to reach their genetic potential for adult height. However, we have now come to realise that growth hormone has many other actions as well as promoting growth. This booklet is written mainly for adolescents and young adults who have growth hormone deficiency, and received growth hormone treatment as children/adolescents to help with their growth, and who now require advice about whether growth hormone replacement therapy should be continued into adulthood, after growth has stopped. In addition, this booklet may help those individuals who have become deficient in growth hormone as adults for various medical reasons, and discusses the benefits that some have experienced while receiving growth hormone replacement.

Normally, growth hormone levels are relatively high during childhood and reach a peak during the adolescent growth spurt. The levels then progressively decrease during adult life and in middle age the levels have become significantly lower when compared with younger people. However, because of the many effects growth hormone has in the body, even these relatively low levels probably play an important role during adulthood.

Of course, every patient with a deficiency of growth hormone should discuss their individual needs with their specialist and hormone replacement therapy is one option which should be covered.

There are many children who are **not** growth hormone deficient but who have received growth hormone treatment during childhood to help improve their growth (eg Turner syndrome girls). Because they have relatively normal growth hormone levels, when they have stopped growing further growth hormone treatment is not needed. This booklet is for those individuals who have a diagnosis of **growth hormone deficiency**.

HORMONES

Hormones are the chemicals that carry messages from one cell to another via the blood stream, Growth hormone acts directly and indirectly on the growth of bones, tissues and organs. Another name for growth hormone is somatotropin. Growth hormone deficiency occurs when the pituitary gland, a small pea-sized gland at the base of the brain, fails to produce adequate levels of growth hormone. Part of the brain called the hypothalamus controls the levels of hormones in the blood by triggering the pituitary gland into producing the required hormones. This low level of growth hormone may be the result of problems in the hypothalamus, or with the link with the pituitary, or with the pituitary gland itself. A deficiency of growth hormone may occur alone or it may be associated with other pituitary hormone deficiencies. Frequently, the hormones which control sexual development (the gonadotrophins) as well as the hormones that control the thyroid gland (TSH) are affected. Much less frequently, the hormone which stimulates the adrenal gland (ACTH) is involved. All these hormones can be replaced by regular medication.

One of the main functions of the hormone called growth hormone is to stimulate growth in height and this is why it has this name, However, in adult life, as well as in childhood, growth hormone has other equally important functions which are not directly related to growth. An alternative name for growth hormone is somatotropin.

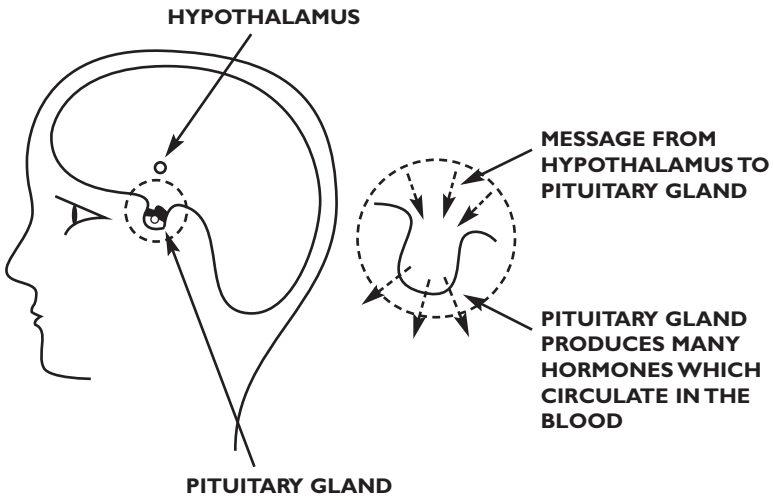


Figure 1: The hypothalamus and pituitary gland

WHAT IS GROWTH HORMONE DEFICIENCY?

In early childhood, the reason why the pituitary gland stops working properly is often not known. It does not produce adequate levels of growth hormone and there may be a lack of the other pituitary hormones too. In later childhood, growth hormone deficiency may result from irradiation treatment to the brain for either a brain tumour or leukaemia. In these children, the irradiation treatment may damage the hypothalamus and the pituitary gland and as a result growth hormone production and secretion may be affected. Whatever the cause, growth hormone deficiency occurring in childhood will continue into adolescence and adulthood.

