INFORMED BODYBUILDING NUTRITION

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Also thanks to colleagues and friends for putting up with me, if they at all saw me, while I shut myself away to write this.

Legal Acknowledgements

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Forward

I first met James during 1994 in the University of Surrey Gym. I had been training since 1989 and had competed the previous summer; I can safely say that bodybuilding led to me giving up my job to study for a Nutrition & Dietetics Degree.

Just like most bodybuilders that find themselves in a new place, my priority was to get into the gym to continue my training. So, having only been on campus for a matter of hours, I was eager to checkout the university gym. Quite confident that I would be one of the biggest there my illusion was soon shattered when I saw James while undertaking my first training session.

We got talking and discovered he was in his final year of the same course. What was also very apparent is this guy really knew his stuff! Many times during that year I would notice he had trouble leaving the gym due to people asking him questions. They had been patiently waiting for him to finish his workout and just when he thought he'd get to go home he'd find himself helping people out.

James and I have been great friends since this time and more recently become business partners in many nutrition related projects. I have great respect for James and while we have the same base qualifications he is dedicated beyond the call of duty in keeping his knowledge to the forefront of current research.

Whatever your current nutritional knowledge this ebook in certain to provide you with a wealth of knowledge to aid you in maximising your bodybuilding progress.

Jason Barnham BSc (Hons) SRD

Chapter 1
Effective Bodybuilding Nutrition and Good Health

Introduction & Background to the Author

Our website, ***www.muscletalk.co.uk*** has been running for a while now, and my colleague and friend Jason Barnham and I have become recognised experts in bodybuilding nutrition. Our visitors range from different standards of bodybuilders and strength athletes, through other sportsmen and women, to the average person who wishes to lose some weight and look good.

I have been working in the nutrition field for nearly 11 years, and qualified in 1995 from University of Surrey with an Honours degree in Nutrition with a State Registration in Dietetics (SRD). SRD is the only legally recognised qualification for nutrition in the UK, and is a licence to practice nutrition and dietetics. It protects the public from unscrupulous practitioners, as all advice we provide *must* be sound and evidence-based. Unfortunately in bodybuilding we are limited by a lack of research, so we have to rely on knowledge and experiences. I will be discussing types of evidence later on in this chapter and their usefulness in making our own judgements.

SRDs are also not allowed to endorse any single nutrition or food product, so we can make no financial gain in this respect, making advice we provide completely unbiased. However, we may name product examples, and if only one product of that type exists on the market, then it may be cited. We may also discuss the pros and cons of competitive products, so consumers are able to make an informed choice for themselves.

I will attempt to cover all aspects of nutrition relevant to bodybuilding in this ebook, including advice for beginners, off-season, pre-contest, different supplements, healthy diet and much more. I hope to clear up some of the conflicting advice bodybuilders continually hear, and educate the reader so he/she can make his/her own ***informed choice***. In this ebook, I in no way mean to give individual advice, but I do intend to educate the enthusiastic bodybuilder to learn for his- or herself. Bodybuilding is a science, and those keen enough to find out more and put things into practice, will get better results. Remember, ***the more you know, the more you'll grow!***

Making an Informed Choice

"Many bodybuilding nutrition theories are backed by little research…"

As I have said, the object of this ebook is for the reader to be able to make an informed choice. At times I will be expressing my opinion, but this will be based on any evidence available, even if it is weak evidence. Many bodybuilding nutrition theories are backed by little research for a number of reasons, including the fact that there is little financial gain from it as supplement companies are already making a fortune without hard evidence. In sports nutrition, proper research is not necessary in the same way that research is imperative in clinical nutrition in order to improve health parameters.

In sports all we are looking at is improved performance, not good health. It is hard to get ethical approval to do such studies, as some products are controversial and many possible candidates for a trial will be bodybuilders using illegal performance enhancing drugs.

I feel it is important for me to teach you a little about the types of evidence available in research in order for you to have a better understanding as to the angle I am coming from in this ebook. It will also help you to comprehend the strength of information I will provide in helping you to make an informed choice.

There are three main types of gathering evidence:

1. Experimental studies

These are laboratory-based studies, which show the direct effect of administering a substance on a subject. Subjects are usually not human (those poor lab rats!), as it can be hard to get approval to do tests on human subjects. Experimental studies provide a plausible theory from which other studies can follow.

2. Epidemiological studies

There are a number of types of epidemiological studies, which are studies on the effects of substrates on populations or groups of people. Depending on their design, the strength of these trials varies. They include retrospective studies, where many subjects may be questioned as to the effect something has had on an outcome.

The strongest type of epidemiological evidence comes form double blind placebo prospective case-controlled studies. In these, two groups of subjects are randomly allocated to be given (a) the substance in question, and (b) a placebo, and neither the subject nor those performing the experiment knows who is taking which. This totally eliminates bias. In the case of bodybuilding, subjects would be on the same training regime and diet plan for a set period, when the results are compared, the study designers will look for statistical significance between the two groups. If, present this strongly suggests that the substance in question is effective.

Prospective trials could also be performed, say to examine protein intakes. Subjects could be interviewed before, at points during and after the trial to see what their protein intakes were. This could test the hypothesis that high protein diets increase muscle gain.

3. Anecdotal evidence

This is also known as empirical data. This is evidence reported by individuals, and is weak evidence. Unfortunately, anecdotal evidence is the basis for most bodybuilding nutrition theories, due to lack of epidemiological evidence. You often hear guys down the gym, saying they've tried chemical X and it made them gain half a stone. Clever marketing by supplement companies uses testimonials by 'users' of their product. Anecdotal evidence may be weak, but it is *extremely* powerful in sales.

Of course, the more types of clinical trial performed and the more studies there are testing a hypothesis, the stronger the evidence is. Experimental evidence backed up by prospective epidemiological evidence is extremely strong. And with case studies (anecdotal evidence) as back up, the chance that taking a substrate will lead to a desired outcome is high. This is the ideal scenario, and rare in bodybuilding.

Creatine monohydrate is an exception to the rule that there is little evidence for a theory in bodybuilding, as it is well researched. Experiments have measured muscle creatine concentration, and there are numerous studies that have measured improved performance on individuals using creatine against those on placebo (see Chapter 8).

Informed Bodybuilding Nutrition

I have tried to write this ebook with a broad outlook. There is frequently conflicting advice between nutritionists/dietitians and bodybuilders. Well, I am both. I look at the science and what actually seems to work in practice.

"I look at the science and what actually seems to work in practice"

Hopefully, by the end of this book, you'll have a good understanding of what to eat in order to pack on muscle and improve your strength. I also hope to open up your minds to the quest of wanting to find out more about the vast subject of bodybuilding nutrition. It's good to have questions. Nutrition is a growing science and so little is based on fact, merely evidence. After reading this, your knowledge of nutrition will be sound and you will be able to apply this knowledge to your bodybuilding lifestyle everyday. You will also be keen to learn more, which you can do so by visiting www.muscletalk.co.uk I hope you will be able to make better judgements as to which supplements are good value for money, and identify those which are of no use to you, although they may be useful for someone else.

No one knows your own body better than you do, so you will have to go away, continue to learn and try things…

HAPPY LEARNING

Chapter 2
Healthy Eating And Bodybuilding

The appearance of a bodybuilder is generally the fine figure of health, so it should be that a bodybuilders *is* the fine figure of health. For this reason, it is imperative that the bodybuilder adapts the healthy eating guidelines to suit his/her nutrition. Some principles of healthy eating are not entirely in line with the ideal bodybuilding diet in order to achieve optimum results; for example the average individual would not consume anywhere where near as much protein as a bodybuilder would. Some bodybuilders argue that a 'normal' diet is just not suitable for optimum muscle growth. I feel, eating a good diet is crucial in order to stay healthy, and staying healthy is, in turn crucial, for maximum training intensity and performance, as well as general well being and longevity.

Too many bodybuilders become fanatical and obsessive about their diet. They read or hear something which they take to be gospel truth. In reality, the basic principles remain the same for everyone.

A ***healthy balanced diet*** is a concept shunned by many so-called 'bodybuilding nutrition experts'. It could be defined as 'enough of each nutrient being taken in as is being used up by the body's functions.' Remember, for everyone, the main principles of healthy eating are merely a guide, but let's see how they tie into the bodybuilding diet:

- **Eat a wide variety of foods** - *Important for everyone, including bodybuilders, to ensure they obtain adequate amounts of all essential nutrients.*

- **Eat regular meals, and try to eat similar amounts of starchy carbohydrate foods from day to day. Make complex carbohydrate foods the main part of each meal** - *Regular meals are vital for the bodybuilder for optimum muscle growth. It is also important that the bodybuilder has regular amounts of carbohydrate, but the main part of each meal should be the protein foods.*

- **Eat more high fibre foods** - *important for a strong healthy bowel, good health and for more steady digestion and absorption of carbohydrate. High fibre foods are also useful for weight control, as fibre foods are more satisfying, so if you are more full, it helps to stop you wanting to snack on fatty and sugary foods too often.*

- **Include plenty of fruit and vegetables – 5 servings a day** - *a must for bodybuilders.*

- **Limit the amount of fried or fatty foods you eat** - *definitely important for bodybuilders, although some types of fat should be eaten. We will look at types of fat in Chapter 4.*

- **Reduce your sugar intake – swap high sugar foods for low sugar alternatives** - *also suitable as part of a bodybuilding diet. Unless an individual is the extremely lean hard gainer type, who struggles to gain weight, in which case, sugar can become a useful source of energy.*

- **Try to get to a healthy weight and stay there** - *bodybuilders are often classed as 'overweight' according to the weight-for-height tables. In reality they obviously are not, from a body fat point of view, so a degree of subjectivity is needed.*

- **Be careful not to use too much salt** - *in agreement with the bodybuilding diet.*
- **Keep to sensible alcohol limits** - *a keen bodybuilder will only drink very occasionally, although a small amount of alcohol can have some health benefits.*

Variety

"Like everyone, a bodybuilder should eat a wide variety of foods…"

Like everyone, a bodybuilder should eat a wide variety of foods, and include foods from the four main food groups everyday. Obviously, the quantities which are recommended to the general population are not in line with bodybuilding nutrition requirements, but do give a guide as to what is a healthy diet.