Pituitary tumours may occur during adult life and these can produce a deficiency of pituitary hormones, either as a direct effect of the tumour or resulting from surgery and or X-ray treatment.

Many of the symptoms of growth hormone deficiency in adulthood are subtle and it may not be realised by the individual, or even their specialist, that some of the problems they have are actually related to the deficiency of growth hormone. Only when growth hormone deficiency syndrome is suspected, and a trial of replacement hormone therapy is given, does the improvement in general health and quality of life become apparent. As part of your initial assessment, it will probably be necessary for you to have a test of growth hormone secretion to confirm or exclude the diagnosis of growth hormone deficiency. This is usually done by giving insulin to lower your blood sugar level which stimulates the release of growth hormone from the pituitary gland. There are alternative tests which stimulate the release of growth hormone which may be preferred by your specialist. In addition to testing for growth hormone deficiency, some tests also indicate any other pituitary hormones which may be deficient.

ADOLESCENCE AND GROWTH HORMONE DEFICIENCY

There have been various studies looking at what happens to adolescents with growth hormone deficiency after they have stopped growth hormone treatment because growth has ceased. If the individual has multiple pituitary hormone deficiency (MPHD), and is not just deficient in growth hormone, any assessment of well-being has to take this into account. The deficiency of other hormones may exaggerate some or all of the symptoms and the need for appropriate hormone replacement therapy should be evaluated before the value of growth hormone treatment can be assessed.

Many young adults with growth hormone deficiency often do not fulfil their genetic potential for final height, even with growth hormone treatment. This may be for a variety

of reasons, including late diagnosis, but it means that they remain relatively short compared to their friends and colleagues. In addition, some have poor muscle strength and experience difficulty in carrying out normal physical activities. They are frequently aware of a general lack of energy and vitality which can affect academic achievements and subsequent qualifications and create problems later with careers and work prospects. If an adult with growth hormone deficiency is experiencing these problems, he/she is described as having *Adult Growth Hormone Deficiency Syndrome*.

It is important to emphasise that not all young adults with growth hormone deficiency experience these problems but for those who do, we hope this booklet will help to explain the reasons why and how they may be helped.

WHY STOP GROWTH HORMONE TREATMENT WHEN GROWTH HAS CEASED?

Before 1985, supplies of growth hormone were very limited and growth hormone treatment was used only for children with severe growth hormone deficiency in order to improve their growth and final height outlook. Since growth hormone has been manufactured biosynthetically and is in plentiful supply, other possible uses have been studied more widely.

There appear to be many additional indications for growth hormone other than for the promotion of growth in childhood, and growth hormone deficiency in adults is one of the areas where growth hormone replacement is being shown to be of benefit. There are now a number of medical reasons to suggest that growth hormone treatment should be continued into adult life in certain individuals.

WHAT OTHER ROLES DOES GROWTH HORMONE HAVE?

One of the major roles of growth hormone in childhood is to stimulate growth. However, growth hormone has other equally important effects on the body's functions, many of which have only recently been appreciated.

Growth hormone is important for maintaining normal levels of sugar in the blood. This is important for adults as well as children during everyday life, but especially during periods of prolonged fasting (e.g. severe dieting, religious practices etc) or after the consumption of alcohol. Growth hormone also has other important effects on the metabolism of sugar, fats and protein. It is an important "anabolic" hormone that is to say it is important in the building up of tissues in the body, including muscle and bone. It also supports the immune system and helps the body to fight infection.

WHAT ARE THE BENEFITS OF GROWTH HORMONE TREATMENT IN ADULT LIFE?

There are several benefits listed below. You may not be directly aware of some of these as they affect the internal functions of the body. However, some changes will be more noticeable as they may have a more direct effect on your daily life.

It must be emphasised that this is an area of active research. A considerable amount of information has already been accumulated but medical knowledge is constantly being updated. If you ask, your specialist will keep you informed about new information.