1. **Starchy foods -** cereals, potatoes, bread, rice pasta.
2. **Fruit and vegetables -** all fresh, frozen and canned, fruit juice. Have at least five servings a day ~ provides vitamins, minerals and fibre.
3. **Meat, fish and alternatives -** red meat, poultry, fish, beans, lentils, nuts, eggs, cheese ~ provides protein and some minerals.
4. **Milk and milk products -** milk, yoghurt, cheese. Have either a half to one pint of low fat milk per day, or include yoghurt or low fat cheese ~ provides protein and calcium.

There is a fifth group, i.e. everything else – all fatty and sugary foods. There is no set requirement for these as part of a healthy diet. If these foods are enjoyed, they can be included in a balanced diet occasionally, and will improve variety.

It is important to enjoy your food and okay to include personal favourites in your diet sometimes. If you are watching your weight you should consider the portion sizes of your meals, and try not to eat in between meals.

I'll be looking at incorporating a healthy diet into a bodybuilding eating regimen in Section D, where I will give examples of meal plans.

Key points

- *Staying healthy is crucial for maximum training intensity and performance, as well as general health and longevity*
- *Remember the principles of a healthy balanced diet, they are fundamental to everyone, including bodybuilders*
- *Most importantly, eat a wide variety of foods*

Chapter 3
Protein and Carbohydrate In Bodybuilding

I have opted to discuss protein and carbohydrate and the effect they have on muscle gains in the same chapter, as their absorption and metabolism are linked. I also want to examine the controversy regarding whether protein or carbohydrate is required more in a bodybuilding diet (discussed later in the chapter).

Protein Requirements

One of the more frequently asked questions in bodybuilding is the amount of protein which is required for optimum muscle development. A large proportion of muscle is protein, it is said that more protein is required for growth, but it is also argued that a high carbohydrate diet is needed to improve strength and size (see later).

Muscle consists mainly of two proteins, actin and myosin. The turnover rate of amino acids in these proteins is high, and increases upon stimulation, i.e. exercise. If the muscle is worked to maximum effort, as is the case in hard training bodybuilders, turnover of amino acids is extremely high. Hence, there is a large demand from the body's pool of all amino acids, so intakes of protein must mimic this demand. Bodybuilders, who have reached a plateau in their gains for a long period, have dramatically increased their protein intake and started making gains. Also, anabolic steroids increase the rate of protein synthesis within muscle cells, further increasing demand for protein.

Let us ignore the high protein v high carbohydrate argument for now, and return to it later in the chapter. There have been few studies on the effect of higher protein intakes on increasing strength and muscle size, and most are of poor design and the evidence is remain inconclusive.

Lemon *et al* (1992) looked at a group of twelve novice bodybuilders and put them on one of two diets: *(a)* High protein of mean protein intake 2.62g per kg body weight; *(b)* high carbohydrate of mean protein intake 1.35g per kg body weight. Subjects were put on a 6 day a week intense exercise regimen. They measured nitrogen balance, strength and muscle mass gains before and after 3 ½ weeks. Results showed no difference between the two groups. We all know that this is hardly surprising, as a sample of twelve subjects is small, and it is only possible to build small gains in a month anyway. Subjects were novice bodybuilders who can not know, at their stage, how to genuinely train properly. Although they may be on a set intense exercise regimen by the experiment design, genuinely training at high intensity is hard and something which comes with experience. Therefore I would argue that the demand for more protein was not created. There is no mention of protein quality or regularity. So, really, Lemon *et al* showed nothing conclusive.

Marable *et al* (1979) looked at four groups of men who consumed two levels of protein (approximately 0.8g or 2.4g protein per kg body weight) for 28 days as controls or subjects engaged on a progressive resistance exercise programme. They compared nitrogen excretion and weight gain. They found that exercising subjects gained a mean weight of 3.2kg, and their nitrogen excretion was reduced. They indicate that increased demand for protein is in part met by more protein retention by the body. Again, as you can see, this study is full of flaws.

There are too many confounding factors in bodybuilding and with the study design of the above it is not possible to say truthfully how intense subjects were training. Training intensely comes with experience, but were subjects going beyond the failure point that we all know is needed to get the absolute most out of the workouts? Doubtful.

As a dietitian and bodybuilder, I am continually debating this point with my dietetic colleagues who take the blinkered textbook view. They say, while a slightly increased protein intake may be needed, it is carbohydrates which are more important for muscle growth. Any bodybuilder who has trained for a while knows the most fundamental lesson in bodybuilding, in that you need to eat large amounts of quality protein regularly. I have seen many bodybuilders who have plateaued increase their protein intake and start making gains again. Conversely, I have also seen the extreme bodybuilding approach where trainers eat mega amounts of protein and do no better than others in respect of strength and size gains.

Protein Quality

From the results of few studies which have been done, experience with my own gains and from working with others from varied levels of bodybuilding, I feel that protein quality and regularity is more important, than actual amount of protein in grams eaten per day. By consuming quality protein, in respect of what is actually absorbed, a high protein diet will, in fact, be achieved.

"…protein quality and regularity is more important, than actual amount of protein in grams…"

Biological value (BV) of protein is a method of assessing how similar a protein source is, in respect of amino acid profile, to that of human requirements. Proteins are grouped into those of high BV (HBV), generally foods of animal origin and some pulses, and low BV (LBV), like cereal-based foods which we eat more for carbohydrate but do contain some protein. It could be argued that bodybuilders need to consume plenty of HBV protein foods regularly, but there are other important considerations.

Amino acids are the simplest units of protein, and are needed in a specific ratio for optimal muscle growth. Even if one is missing the quality of the amount of protein ingested is reduced, so you actually need more total protein. Some amino acids are considered essential / indispensable, as our bodies cannot synthesise them, therefore we must consume them. There are also conditionally essential amino acids, which under certain circumstances we are unable to make enough, for example during physical stress like trauma or bodybuilding. The remaining amino acids are considered non-essential, though what we obtain from our diet are still used abundantly in the body, and they are still crucial to muscle growth.

How akin the amino acid profile is to human muscle tissue, is one issue, as this is the primary reason why we consume so much protein. Another consideration is how readily a particular protein food is digested and absorbed by the body, then taken up by muscle tissue. In this respect there are sources of protein which are better than others, for example whole eggs, whey and red meat. Other proteins are still have their place, but these are best.

Whey protein is one of the main milk proteins, but is not as abundant in milk as casein. Whey protein can be isolated by a variety of processes, the most efficient being ion-exchange filtration, which filters out everything, leaving almost 100 % pure whey protein powder available as a supplement. Not only is the amino acid profile of whey very similar to human muscle tissue, but it is also absorbed very quickly as it is semi-elemental, i.e. partially digested. Amino acids are one of the end products of protein digestion, and much protein is absorbed in this form. Peptides are small chains of a few amino acids from partial digestion, and protein is also absorbed in this form, but by a different mechanism to that which absorbs amino acids. A semi-elemental protein source therefore, such as ion-exchange whey, containing amino acids and peptides has optimal absorption, as they are absorbed to two separate methods.

Another, more modern, method for evaluating protein quality is something known as the Protein Digestibility-Corrected Amino Acid Scoring (PDCAAS). This is actually a highly accurate method, although the quality score of proteins measured this way does differ to that of the BV scoring system. PDCAAS takes into account the profile of essential amino acids of the protein in question, as well as its digestibility in humans, rather than in rats. It is the method of assessing protein quality adopted by the World Health Organisation / Food and Agriculture Organisation (WHO/FAO) and the US Food and Drug Administration (FDA).

With PDCAAS, the proteins with a high BV score also rank quite high, but it also ranks isolated soy protein as one of the highest (WHO/FAO 1989), and casein scores higher than whey. Note that it is only isolated soy protein that has the high score, soy protein concentrate (which is used in many poor quality protein powders) does not. Isolated soy protein has also been shown to help boost thyroid hormone levels during calorie-restricted diets, a time when thyroid hormones decline (Barth, *et al* 1989; Forsythe 1995), thus boosting metabolic rate. A recent study showed isolated soy protein produced antioxidant beneficial effects in athletes who used it, compared with athletes who used whey protein (DiSilvestro 2000).

Confused? I am! Well, this is just one example of many inconsistencies in the science of nutrition. It is another inconclusive fact that dietitians and nutritionists, such as myself, have to convert into relevant information for the public to make use of.

One problem with PDCAAS in respect to bodybuilding nutrition, is the high requirements of *all* amino acids, not just the essential ones, and this is a downfall of isolated soy protein.

From this, you can conclude that all the proteins that score high from the BV score are of good quality, as is isolated soy protein. The best way to ensure maximum protein quality is by mixing protein sources with each serving. For example, rather than having 200g tuna at one meal, and a chicken breast at the next, try having 100g tuna and half a chicken breast at both meals. This will give a wider spectrum of amino acids, so will be more in line with that of muscle tissue. Although soya and protein from other pulses is of lower quality that animal sources, in this way you can include them in your diet, hence reap their additional health benefits, e.g. have fish and baked beans at a meal.

In some circumstances, e.g. when eating out, it may be inconvenient to mix proteins, in which case supplement the meal with five or six amino acid capsules, thereby improving the amino acid profile available to the body.

Protein Quantity

The UK recommendations for protein intake of sedentary males of 19 - 50 years is 55.5g per day and females 45.0g per day assuming varied protein quality intakes (DoH 1991). This amount accounts for maintenance of human tissue and turnover of amino acids. It does not account for maintenance and repair associated with the high demand athletes initiate. Infact, Lemon 1991 estimated an average experienced athlete needs two times the recommended amounts of a sedentary individual to maintain nitrogen balance. Moreover, bodybuilders, who put extreme stress on their muscles, have even greater requirements.

The UK Department of Health (DoH) advises against high intakes, saying that most people have intakes in excess of the guidelines anyway, and point out possible stress on the kidneys with continuously high intakes, possibly leading to acute renal problems. However, if all the protein absorbed is being utilised by the body then there will be less excreted via the kidneys, hence less stress on them. I would only argue for very high protein intakes where there is very high demand, i.e. only in hard training strength athletes and bodybuilders

One of the most frequently asked questions, I am asked is how much protein is needed for muscle growth? Answer – difficult to say! We tend to quote requirements in grams per kilogram (g / kg) body weight. The amount lies somewhere between 2 - 4g / kg body weight, which is broad, but there are so many confounding factors including intensity of training, efficiency of protein metabolism, genetic make up and general health. Also the use of anabolic steroids increases the rate of protein synthesis in the muscle. Assuming our subject is training correctly, i.e. very intensely, has an averagely efficient protein metabolism and is in good health, I estimate about 3g / kg per day is about right. This is only an *estimate*, and based on experience, unfortunately not epidemiological evidence, due to the reasons discussed in Chapter 1. The example meal plan in Figure 1 will provide adequately for this. If a bodybuilder uses anabolic steroids, then this requirement may rise to 4g / kg in order to optimise gains.

Optimising Protein Intake for Gains

I have discussed the optimal distribution of protein intake throughout the day and the benefits of combining different sources of protein. There are times when efficiency of uptake through the intestine and muscle cells is highest so you can optimise utilisation of what you eat.

“There are times when efficiency of uptake through the intestine and muscle cells is highest…”

The hormone insulin changes in its concentration in the blood with the daily sleep-wake cycle. Insulin levels are lowest in the morning and increase during the day. This is why people say you are more likely to lay down excess food as fat in the evening than you are in the morning. You have probably heard a lot about insulin in relation to carbohydrate metabolism in respect of controlling blood glucose levels, and it is well known for its use as therapy in types of diabetes. Insulin is also heavily involved in protein metabolism, and is an extremely anabolic hormone. For this reason it too has become abused by bodybuilders and strength athletes, and injected to increase protein uptake by muscles.

Natural insulin levels are also highest straight after weight training, when there is a high demand on the muscles which have been trained to recuperate, if they have been fully worked. Insulin is needed here to help replenish the glycogen stores and put protein in the muscle cells for repair and growth. We have now identified a large protein 'window', i.e. a time when insulin concentration is high and the muscles are crying out for more protein. It is at this time that we should take advantage of the situation and consume a large protein dose, as uptake by muscles will be high. Absorption in the digestive system will also be more efficient at this time, due to the effect of hormones. The window is estimated to be open 'wide' for 30-40 minutes, after which time it closes to 'normal' level. In this time you may be able to utilise up to 20g more protein.

Another protein window is first thing in the morning. At this time you have fasted for hours at a time when your body is in growth mode, so it is crying out for protein to repair muscles from the previous few day's workouts. In the meal plan in Figure 1, I have put a protein drink immediately first thing in the morning followed by breakfast soon afterwards. I have also suggested a 40g protein drink straight after training. This optimises use of both protein windows.

It may be argued that the body's priority after training is to replenish glycogen stores, and it may be feared that the protein ingested here will be converted to carbohydrate to help fulfil this need. But, we are bodybuilders, and the demand for protein is high here, so amino acids will be utilised for muscle repair. However, it is imperative to consume carbohydrate foods to replenish glycogen stores soon after training.

Some bodybuilders wake in the night and down a protein drink. I can see the benefit of this, as it's another chance to consume protein, but I feel peaceful sleep is also important. I wouldn't set an alarm to wake up in order to do this. However, should you wake naturally, for example to go to the toilet at night, it may be an idea to have a previously prepared protein drink ready to consume. You can always drink it in the morning if you don't have it at night.

Figure 1 : Example menu plan looking at protein foods only

This is based on a 90kg (210lb) man, moderate to low body fat. This is merely an example of the HBV protein foods spread out showing quality protein sources and combinations. Remember that the subject will also be eating carbohydrate sources like bread and potatoes, which contain protein too, bumping the total up by another 20 – 30 g a day.

Time	Food	Protein
Wake 7.30 am		
7.30	1 scoop whey protein	20g
8.00 breakfast	cereal with skimmed milk	
	½ MRP*	30g
10.30	½ MRP	22g
12.30	tuna (95g)	22 g
	½ small chicken breast (60g)	18g
	low fat yoghurt	7g
3.00	½ MRP	22g
5.00	½ MRP	22g
TRAIN		
6.30 (after training)	2 scoops whey protein	40g
7.30	tuna (95g)	22g
	½ small chicken breast (6g)	18g
	low fat yoghurt	7g
10.00	2 scoops weight gain	25g
11.30	1 scoop whey protein	20g
11.30 bed		
	TOTAL PROTEIN	**290g**

*MRP stands for meal replacement powder (see Chapter 8).

Carbohydrate Requirements

There are two main groups of carbohydrate foods:

- **Starchy foods:**

Starchy carbohydrate foods are broken down more slowly into glucose than sugary foods, so there is a more gradual absorption into the blood. Examples of starchy foods are bread, breakfast cereals, potatoes, pasta, noodles, rice and biscuits. Starchy carbohydrate foods can be subdivided into high fibre and lower fibre ones. The high fibre ones, like wholemeal bread, brown rice, wholewheat pasta and breakfast cereals, give a more steady and efficient provision of energy.

- **Sugary foods:**

These foods are broken down into glucose rapidly by the body giving quick amounts of energy. It is best to only have small amounts of sugary foods as they can cause a sharp rise in blood sugar levels followed by a large drop in levels. It is also easy to consume a lot of sugar so they contribute to unwanted weight gain.

"To train to full intensity all the time, a good and steady intake of starchy carbohydrate foods is needed throughout the day…"

To train to full intensity all the time, a good and steady intake of starchy carbohydrate foods is needed throughout the day. A reasonably high intake of quality complex carbs is also required to train on and for recuperation. Eat complex carbs regularly throughout the day. How much is required depends on the individual and to whether he or she is trying to lose body fat, who will require small amounts, or whether he/she is a typically 'hard gainer' who will need loads to pack on size. These will be discussed in more detail in chapters and respectively.

How much you need is up to you to find out for yourself as we are all different, but one key rule applies: you must eat high fibre complex carbohydrates regularly throughout the day, although the quantity at each meal will vary.

The simplest units of carbohydrate are monosaccharides. Two monosaccharides together make up a disaccharide, e.g. table sugar. Complex carbohydrates like starch are polysaccharides, i.e. long chains of monosaccharides. A chain of a few monosaccharides is called oligosaccharides. Like protein, where amino acids and short peptide chains, are absorbed by different mechanisms, the same is true for carbohydrates. Monosaccharides and oligosaccharides are each absorbed in the gut by a different process. For optimal absorption, therefore, both should be available. By eating starchy carbohydrates, in digestion, both will be available in the intestine.

Maltodextrose powders are synthetic carbohydrate powders which contain polysaccharides and oligosaccharides. They are useful sources of complex carbohydrate, and will be discussed more in Chapter 7.

As I have already said, it is hard to give you figures as to how much carbohydrate is required, as we are all so different. But as a general rule for any bodybuilder who is trying to gain muscle size and strength and does not wish to lose body fat approx. 4g of total carbohydrate per kg bodyweight, eaten regularly throughout the day, would be a good estimate. If the subject had a busy and energetic job, e.g. a builder, this figure may need to be a lot higher.

Protein or Carbohydrate? - Which Do I Need?

Before going any further let's look at the argument of protein v carbohydrate in bodybuilding, which has got to be the biggest controversy in modern bodybuilding. Bodybuilders will say you've got to consume loads of protein to pack on quality muscle mass and increase strength. Dietitians and nutrition 'experts' say that you must eat a high carbohydrate diet, particularly complex carbs, to improve strength and size, and say that a high protein intake is of no benefit.

Who is right? In essence, both. Remember that we are bodybuilders and are therefore different to other athletes, who need to make complex carbs the basis of their diet. As I discussed earlier, few studies have been carried out looking into high protein intake and improvements in strength and muscle size and the results were inconclusive. Study design was poor, often only having very few subjects, who may be over- or under-training, other aspects of diet were often overlooked, and most were only carried out on novice weight trainers who may not know how to train correctly. Also, the topic of anabolic steroids is avoided which do increase demand for protein.

The Argument

- **For High Protein Intake**

As discussed earlier, muscle consists mainly of protein, and the turnover rate of the amino acids is high, and increases upon stimulation, i.e. exercise. So, when muscle is worked to maximum effort, as in the case in hard training bodybuilders, turnover is extremely high, creating a large demand from the body's pool of all amino acids. High carb fans say this demand can be met by only a moderately higher than normal protein intake. High protein fans argue that very high levels of protein are needed to meet this huge demand. Bodybuilders, who have plateaued in their gains for long periods, have dramatically increased their protein intake and started making gains. Also, anabolic steroids increase the rate of protein synthesis within muscle cells, further increasing demand for protein.

- **For High Carbohydrate Intake**

The argument for a high carb intake comes from the fact that we need energy to fuel workouts and to recuperate and grow. This is certainly the case for athletes who may need as much as 60% of their energy intake from carbs. High carb advocates also say that only a slightly higher than 'normal' intake of high protein foods should be eaten, as starchy carbohydrate foods also contain some protein which will increase protein intake sufficiently. The type of carbs which should be consumed are high fibre starchy ones like wholemeal bread, brown rice, wholewheat breakfast cereals, etc.