Growth hormone treatment is now licensed for use in adults with growth hormone deficiency in certain circumstances. It may be prescribed by your General Practitioner (GP) on the advice of a specialist. There may be particular reasons why your specialist considers that you would benefit from treatment and your specialist can recommend that your GP prescribes growth hormone replacement for you.

Quality of life and general well-being

Although it may seem that this is a difficult assessment to make, there are well established questionnaires which measure ‘perceived ill health’ and identify a quality of life quite accurately and reproducibly. Adults with growth hormone deficiency have been shown to have more than the usual number of symptoms of a poor quality of life and these include;

- reduced energy and vitality
- poor general health
- impaired ability to cope
- disturbed emotional reactions
- increased anxiety

These subsequently often lead to a lack of positive well-being, depressed mood and feelings of social isolation. It has been shown that these symptoms can improve or even disappear during growth hormone therapy.

Hypoglycaemia (low blood sugar)

In children and adults who are growth hormone deficient, and who are not receiving growth hormone treatment, the symptoms of low blood sugar are experienced usually if there has not been sufficient food intake. Irritability is most often noticed and this usually disappears after eating. Excessive sweating at night and waking up with a headache may also be symptoms. These are real problems and if you are experiencing any of these you should tell your doctor.

“Hypoglycaemia is often written off as a neurotics problems – one doctor scoffed at me when I said I had a sugar problem (I didn’t know back then that it’s a well known symptom of GHD)”

Patients should be counselled about not drinking excessive quantities of alcohol as it reduces blood sugar which may lead to severe hypoglycaemia. Alcohol lowers the blood sugar levels very quickly and in some individuals a bad ‘hangover’ may be felt after only one glass of wine’

Growth hormone has important actions in preventing the occurrence of low blood sugar if food is not taken regularly. This may be of importance in any of those religions where food intake is particularly restricted as part of the religious practice. Growth hormone also helps control the accumulation of fat so weight gain can be a frequent problem for individuals with growth hormone deficiency. Slimming is difficult and, in most cases, is unsuccessful as it is important that patients with growth hormone deficiency do not have prolonged periods of fasting. It is particularly important to discuss with your specialist how to avoid low blood sugar levels occurring during the night and early in the morning when there has been a relatively long period without food (NB eating a banana just before bedtime may help!).

Control of blood sugar levels generally improves during growth hormone therapy. Also, alcohol is better tolerated in normal amounts, fat distribution alters and weight control becomes considerably easier.

Bone quality

Growth hormone is important for building up the strength of bones and individuals with growth hormone deficiency may develop osteoporosis (thin or brittle bones). In adulthood this is extremely difficult to reverse and those treatments currently available usually only prevent further loss of bone strength. Osteoporosis is a very painful and disabling condition and it may be that one of the most important reasons for continuing growth hormone replacement therapy into adult life is to strengthen and maintain the overall quality of the bones.

Muscle strength and energy

It has been well documented that in adults with growth hormone deficiency, there is reduced muscle size, strength and performance. These problems can often be overcome during growth hormone replacement therapy.

Cardiovascular disease

Adults with growth hormone deficiency have a higher risk of illness from heart disease and it is probable that long-term treatment with growth hormone will decrease this risk.

Blood cholesterol

It has been shown that adults with growth hormone deficiency do prematurely develop disease of the major blood vessels which may be associated with a higher than normal number of risk factors including increased abdominal fat and high levels of cholesterol in the blood. Treatment with growth hormone has been shown to lower the level of cholesterol.

Psychological problems

Children with growth hormone deficiency do have a high incidence of emotional problems and may experience difficulty fitting into society, first during childhood and then as adults. Some of these problems are associated with coping with their short stature and its effect on self-esteem, potential achievement and physical and emotional immaturity.

However, there is evidence that growth hormone replacement therapy has a beneficial effect on well-being and general performance over and above its effects on growth. Growth hormone deficiency in adults is also associated with a high incidence of psychological problems, particularly anxiety and depression. There is evidence that this is different to normally accepted clinical depression as it appears that the physical deficiency of growth hormone is actually contributory. This is supported by the often remarkable change in outlook seen in some growth hormone deficient adults once they have started growth hormone replacement therapy.