♦ **For Both High Carbohydrate and High Protein**

Dietitians and nutritionists too often look at the percentage of total energy intake for proteins, carbohydrates and other macronutrients. It would be better to look at *actual* intake levels. Both protein and carbs are needed in high amounts in order to gain muscle for all the reasons discussed in both arguments. Remember that I am both a dietitian and bodybuilder.

"Both protein and carbs are needed in high amounts in order to gain muscle…"

The problem in giving general advice is that we are individuals and therefore our requirements for different nutrients vary. If you are trying to gain muscle at the same time as trying to lose body fat, your carbohydrate intake will need to be reduced. If you are a beginner bodybuilder who is very skinny, your protein intake will need to be high but you will need to consume high carb foods regularly to gain weight.

Remember that you will not make good gains unless your protein intake is sufficient; period. Any successful bodybuilder will tell you this, no matter what so-called 'experts' say and clinical trials show. Also, remember that protein and carbohydrate foods complement each other, and their absorption will be optimal if they are consumed together.

Key points

- *A regular intake of protein is required throughout the day*
- *Protein quality is important, and can be enhanced by combining protein sources*
- *2 - 4g of protein per kg body weight per day is required, depending on a number of factors*
- *Protein 'windows' should be utilised*
- *A steady input of high fibre starchy carbohydrate foods is needed throughout the day*
- *Carbohydrate requirements vary depending on a number of factors*
- *The topic of whether protein or carbohydrate is the primary nutrient in bodybuilding is an area of debate*
- *Protein and carbohydrate foods compliment each other and should be consumed together*
- *Amino acids and short chain peptides, and monosaccharides and oligosaccharides should be available in the intestine for optimal protein and carbohydrate absorption*

Chapter 4
Fats and Bodybuilding

Fat has traditionally been viewed as the bad nutrient in nutrition, although more recently people are recognising that there are different types of fat and that there may be some health benefits by including certain types of fat in the diet. An 'obsession' with many people has come about recently, in counting the number of grams of fat in foods. It used to be to count calories, and we managed to educate people not to do this, so now they have gone onto counting fat grams, in desperation to keep under a certain level each day. This fad has probably come about from manufacturers quoting their products as so many percent fat free. I try to educate my clients not to count fat grams either, as there really is no need, due to the fact that there are different types.

Why has fat been given such a bad rap? Well, in the Western population, in recent years, people are generally eating too much fat, from junk food and take-aways. It has been engrained into us that *high fat = high blood cholesterol = heart disease*. But, in reality the equation is much, much more complicated. As we are looking at healthy bodybuilding nutrition, I will firstly run through the types of fat, then look at their effect on health, and lastly look at the benefits of certain fats to the bodybuilder.

Types of Fat in the Diet

- **Saturated fats** generally come from animal sources such as meat and dairy produce, but are also found in some vegetable oils, margarines and processed foods.
- **Polyunsaturated fats** are abundant in sunflower and soya products.
- **Monounsaturated fats** are found in very high concentrations in olive, rapeseed and avocado oils.
- **Trans fats** are found in hydrogenated oils and margarines and some confectionery.
- **Omega-3 fish oils** are a type of polyunsaturated fat, with considerable health benefits. These are found in naturally oily fish in varying degrees, for example salmon, sardines, trout, mackerel.

Types of Fat in the Blood

There are a number of fats in our blood. Doctors measure levels of some fats per unit of blood as part of a heart disease risk assessment. These are known as serum lipids, and the most common ones are discussed below, though there are many more subdivisions beyond the scope of this ebook.

Cholesterol is waxy fat, made naturally in our bodies by the liver, and is an essential part of living tissues. Too much cholesterol builds up on the walls of arteries including those which supply the heart (coronary arteries). If these deposits become too large clots are liable to form, cutting off blood flow through the vessel causing the tissues which are served by the vessels in question to have insufficient blood supply. This is the case in heart disease where the coronary arteries become blocked, or in a stroke where the cerebral arteries block.

A high cholesterol level can be inherited but it can also be significantly affected by lifestyle, especially exercise levels and diet. A raised blood cholesterol level is a primary risk factor for heart disease.

Your ***total cholesterol*** level can be divided into subfractions to give a more accurate reading of what is going on in your blood. The two main subfractions are:

- **LDL**s – Low density lipoproteins are 'bad' cholesterol, and this level should be kept to a minimum. The LDL level signifies fat which is being taken to peripheral tissues for storage, or to be laid down as cholesterol in blood vessel walls.

- **HDL**s – High density lipoproteins are 'good' cholesterol as it denotes cholesterol which is being returned to the liver for disposal. This level should be high, signifying a reduced risk of heart disease.

There are further subfractions that give an even more detailed reading of what is going on, but since doctors rarely measure them, I will not go into any more detail.

The problem with total cholesterol (TC) level is that it masks the subfractions. You could have a fairly high TC but this may be because HDLs are high, reducing heart disease risk. Nevertheless, if your TC is very high it is very likely that your LDLs are also raised.

Triglycerides are another fat in our blood. Doctors commonly measure this level, as a high figure also increases your risk of heart disease. Triglycerides are not only affected by the amount of fat in your diet, but also by exercise level, dietary sugar intake and alcohol consumption.

Fats in the Diet and Good Health

Saturated fats should be kept to a minimum as they can contribute to a raised TC and LDL cholesterol level. A high intake of polyunsaturated fat in proportion to total fat intake can help lower total cholesterol. Consuming more monounsaturates helps lower triglycerides, LDLs and total cholesterol, whilst keeping HDLs high. Monounsaturates are therefore the most favourable choice. Trans fats should be avoided as can raise LDLs and reduce HDLs. Omega-3 fish oils reduce the clotting of blood, to an optimal level, as in the aetiology of heart disease, it is not just build up of cholesterol, but also the readiness of the blood to clot in the narrow regions, which causes occlusion. Omega-3s may also have a beneficial effect on cholesterol subfractions (Yannios 1999).

So, with all the conflicting evidence from 'experts' how much, and what types of fat should we be consuming? The answer lies in the individual. It would be impractical and far too costly to screen the population properly for heart disease risk, and it is unlikely you know your own risk, so I will attempt to provide general recommendations (bodybuilding aside for the moment).

The population guidelines in the UK aims for an average total fat intake of 30 – 35 % of total energy intake, and the saturates : polyunsaturates : monounsaturates ratio should be approximately 1 : 1 : 1. But, if you are trying to lose weight this percentage guideline is considered too high.

If your weight is fine, as a percentage of total fat intake, cut right down on saturated fat sources, eat moderate amount of polyunsaturates, include monounsaturates whenever possible, and eat oily fish at least three or four times a week.

"…do include small amounts of monounsaturates and eat oily fish a few times a week"

However, if you are overweight, cut right down on total fat intake, as fat is very energy dense (nine calories per gram, compared with four calories per gram of protein and carbohydrate), but do include small amounts of monounsaturates and eat oily fish a few times a week. Try to make it so that when you do have fat, consume from the beneficial sources, but don't exclude fat altogether.

Fats in Bodybuilding

The guidelines for the bodybuilder really go along with the health guidelines in respect of fat. Oily fish, remember, is a great source of protein, as well as omega-3 fats, so is an excellent food to consume. Tuna is a traditional bodybuilder's food, and has significant amounts of omega-3s, especially the blue-fin variety from the South Atlantic Ocean.

Also, there is excellent evidence that Omega-3 fish oils help muscle anabolism when supplemented to post trauma patients with the amino acids glutamine and/or arginine and RNA (see Chapters 8 and 9) (Kemen, *et al* 1995; Atkinson, *et al* 1998). This is of great interest to the science of bodybuilding, but there is, as yet, no research looking directly at the effects of supplementation with omega-3s on muscle growth.

Bodybuilders tend to want to keep lean, so consume a fairly low fat intake. Too low an intake of fat, however, could be detrimental to optimal muscle growth. Bodybuilders have high-energy requirements due to the intensity of workouts, and the energy required for growth, so fat is a valuable source of energy. As discussed in Chapter 1, variety is important, so consuming fatty foods occasionally will add variety to the diet. Consuming monounsaturates on a daily basis will also provide adequate amounts of the essential fatty acids. It may be an idea to this in the form of a high monounsaturated margarine or spread, or many bodybuilders like to have a tablespoonful of virgin olive oil a day – sounds horrible, so mix it into a glass of orange juice to mask its taste.

Even for the bodybuilder trying to lose fat, e.g. in dieting for a competition, including some fat is essential, as traditionally bodybuilders eat as near to zero fat at this time as is possible. By consuming some fat, not only do you obtain all essential fatty acids for good health, but it also helps stop the metabolism from becoming too stubborn and slowing down from lack of energy coming in. Fatty foods also contribute to satiety (feeling full up), important to the hungry dieting bodybuilder! A source of oily fish every day or two, and a spoonful of olive oil a day is ideal.

Indeed, some bodybuilders argue to eat actually quite a high fat diet in contest preparation (as high as 40 % total energy intake), and cut those carbohydrates down or out. This method is effective as their calorie intake is still in deficit, but I cannot see why the science of this method is more effective than the method I describe in Chapter 17.

I have tried to demonstrate that for good health and bodybuilding, some fat is needed, and it is the type of fat which is more important than total fat intake. Fat is a valuable source of energy, and beneficial to good health; an overlooked important point in bodybuilding in order to keep well to train and grow optimally.

I'll look at fats again in Chapter 9, where I'll discuss the use of fat supplement concoctions in bodybuilding, including essential fatty acids (EFAs) and medium chain triglycerides (MCTs).

Key points

- *We should include some fat in our diet, the amount varies depending upon our goals*
- *Monounsaturated and omega-3 fats are important to eat for good health and optimal bodybuilding*
- *Fat is a valuable source of energy*
- *If you are controlling your weight, then it is more important to watch the amount of fat you eat*

Chapter 5
Vitamins and Minerals in Bodybuilding

In this section I aim to discuss the importance of vitamins and minerals (also known as ***micronutrients***) in bodybuilding. I do not intend to go through each vitamin, mineral and trace element individually, like so many other bodybuilding books, because I can see no use in this; after all we eat *food* not *nutrients.* I will, however, mention the use of individual micronutrients where they have a role. I will cover the importance of all micronutrients for good health and effective bodybuilding, and also sources of vitamins and minerals. I also want to examine the use of vitamin and mineral supplement preparations.

According to the US Department of Agriculture, roughly 39% of all Americans use vitamin and mineral supplements daily (Phillips 1997). It has been estimated that well over 80% of bodybuilders regularly use them (Phillips 1997). As I have previously pointed out, bodybuilders are extremely compulsive and adamant about taking care of their bodies and will do anything possible to maximise their muscle building and fat loss efforts. But most do not really understand what vitamins and minerals are, nor what they do, they merely believe more is better.

Vitamins and minerals are essential nutrients, as, broadly speaking, our bodies do not synthesise them, so we have to obtain them elsewhere. Micronutrients regulate metabolism and assist in numerous physiological and biochemical functions. Insufficient intakes may lead to deficiency problems, and in extreme cases, even death.

Vitamins

Vitamins are fat-soluble, i.e. vitamins A, D, E and K, or water-soluble, i.e. vitamins C or B complex. Some are involved in the circulatory system; some assist enzymes in their activity and others help organs to function.

Minerals

Minerals are subdivided according to their functions or the amounts needed by the body: Macrominerals, e.g. calcium and phosphorous, are present in large amounts in the body, e.g. in bone. Electrolytes, e.g. sodium and potassium, are involved in the transfer of substances across membranes and impulse conduction. Trace elements, e.g. selenium, copper, are essential, but only in minute quantities.

Anutrients

These are substances found in food, which are not required to live, but may have some nutritional or health benefit. For example, phenolic compounds such as tannins, flavenoids and polyphenols, all have antioxidant capabilities, and may reduce risk of certain diseases. They are not needed to live, but have a use in the diet. They are abundant in fruit and vegetables and many other foods.

Dietary Requirements

Countries, such as the UK and USA, have developed guidelines to give the public an idea as to the amounts required for each individual nutrient. These values are commonly known as the Recommended Daily Allowance (RDA). The most up to date guidelines in the UK are the Dietary Reference Values (DRVs), compiled in 1991, which give amounts for various sectors of the population (DoH 1991). Using statistics, different levels have been devised, the upper and most important level being the Reference Nutrient Intake (RNI). This is the level of intake that will cover 97% of the population, i.e. the majority.

The problem with the RDAs is that they differ between countries, and are out dated in respect of modern evidence. They are always under criticism by top scientists, as to what extent they protect against ill health. For most nutrients, the RNI is said to be the figure which the Board came up with to cover frank deficiency for most of the population, whilst maintaining adequate amounts of that nutrient held in body stores for an stated amount of time. Newer evidence has shown new functions and roles for many vitamins and minerals, and higher levels may protect from certain diseases. Many papers have been written looking at *optimal* intakes, i.e. not just avoidance of deficiency but minimising risk of diseases and, in some cases, maximising performance. RDAs are therefore a starting point and 'safety net', but not necessarily optimal levels.

A good example of controversy is with the mineral calcium. The UK RNI in adults is 700 mg per day (DoH 1991); the US RDA is 1,000 mg a day – a big difference. Calcium is needed in the bone building years to help to protect against brittle bones or osteoporosis later in life. Later studies have indicated the 'optimal' level to be nearer the US figure. This is just an example; many macro- and micronutrients are under controversy. As bodybuilders we are all well aware of the protein requirements issue (discussed in Chapter 3)!

The Vitamin and Mineral Supplement Controversy

As I have said, I do not want to go through each vitamin and mineral individually, as I feel this serves no purpose, and there are plenty of books available if you want to find out more. Literature is available as to the amount of certain nutrients you may need, but if you are eating a healthy balanced diet, as discussed in Chapter 1, then, in most cases, you'll be okay. If you feel you may be consuming inadequate amounts consult an appropriately qualified practitioner, such as a dietitian; please contact me through www.muscletalk.co.uk, and I may be able to help.

The issue as to whether individuals *need* vitamin and mineral supplements is a big one. Most alternative practitioners and nutrition therapists will claim that you do need supplements for 'optimum' health. Bodybuilders will also say they are needed, just to make sure you're getting enough. When I am referring to 'supplements' in this section, please note that I am referring to vitamin and mineral supplement preparations.

There has been loads of scientific research into this debate, to see if supplementation over and above normal nutrition is required in order to reduce risk of disease and/or maximise performance. In some cases the research is conclusive and supplements are recommended, e.g. folic acid in pregnancy to reduce the risk of spina bifida in the child. Generally, it is certain subgroups of the population that do have a use for supplements.

Bodybuilders are traditionalists for megadosing, without any real reason for doing it. Certain vitamins can have harmful side effects if taken in too large quantities. Vitamin C is frequently megadosed on, but are you aware that too much for long a period can cause a type of kidney stone? As vitamin C is water soluble, people have the misconception that you cannot take too much – WRONG!

Some other examples, to name but a few (DoH 1991): There have been cases of death from too much vitamin A; rare, but there are many reports of hair loss, liver and bone damage. Excess thiamine (vitamin B_1) can cause headaches and irritability. Over intakes of vitamin D can cause too high blood calcium levels, potentially causing muscle spasms. Too much sodium raises blood pressure. Megadoses of iron can be lethal, especially in children, as iron levels are only controlled by what you eat, absorbed and what comes out when you bleed. Zinc in high amounts can cause nausea and vomiting. There are many cases of excess iodine intake causing goitre (an enlarged thyroid gland, making the neck swell up) and hyperthyroidism, i.e. a racing metabolism. Too much fluoride can cause tooth and nail crumbling. I could go on…

Antioxidants

Many vitamins and minerals are consumed in high doses for their antioxidant effects. Vitamins C and E, beta-carotene, selenium and phenolic compounds are antioxidants, which have been shown to reduce incidence of cardiovascular disease and some cancers. Antioxidants help stop the oxidation process, which is part of the aetiology of certain diseases. People therefore believe that consuming more of these antioxidants more means reducing risk of disease further. But, studies have shown that there are optimal intake levels.

“Consuming too high intakes of antioxidant supplements may have detrimental effects on health.”

The American Food and Drug Administration (FDA) have researched this in detail and their results conclude that the consumption of food in its natural form is ideal. In nature chemicals are naturally in a biochemical redox system, which is where some nutrients and anutrients act as antioxidants and others act as pro-oxidants, so they balance each other out. If there are too high levels of antioxidants in the blood, from consuming supplements, they can become pro-oxidants in certain circumstances, thereby increasing oxidation and risk of disease. Consuming too high intakes of antioxidant supplements may therefore have detrimental effects on health.

For these reasons orthodox nutritionists and dietitians recommend consuming a healthy balanced diet including foods from each of the food groups, with at least five servings of fruit and vegetables daily. In certain circumstances, there may be a case for supplements. But in general a healthy diet should cover all.

Okay, we are concerned with bodybuilding nutrition here, and I can hear you all arguing with me! "We need more than 'normal' people"; "It's better to have too much than too little"; "I need to optimise my performance"; "'Top' bodybuilding nutritionists are adamant that we need supplements"; "I used to feel crap all the time, so I started taking vitamins and minerals, and now I feel great". Remember, you know your own body better than I can ever do, so if you are adamant that taking micronutrient supplements has helped you, then keep on taking them. You can see that my views on this issue are extremely different to other bodybuilding nutrition gurus. But, I've supplied the reasoning and the evidence, so make up your own minds.

Many 'so called' experts, like Bill Phillips, will argue with me, and slate my advice such as mine in his literature. Quote: '…many old-school nutritionists and dietitians will tell you that you can get all these important micronutrients from simply consuming a "balanced diet" (whatever the hell that is)…' (Phillips 1997). Well, I hope to have clearly described the concept of a balanced diet in Chapter 2, and eating a wide variety of foods will cover this, as shown by reams of experimental, epidemiological and anecdotal evidence.

"…Bodybuilders can benefit from supplements, but not the vitamin and mineral types."

You've heard my argument, but let me further it: Yes, bodybuilders can benefit from supplements, but not the vitamin and mineral types. As you will see from Chapters 8 and 9, I *do* strongly advocate the use of some other supplements including meal replacement powders, and these are significantly fortified with the full array of micronutrients and some of the discovered anutrients. Also, if you feel you need more vitamins and minerals, then why not consume more fruit and vegetables? If you follow these guidelines, unless in certain circumstances, you will be getting ample amounts of all vitamins and minerals – so save your money and spend it on some of the other supplements discussed in Chapter 8.

Micronutrients Supplements which do have a Role in Bodybuilding

Some vitamin and mineral supplements do have a role when megadosed in bodybuilding. Although it would be irresponsible of me to recommend you take them, I will nevertheless inform you of the reasoning behind their use in certain circumstances.

Calcium

Although bodybuilders typically consume large amounts of food and nutritional supplements, they often skimp on dairy products, even low fat varieties. The case nowadays is whey-based protein powders are mixed with water and not milk. As dairy products are the largest contributors to calcium intakes, if you do not consume sufficient amounts, other sources of calcium have to be eaten. Another great source is naturally bony fish, like sardines and pilchards.