It may be that growth hormone treatment will reduce many of the psychological problems associated with adult growth hormone deficiency syndrome, however, it is a little early to be certain of this. Although it may be very difficult for you, it is important that you discuss your feelings, and your concerns about your quality of life, with your specialist so that a psychological assessment can be arranged if needed. If you need more help and support to do this, contact the Child Growth Foundation.

It is very important to appreciate that you may not be fully aware of the psychological impact of being growth hormone deficient until after you have started growth hormone replacement therapy. You may then realise that how you felt before was not “normal” – you may feel that you were existing but not really living life to the full. This is particularly important for those individuals who start growth hormone as part of a clinical trial, and who experience beneficial effects, as the prospect of not being able to continue treatment can cause extreme distress.

Premature aging

It has been proposed that one of the reasons that the physical signs of normal ageing occur is related to the decrease of growth hormone secretion with age hence the “middle age spread”. Some preliminary research has suggested that growth hormone treatment may reverse some of these changes and these are very interesting views. However, these are very preliminary pieces of research and much more information is needed before any recommendations can be made.

***AS AN ADULT WITH GROWTH HORMONE DEFICIENCY,
DO I NEED GROWTH HORMONE TREATMENT?***

If you have growth hormone deficiency in adult life, will you benefit from hormone replacement therapy? This is an important question which should be addressed. You will need to discuss this with a specialist familiar with these problems and who can assess your individual needs. Although it has been shown in many adults with growth hormone deficiency that treatment with growth hormone has been beneficial, there are those who experience no problems and who therefore do not seem to need treatment.

If you are not already under the care of a specialist, and feel you may benefit from growth hormone replacement therapy, you should discuss this with your GP who can refer you to a specialist who has knowledge and experience in the treatment of your type of hormone problem. If you are experiencing difficulty in finding a specialist who is sympathetic to your situation, contact the Child Growth Foundation will try and advise on particular specialists in your area.

HOW IS THE DOSE OF GROWTH HORMONE CALCULATED AND THE TREATMENT GIVEN?

If you received growth hormone as a child, the dose of growth hormone given will have been higher than is now given in adulthood. You will be given a dose based on your body size and this may be slightly increased or decreased at follow-up clinic visits depending on how well you tolerate the first dose given. In some adults given a dose similar to that used in children, mild side effects have been noted including fluid retention (with swelling of the ankles) and, occasionally, raised blood pressure. A slight reduction in your dose will cause these symptoms to go.

Delivery

The only method of administering growth hormone is by injections (see Q&A section; page 14, question 2). These are very small volume injections injected just under the skin (subcutaneous) in the thighs, upper arms or abdomen. The needles used for the injections are very small (about 1cm long) and fine and are similar to those used by diabetics. Problems with injections are unusual but for those who are unsure, there are a number of injection devices including autoinjectors and pens which may be helpful. Growth hormone injections are given daily, usually in the evening.

HOW IS GROWTH HORMONE MANUFACTURED?

Since late 1985, growth hormone has been manufactured biosynthetically using a process whereby the gene for growth hormone is inserted into bacteria or mammalian cells in culture. These cells then grow and reproduce an identical copy of the natural human growth hormone. The growth hormone is extracted and stored as a powder until you need to reconstitute it for your injection.

Before 1985, growth hormone was extracted from the pituitary glands of dead people (pituitary extracted human growth hormone). This method of obtaining growth hormone was stopped in May 1985 when it was found that there was a link between a contaminant in the extracted hormone and a virus-like illness called Creutzfeldt Jacob disease (CJD). CJD causes degeneration of the brain and is fatal. Pituitary extracted growth hormone has not been used since its withdrawal in 1985. If you see any reports about the side effects of growth hormone treatment in the newspapers or on the television, it is y~ important to distinguish between the old pituitary extracted growth hormone and the more recent biosynthetic growth hormone which cannot cause CJD.

If you have any questions or concerns about CJD, you should discuss them with your specialist.

QUESTIONS AND ANSWERS

There are still several unanswered questions about growth hormone treatment in adults and these include:

- which patients would benefit the most and can they be identified by medical criteria?
- how long should treatment be continued?
- at what doses are the benefits optimal?

Certainly, these and other questions should be discussed with you by your specialist. If not, you should not be afraid to ask any questions you may have.

Q. Are there any side effects to growth hormone treatment?

A. This is a *replacement* hormone therapy (replacing a missing substance which the body would normally make) and very few side effects would therefore be expected. In adults with growth hormone deficiency, growth hormone replacement may initially cause fluid retention, with swelling of the ankles, if the dose is too high. This is the reason why relatively low doses are used in adults compared to those used in children. Your specialist should monitor this closely and make any necessary dose adjustments. Thus any side effects are temporary, dose related and, usually, avoidable.

Q. Is there any method of giving growth hormone except by injection?

A. No; growth hormone is a protein and if given by mouth would be digested in the stomach, so it has to be injected. For those experiencing problems with ordinary needles and syringes (which are much smaller than they used to be) there are a number of devices which can make the injection automatic and no needle is seen. These devices can be shown to you by your specialist—just ask!

Q. Will growth hormone make me grow?

A. Not if you have already completed puberty and are physically mature. However, if you are in your early twenties, and in very exceptional circumstances, it may be possible for you to achieve some extra growth. Your specialist will discuss this with you.

Q. Will growth hormone give me more vitality?

A. This may indeed happen but it is important, before starting growth hormone treatment, that any other hormone deficiencies you have are properly replaced as these too can affect how you feel including your 'get up and go'.

Q. Will growth hormone make me feel younger?

A. It has been suggested that one of the reasons that the physical changes of ageing occur is due to the gradual decrease in growth hormone secretion with age. Very limited short-term studies have shown that some of the ageing processes may be slowed or even reversed with growth hormone treatment. However, it is important to remember that an increased level of energy and vitality will make you feel younger. Growth hormone treatment is not the answer to old age.

However, in the growth hormone deficient adult, it may be that growth hormone replacement therapy is necessary to prevent premature ageing and to allow a full quality of life.

Q. Will growth hormone help me to lose weight?

A. Growth hormone treatment itself will not result in weight loss. It will, however, alter the distribution of body fat around the body and it will noticeably reduce from the abdominal area and should allow you to have far greater control over your weight, particularly if you follow a calorie controlled diet. If you are also on other replacement hormones (cortisol, testosterone, oestrogen, or thyroxine) these may also affect your weight.

Q. Can I drink alcohol in normal amounts?

A. Yes, providing it is sensible amounts. The recommended alcohol intake for women is 14 units per week and for men 21 units (a glass of wine, a half of beer or larger and a single measure of spirits each equal 1 unit). If excessive alcohol is consumed it can cause hypoglycaemia and in growth hormone deficient individuals this is an extremely dangerous situation as unconsciousness may result.

You should discuss this with your specialist if you feel you do not fully understand this matter.

A PATIENT'S STORY

How it Feels to be a Growth Hormone Deficient Adult

I was given growth hormone for growth as a child and then spent 10 years without it before taking part in a clinical trial last year. I would like to describe here how I felt in the 3 months after the trial before I started GH long-term.

The GHD feeling is not an easy one to describe. Indeed, for the decade that I was off GH, I was not only unaware that my lack of energy was due to a hormone deficiency, I was not even aware that I did lack energy. I thought this was the way everybody felt.

GHD produces a physical feeling in me of being completely drained, that spills over into the mood of apathy and resignation. I feel the tiredness most in my legs. I wake up with it and it increases throughout the day so that by late afternoon, I just want to lie down and go to sleep.

But more difficult to handle are the psychological symptoms, the most unpleasant being depression and anxiety. My natural mood off GH is consistently very low without any provocation and on top of this, I often feel panicky even if there is little cause to be stressed.

I've felt many other effects from GHD:-

- *physical or mental activity quickly brings exhaustion*
- *muscles tire out almost immediately when lifting heavy weights*
- *lack of concentration, particularly at work*
- *poor memory*
- *fear of the future*
- *minor illnesses (such as a cold) are quite debilitating*
- *alcohol intolerance*
- *persistent baby shape to my body*

The best description of the GHD feeling I've heard is that it is like "going uphill with the brakes on". I would liken life without growth hormone to the experience of driving my old Austin Allegro; it gets me to work and back every day but I couldn't describe it as a pleasure to drive. Similarly, I can make it through the day without growth hormone and can hold down a job but I have no energy left to pursue my interests outside work and I am simply not enjoying my life. This is surviving, not living, and yet that's an important distinction some doctors have yet to learn.