I suggest aiming for the US RDA of 1,000mg per day, especially so in women, as they are more prone to osteoporosis (brittle bone disease) later in life. Sources of calcium are:

Glass of whole milk (190ml)	-	226mg
Glass of semi- skimmed milk (19ml)	-	232mg
Glass of skimmed milk (19ml)	-	236mg
Pot of yoghurt (150g)	-	225mg
Small pot of fromage frais (100g)	-	86mg
1oz (28g) cheddar type cheese	-	210mg
2 tblsp (20g) grated hard cheese	-	148mg
Cheese spread triangle (25g)	-	150mg
Small pot cottage cheese (115g)	-	90mg
Cream cheese (in sandwich – 30g)	-	29mg
Scoop ice cream (60g)	-	66mg
Thick slice white bread	-	37mg
Thick slice wholemeal bread	-	20mg
Crumpet (40g)	-	60mg
Scone (48g)	-	90mg
Bowl muesli (50g)	-	55mg
Breakfast bar (35g)	-	200mg
2 oz (57g) drained sardines	-	310mg
Shelled prawns (60g)	-	90mg
1 egg	-	32mg
4 oz (110g) green vegetables	-	35mg
Small can baked beans (150 g)	-	80mg
2 tblsp red kidney beans (70g)	-	50mg
Large orange (210g)	-	70mg
7 dried apricots (56g)	-	52mg
1 tblsp sesame seeds (12g)	-	80mg

So, if you are not consuming many dairy products, it is hard to achieve 1,000mg a day from food alone. Remember meal replacement powders are quite high in calcium, but if you're not consuming these or other good sources, then a calcium pill may be in order for optimum health. As calcium homeostasis is so well regulated, only when there is a malfunction in the body can you overdose.

Vitamin C

This has got to be the most megadosed supplement of them all. Since Pauling's theory in the 1970s that a high intake of vitamin C may prevent the common cold, people have gone overboard. Pauling's research has since been disproved many times.

Vitamin C is an antioxidant and is also involved in immune function, but more does not mean a better immune system. There is an optimal level. While evidence suggests that both the UK RNI and the US RDA are too low, megadoses are not required. Intakes of people consuming plenty of fruit and vegetables as part of a balanced diet are way in excess of the RDAs anyway.

In contest preparation, bodybuilders have to rid their bodies of excess fluid to help with definition, and will use natural (and unnatural) diuretics in order to do this. The build up of high levels of vitamin C in body stores can act as a natural diuretic, helping to reduce water in contest preparation. Bodybuilders consume one to ten grams of vitamin C per day as a supplement for this effect (compare this to the UK RNI of 40 mg a day!). While I would not condone intakes of this quantity, it must be appreciated that vitamin C does have a beneficial purpose here in helping a bodybuilder achieve an important goal. If you do chose to use vitamin C supplements in excess of one gram, then definitely make it a short term action.

Niacin

Niacin, also know as nicotinic acid, nicotinamide or vitamin B_3, is used by bodybuilders when presenting themselves on stage due to its flushing effect from a megadose intake. One of the side effects of high intakes from a supplement is vasodialation of the capillaries. This helps the bodybuilder achieve a more vascular, fuller appearance on stage. Supplements of 200 – 400 mg are taken about 15 minutes before going on stage, and the effect lasts for approximately a further 15 minutes. The downside is intense itching, irritability and hotness.

Potassium

As I have already pointed out, many bodybuilders use artificial diuretics in contest preparation. For example, the diuretic Freusemide is commonly taken on the day of and day before the show, to rid the body of water, but it also drastically reduces the body's potassium levels. So, if the bodybuilder does choose to use these very dangerous drugs pre-contest, I would definitely recommend potassium supplementation during this period. Otherwise this will increase the already substantial risk of damaging themselves and not appearing on stage due to being rushed to hospital.

Magnesium

When reducing the fluid intake pre-contest and using diuretics, the muscles are more prone to cramps. Magnesium supplementation can reduce the risk of muscle cramps, especially with the hard tensing of muscles when on stage. Bodybuilders typically supplement with magnesium for the last week of contest preparation.

Vanadyl Sulphate

Vanadium is an essential trace element, but adequate amounts are easily obtained from the diet. A variant of vanadium is vanadyl sulphate, which has been a popular bodybuilding supplement for over 10 years. Vanadium is involved in the control of blood sugar levels, and it is able to mimic the actions of insulin. There have been a number of studies showing that oral supplementation of vanadyl sulphate can help sensitise muscle and liver tissue in types of diabetics helping to control blood sugar levels without the use of insulin (Halberstam, *et al* 1996).

Bodybuilders claim that using vanadyl sulphate enhances muscle fullness and makes it easier to create a good pump. There is no proof of this, as there is no good research on the effects of vanadyl sulphate on improved muscle growth. Vanadyl sulphate appears to help insulin in its glucose uptake action, but has no effect on its amino acid uptake action. One study has suggested that vanadyl sulphate may help to increase creatine uptake by muscle cells (Radda 1996).

Dosage of vanadyl sulphate is 10 – 20 mg two or three times per day, with food (Phillips 1997). Do not exceed this level, as high intakes may be toxic.

Sodium

Sodium is another nutrient that has a role in contest preparation. It used to be felt that you had to restrict sodium for 2 - 4 weeks pre-contest. The up to date method is to consume higher than normal amounts of sodium, and then cut it right down just before the show. Now sodium manipulation pre-contest is more complex (discussed in Chapter 17). But, you do not really need to take sodium as a supplement *per se*, as you can just consume high sodium foods or add more salt or Marmite.

Key Points

- *Vitamins and minerals are essential nutrients which can be obtained by eating a healthy balanced diet*
- *Anutrients are substances found in food which may help to protect against disease*
- *Whilst RDAs for nutrients are a good base line for requirements, they are merely a guide, and higher intakes may be needed to prevent against disease and optimise performance*
- *Vitamin and mineral supplements are only required in special circumstances, and sufficient amounts can be obtained from food*
- *In bodybuilding, under certain circumstances, some vitamin and mineral supplements may have a use*

Chapter 6
Fluid and Bodybuilding

Like all sports people, it is crucial that the bodybuilder keeps well hydrated. Most people do not drink enough, and with the intense exercise that bodybuilders do, it is even more important to drink. Even if it is not water, drink plenty of other fluids every day; at least twelve cups. Fluid manipulation is especially important pre-contest (see Chapter 17).

Temperature Regulation during Exercise

Man is very inefficient when it comes to converting the energy stored in food into mechanical work. Only 20 - 25% of the available energy stored in carbohydrate or fat is actually converted into a form which muscles can use to contract and generate force. So, what happens to the rest? Well, it is released as heat, which is why we get warm when we train. As the rate of energy utilisation rises, so does the rate of heat production. In order to stop hyperthermia (excessive rise in body temperature) the body must take action. The aim is to keep the body temperature around 37 - 38°C.

There are number of mechanisms which the body calls upon to lose heat. Obviously the surrounding environment plays a role, i.e. if it's hot, the body gets hot quicker, and it's harder to lose heat. One method whereby the body can lose heat is by convection, i.e. heat dissipating from the body, but you are not able to adjust the amount lost by this method very much, even during training, when we need to get rid of more heat.

"During prolonged exercise it is possible to lose as much as two litres of sweat per hour."

Another method of cooling is sweating. The evaporation of fluid from the skin is very effective. For every one litre of sweat that evaporates, some 600 kcal / 2500 kJ of heat energy may be released (Wootton 1988). During prolonged exercise it is possible to lose as much as two litres of sweat per hour. But, as I'm sure you'll have noticed, not all sweat evaporates, as some drops off the skin and is wasted; a disadvantage to the heavy sweater.

As sweating is an effective cooling mechanism, care must be taken to ensure dehydration doesn't impair the process. Bear in mind the body not only loses water in sweat, but also electrolytes, although electrolyte replacement has no real advantage (discussed later). Losses of fluid corresponding to as little as two percent of body weight can seriously impair the capacity to perform muscular work. In temperate climates, most athletes lose one to five percent of body weight in prolonged exercise, even when taking regular fluid throughout. In extreme conditions, losses of eight to ten percent have been reported. So in severe dehydration and electrolyte loss, a reduction in blood plasma volume can occur, which could result in circulatory failure.

The body needs to balance the loss and intake of fluids in order to maintain its capacity to regulate body temperature. So with the production of heat, performance falls off, and more effort is required to maintain the same exercise intensity, even if the individual does not feel particularly hot (because cooling methods are in operation). The result is heat exhaustion, and in extreme cases this can be fatal.

Gastric Emptying

I have gone into a bit of science here, but I felt it was necessary, in order to illustrate the importance of hydration. The main limitation to fluid replacement is not *how much* you can drink, but *how quickly* the drink can leave the stomach (Wootton 1988). This is the ***rate of gastric emptying*** and is influenced by:

- How much you drink
- The temperature of the drink
- How hard you are exercising
- Current hydration state of the body
- How much water is in the stomach
- Relative concentration of electrolytes in the fluid
- Relative concentration of carbohydrate in the fluid (less an effect, but does significantly affect the rate of fluid absorption directly)

Optimal Drinking During Training

The following factors suggest how athletes and bodybuilders may best use drinks:

- Although larger volumes, up to 600ml, are emptied from the stomach more rapidly than smaller portions, it is generally more uncomfortable to exercise with too much fluid in the stomach. It may cause nausea and reflux, or may interfere with breathing. It is generally better to drink little and often, but how much and how often depends on the individual. Sip water during training, as it feels comfortable.

- Colder solutions empty form the stomach more rapidly than warm ones. A cup of tea or coffee during your workout lies on your stomach more, as you may have noticed. Optimum water temperature during exercise is 8 – 13°C, but it is better to have a drink too cold than too warm. Don't worry about over-chilling the stomach, as cramps are more likely to occur as a result of an over-concentrated solution than from a cold drink. There is also psychological relief from drinking lovely cold water during a hard training session, especially on a hot day – this is therefore advantageous!