Since starting GH, I have felt profound effects: At work, programming computers, I now have energy up to the end of the day. I can concentrate. I am no longer hampered by anxiety and panic attacks. Thinking no longer tires me out! My solutions are more creative, come more easily and I can implement them more quickly. Overall, I seem to work with three times the efficiency I once did.

At home I feel more positive. I'm not scared anymore and I have the energy and inclination to go out in the evening. But now I have to drink twice as much beer to get the same effect!

Editors' comments: It must be emphasised that this is how one person is affected and we know that not all "GHD adults" feel this way. This is a classical story and reads very well; it probably represents the view of >50% of GHD adults!

SUMMARY

We are now entering a new era of treatment for adults with pituitary hormone deficiency. It may be that growth hormone treatment will be of enormous benefit to you but you will need to discuss this with a specialist endocrinologist. We are, as yet, unable to give detailed answers to many of the questions that the possibility of treatment raises but your specialist will help you to understand whether growth hormone treatment will help you.

FURTHER READING

CGF Information Booklets:

Series No 2: Growth Hormone Deficiency

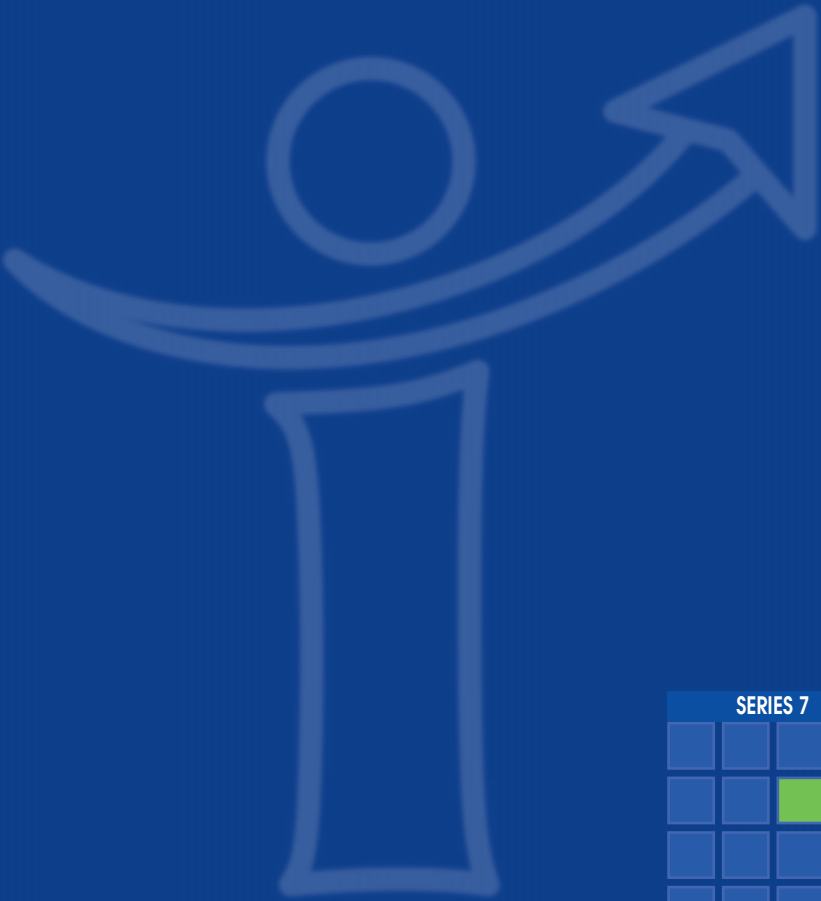
Series No 3: Puberty and the Growth Hormone Deficient Child

Series No 5: Emergency Information Pack for Children with Cortisol and GH Deficiencies and those Experiencing Recurrent Hypoglycaemia.

FURTHER INFORMATION

Hypopituitary patients are currently exempt from prescription charges.

For further details, ask your local pharmacist.



SERIES 7

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