- Exercise duration has little effect on the rate of gastric emptying, but exercise intensity is very important. The harder you are working, the more difficult it is to replace fluids lost as sweat. Remember, though, that bodybuilding is a train-rest pastime, i.e. during a workout, you may do a very ferocious and intense set, but then you rest for a couple of minutes. This helps gastric emptying, and explains why during weight training we do not need as much water than when we are doing cardio session.

Accustom your body to accept fluids whenever you exercise. Thirst is a poor indicator of the need for water, as it is too slow a sensory perception. Ensure your body is fully hydrated pre-exercise, and sip plenty during exercise.

"Accustom your body to accept fluids whenever you exercise."

Somewhere around 250 – 500 ml of fluid about twenty minutes before training is roughly optimal. This is not too much fluid taken too soon before exercise to make you feel bloated, but sufficient in order to keep you well hydrated for an intense workout.

Electrolyte Replacement

Whether you need to replace electrolytes or not during exercise is an area well researched, but still somewhat of a debate. During exercise, stores of sodium, potassium and chloride barely alter, because as more fluid is lost than electrolytes, the concentration of electrolytes in plasma increases or remains constant. As part of the heat acclimatisation process, the body adapts to the stress of repeated episodes of dehydration by producing more abundant, yet dilute sweat.

However, a higher concentration of electrolytes in the digestive system can help to promote fluid absorption, thereby reducing the risk of dehydration.

Fluid Replacement Drinks

Many fluid replacement drinks are available on the market, which are very expensive. They are extremely palatable and refreshing, which is why they sell so well, but they don't really make much difference to the performance of a workout. As many are fizzy and often gulped, they can bloat you, so may even impede performance.

They do often contain additional carbohydrate, which can help the rate of gastric emptying and absorption of fluid, whilst supplementing the body's energy reserves. The electrolytes present in fluid replacement drinks are to aid absorption of water, and not to replace electrolytes lost in sweat. Very small quantities of glucose, sodium and chloride in solution make it hypotonic, which promotes the movement of water across the gut, thus speeding absorption. Too much, however, will give a hypertonic solution, and compromise absorption. Optimal glucose concentration is below three percent. Above this inhibits effective fluid absorption. Also, too much carbohydrate pre-exercise has a detrimental effect on energy utilisation.

Certainly in bodybuilding there is little place for fluid replacement drinks, as weight training has frequent rest periods. You should be getting all your electrolytes from your balanced diet. But it is imperative to keep hydrated with water during training.

Other Factors Affecting Hydration State

The use of diuretic agents has major effects on hydration. Alcohol and caffeine are two commonly used diuretics. It may take up to 48 hours to fully re-hydrate after a heavy drinking session – so, avoid the booze! Caffeine does have benefits in its own right, i.e. as a stimulant, but don't overdo it. Don't drink tea or coffee before or during a training session, as, not only are they warm beverages, but the diuretic effect of caffeine will limit hydration status. Also, don't consume too many cups in one day. Remember that dehydration is a limiting factor for exercising intensely.

Don't wipe sweat off during training (unless it's getting in your eyes), and splashing water on the skin is also a useful way to aid the loss of heat through evaporation. Wear suitable clothing, to help keep cool – avoid heavy sweaters and thick training bottoms, just because they make you look bigger!

Key points

- *A raised body temperature has a detrimental effect on performance*
- *Have a drink (250 – 500 ml) about 20 minutes before training*
- *Accustom your body to drinking throughout your workouts*
- *Drink cool beverages rather than warm ones*
- *Choose water or weak dilute drinks for fluid replacement*
- *Sip fluids regularly to avoid bloating*
- *Avoid alcohol and use caffeine sensibly*
- *Wear suitable clothing during exercise, and splash water on the skin*

Chapter 7
An Introduction to Supplements

With the vast array of nutritional supplements and erogenic aids on the market it is no wonder that even many experienced bodybuilders and athletes are baffled as to which are effective.

In the next few chapters I will attempt to look at most of the well-known (and not so well known) supplements on the market. It was incredibly hard work trying to arrange these chapters into some sort of order, as they can be grouped in many different ways. I decided to group them by their effectiveness, as this is what is important to the consumer.

This brief chapter discusses supplements in general and mentions some of the groups. The next three chapters will look at the most useful (Chapter 8), some which may be effective and worth trying (Chapter 9) and lastly, the waste of money ones (Chapter 10). Then in Chapter 11, I'll look at ways to help stop you getting ripped off by some of the scams supplement manufacturers and marketers try to pull.

"You do not need any supplements to build a great physique, but they are an extremely useful and effective way of improving your gains."

Discussions on supplements are based solely on my professional opinion and experience, but I *have* taken into account experimental, epidemiological and anecdotal evidence, including my own usage. The world of nutritional supplements is vast, but remember, they are what they say, i.e. *'nutritional supplements'* – they merely serve to *'supplement'* a diet which must already be optimal. You do not *need* any supplements to build a great physique, but they are an extremely useful and effective way of improving your gains. Supplements do not *'work'* as such, they are just a way of optimising your nutrition.

Nutritional supplements may be based on a variety of ingredients form varied sources, but in order to be classified as 'supplements' they must either be derivatives of a naturally occurring substance in the body or naturally occurring in nature which can be of no harm to the body. There is a very fine line between some substances that are classified as a 'nutritional supplement' and ones that are classed as a 'drug' and banned. In fact, products are constantly under review, and, in some cases, laws change so when a substance becomes banned it becomes a 'drug', though previously it may have been a 'supplement'. This is the case with some testosterone boosters.

Below I will introduce you to a few classifications of supplements and briefly discuss them.

Protein and Amino Acids Supplements

There are many protein, amino acid complex and individual amino acid supplements on the market. I will discuss the uses of amino acid capsules in muscle growth, and also the benefits of supplementing with single amino acids like glutamine, in the appropriate chapters, as some may be beneficial, others not. The importance of a quality protein intake was discussed in depth in Chapter 3, but other single amino acids need a mention, as supplement companies claim they have a role in being used as a supplement in their own right. I do not intend to go through each amino acid individually, but will mention a few with specific bodybuilding applications (or that claim to have). Remember that *all* amino acids essentially have a role in bodybuilding, as they are the building blocks of protein. In most cases this is sufficient as part of food or protein powders.

There are a few essential / indispensable amino acids that our bodies cannot synthesise; therefore we must consume them. There are also conditionally essential amino acids, which under certain circumstances we are unable to make enough, for example glutamine. The remainder are considered non-essential, though what we obtain from our diet are still used abundantly in the body.

Fat Derived Supplements

Some supplements are based on individual fatty acids or individual sources of fat or oil, with claims that they improve health and performance. Again these will be examined in the appropriate chapter according to their benefits.

Carbohydrate Supplements

Really, there is only multidextrose powder that is carbohydrate derived (see Chapter 8).

Herbal Supplements

In some countries herbal medicine and herbal supplements are classified as dietary supplements, and are being used more and more in sports nutrition, so are pertinent to this ebook. Herbs have been noted in some cases to have drug-like qualities, and they are frequently used in cookery for taste and garnish. Many of today's pharmaceutical preparations were derived from herbs many years ago, and some herbs and drugs are very similar in their mode of action. Some cultures still use herbal medicine more so than conventional medicine. Metabolism in the body of some herbs is by the same mechanism as their drug counterpart.

The effective use of herbal supplements in both medicine and sports is poorly researched and documented, but is nevertheless, a growing area. It's a subject that is pertinent to the content of this ebook, but if you do choose to use herbal supplements, please buy reputable brands and seek more advice.

We are looking at herbs from a sports supplement point of view, in particular bodybuilding, so whilst some herbs may have a place in health and well being, I will comment on their benefits (or adverse effects) to bodybuilders. The ones mentioned have been marketed as having a role as a supplement in bodybuilding directly or indirectly.

One problem with herbal supplements is that you cannot always be certain of the potency of the formula. Many factors are important, including which part of the plant was used, where it was grown, how it was harvested, what the soil was like, how it was processed and packaged, and so on. The herbal industry has attempted a 'standardised extract' so the potency of a herbal extract is guaranteed. Despite this, some manufacturers make their products with lower levels than they claim.

Homeopathic Supplements

These will be discussed in detail in Chapter 13, as I felt it more appropriate to class these under 'alternative nutrition'.

In Vivo Substrates Used as Supplements

In vivo means in the body, and there are loads of supplements which are substrates or derivatives of substrates naturally occurring in the body. These substrates have a wide range of functions and are essential to life. Manufacturers claim that supplementing your diet with more of that substrate will enhance health or performance. For some products the claims are well founded, e.g. creatine, HMB and GABA, but most are not. I will examine if supplemental doses of these chemicals have any benefits to performance.

Micronutrient Supplements

I made my view on vitamins and minerals used as supplements clear in Chapter 5; i.e. they are only beneficial under certain circumstances. Many micronutrients are marketed singularly or in complexes, and claim to have pertinent benefits to health and performance. I mentioned a few with a possible role in bodybuilding at the end of Chapter 5, and will not go into detail about any others in the next few chapters, as they could just be listed in Chapter 10, with the waste of money supplements.

Okay, enough background. What you people want to know is what works and what doesn't work. Well I will reiterate, nothing *'works' per se*. Though some supplements are invaluably useful aids. These will be discussed, so read on…

Chapter 8
The Top 10 Bodybuilding Supplements

After many questions on www.muscletalk.co.uk, I decided to write this chapter on the top 10 best value-for-money supplements available to bodybuilders. I will cover those which do have a role somewhere in the sport of bodybuilding, and a brief description of their use.

This chapter is based solely on my professional opinion and experience, but I have taken into account experimental, epidemiological and anecdotal evidence. The list is in no particular order (except for the first two, which, I feel, are the most useful for muscle growth), and, indeed, not all listed are appropriate for every bodybuilder, but all listed have their uses for some individuals. Some of the other supplements not listed in this chapter may have a role, but, I feel, do not have such a big role to play in bodybuilding, as these 10 (see Chapter 9). Many others are a waste of money (though I keep a slightly open mind, as there are new developments) (see Chapter 10).

Remember that you do not *need* any supplements to build a great physique, but they are an extremely useful and effective way of improving your gains.

Engineered Nutrition
Meal Replacement Powders (MRPs)

"MRPs… are an invaluable aid to the bodybuilder…"

Meal replacement powders (MRPs) are 'complete' nutrition powders containing high amounts of quality protein, moderate levels of carbohydrate (multidextrose), essential fatty acids and the full array of vitamins and minerals. They are an invaluable aid to the bodybuilder as they can be used to substitute one or more of the many meals he/she has to consume in a day; or MRPs can be taken to complement a meal. MRPs are best made up with water only; although those with the naturally lean, hard-gaining -type physique may want to mix the powder with skimmed milk for extra calories and protein.

I believe MRPs were first developed quite a few years ago with Met-Rx®, which is still a great product. Since the popularity of Met-Rx®, many other companies have developed their own formulas, and improved on the original idea. Some now include pre- and probiotics (see Chapter 12), HMB (see Chapter 9), glutamine (see later in this chapter) and many anutrients (as explained in Chapter 5), amongst other ingredients.

Other examples are ProMR® (Chemical Nutrition Products) and Myoplex Plus® (EAS). Most come in portion sachets, but some are available in tubs. Not only are MRPs nutritious, they are palatable and very convenient. For this reason, despite them being expensive, they have become very popular with athletes and bodybuilders especially for those with busy lifestyles. They also contribute a large proportion of quality protein to the daily high protein requirements of a bodybuilder. One problem with them is, sachets make up to a large volume which can be hard to consume in one go, and the thick beverage leaves you feeling quite bloated.

There are variations to the traditional MRP theme. One such variation is the lean-mass stimulators, which are lower in calories and protein than regular MRPs, but contain high amounts of vitamins and minerals, possibly accompanied by things like creatine. Lean-mass stimulators still contain high quality ingredients. Examples are Phosphagain® by EAS, PhosphaGold® by Weider Nutrition, and Lean Gainer® by Champion Nutrition. These are all great 'mini-meals' for the busy bodybuilder.

Another variation on MRPs is the complete nutrition electrolyte-replacement drinks, like Chemical Nutrition's Rapid Action®. This is a palatable fruity drink with moderate quality protein and carbohydrate, vitamins and minerals, and high in electrolytes.

Regular MRPs are useful for any busy person, and are now being consumed abundantly by many different types of sportsman. Variations on regular MRPs are also useful, but not as 'essential' as mainstream MRPs which are really a 'must' for an enthusiastic bodybuilder, to help ensure good nutrition.

Whey Protein and Other Quality Protein Powders

Hopefully, after reading Chapter 3, as a keen bodybuilder you should recognise the usefulness of protein supplementation. A few years ago, a new system of filtration identified ion-exchange whey protein as a top quality protein source. This is a process of microfiltration which sieves out all other constitutions of milk (whey is one of the milk proteins). Before the discovery of filtered whey, most protein powders were based on cheap, poor quality soya protein, or egg white protein (which mixes poorly).

There is a debate as to whether ion-exchange whey protein is the best, or whether other quality protein powders are better. There is no doubt as to the high biological value of whey, its large percentage of branched-chain amino acids, its similar amino acid profile to that of human muscle tissue, and that it is digested, absorbed and taken up by muscles quickly. However, some researchers feel it passes *too* quickly through our gut, so not all is available for absorption. In this case it may be that quality protein powders based on a combination of different protein sources, may be optimal. These contain two or more sources of protein, and often include whey with other sources like casein, whole egg, amongst others, so there is a more staged digestion of the protein. Remember what we discussed in Chapter 3 about mixing protein sources for optimum quality?

"…the popularity of whey protein continues."

For reasons other than its quality, the popularity of whey protein continues. It is so easily digested and doesn't lie on the stomach like many powders, and is generally palatable, and mixes well in water. Studies have also shown that whey protein has immunostimulating actions too, i.e. it also has the right profile of amino acids for the immune system, and exerts positive actions on immune proteins. It has also been found to increase levels of the antioxidant glutathione (Bounous, *et al* 1989; 1989; 1991).

Quality whey protein or combination protein powders are invaluable to the bodybuilder, as it is often impractical to eat the amount of high protein food required in order to achieve optimal gains. Despite the fact that protein powders are often costly, it may still be cheaper, protein gram for gram than consuming food sources. Protein powders are best mixed with water, and then consume them in between or as a compliment to meals. The two best times to take a protein supplement are first thing in the morning, and directly after a workout. Taking one last thing before going to sleep at night is also useful, and some bodybuilders benefit from waking in the night and having a protein drink. Taking food sources quickly at this time would be impractical and would probably cause indigestion.

Creatine Monohydrate

Creatine is a compound made naturally in our bodies as an energy transporter. It is manufactured in the liver, kidneys and pancreas and secreted into blood for transport to muscle (amongst other) cells. Its chemical name is methylguanido-acetic acid, formed from the amino acids arginine, methionine and glycine by a process that is beyond the scope of this ebook and boring for a bodybuilder! Creatine is probably the most scientifically researched sports supplement ever, providing conclusive results in that creatine *does* work.

The Science of Creatine

Creatine in muscles is converted to creatine phosphate (CP - also known as phosphocreatine), involving the enzyme creatine kinase, which bonds creatine to a high-energy phosphate group. Creatine is permanently stored in muscle cells as CP until it is required to replenish phosphate.

I'll now attempt to briefly explain some of the science of energy production, to give you insight into the background as to how creatine helps. Adenosine triphosphate (ATP) is the molecule used to provide energy in all cells. It is the key molecule formed from the Krebs cycle, glycolysis and lipolysis, three of the key metabolic pathways that show the chain of reactions whereby nutrients are converted to energy or stored. ATP carries three phosphate atoms, and when each bond, which holds a phosphate group to the adenosine molecule, is broken, a 'unit' of energy is released. By this process our muscles have access to energy enabling them to contract and our bodies to function. Each molecule of ATP can release two 'units' of energy by being broken down firstly into adenosine diphosphate (ADP – with two phosphate atoms), and then into adenosine monophosphate (AMP - adenosine plus one phosphate group).

What happens when all the ATP in cells has been used up? Where do we get our energy from then? Well, this is where CP comes in, and creatine replenishes AMP to ATP, by transferring the phosphate in creatine phosphate back to the adenosine in AMP and ADP. At this point creatine becomes ***creatinine***, which is removed by the blood and excreted via the kidneys. In the clinical setting, creatinine levels are measured to assess physiological parameters such as kidney function. Creatine supplementation raises creatinine levels, although it is completely non-toxic to the kidneys (Robinson, *et al* 2000).

Numerous studies have demonstrated that the more creatine that is present in muscle cells, up to a maximum storage level, the more efficient ATP can be replenished, and, hence more ATP is available for energy. Typically, the average person metabolises about two grams of creatine per day, which is roughly the same amount as can be synthesised by the body. The richest food source of creatine is meat and fish, but it has been found that muscles can store far more CP than is possible to obtain from food (Hultman, *et al* 1996), so by supplementing with creatine monohydrate you can maximise these stores. You would have to consume over 10lbs of raw steak a day during the creatine-loading phase to optimise stores!

Other Positive Effects of Creatine

Not only does creatine allow you to have more energy to help lift heavier weights, train harder and at higher intensity, but it also has other benefits to the bodybuilder. It has been demonstrated that creatine may also promote muscle growth by stimulating protein synthesis in two ways. Firstly, is from the increased work you are able to do as a result of the above actions. Secondly is that the more CP that is stored in muscle, the more water is drawn into muscle and makes it fuller and stronger. More CP and water in muscle, the volume of the muscle increases, and the muscle cell and is known as 'volumised' or 'super-hydrated'. A volumised muscle helps to trigger protein synthesis, minimise protein breakdown and increase glycogen synthesis (Haussinger 1996; 1996). If a muscle is then trained properly, this could lead to enhanced muscle growth.

A muscle 'pump', as you know, is a desired effect sought by bodybuilders during training where blood rushes to the muscle and it is worked. The 'pump' experienced when using creatine is reported to be much more intense, and this is as a result of the cell volumising effect.

Creatine may also act as a lactic acid buffer and improve exercise recovery time. Lactic acid is produced as a bi-product during anaerobic (without oxygen) exercise, such as weight training. Lactic acid is responsible for the 'burning' sensation when the muscle becomes fatigued. When you cannot train anymore, it is due to you either having run out of energy or a build up of lactic acid. Creatine may act as a buffer for this lactic acid, which helps to delay the onset of fatigue.

Most users experience notable weight increases when they commence a course of creatine, up to six or seven pounds (about three kilograms), especially during the first time they use it. Most of this weight gain is from the cell volumising effect, but this is not water retention, rather water drawn into the muscle from outside it. The cell volumising weight gain of creatine is therefore not permanent.

Some of the weight gain is from an increase in muscle tissue, and not just water, due to the positive effects of creatine. Studies have shown that creatine supplemented subjects significantly gained more lean body mass than non-creatine-supplemented individuals, but total body water was no different from before and after the study (Kreider; *et al* 1995; 1996). Most size and strength gains from creatine are during the first month of its use.

Creatine Formulas

Creatine monohydrate is the form of creatine that is most commonly sold, because it is virtually tasteless and dissolves quite well in water. Creatine phosphate and creatine citrate are also available, but are not as popular, because they are not as good. Always make sure you use creatine monohydrate.

"…creatine is even more effective when taken with simple carbohydrates."

Some studies have shown that creatine is even more effective when taken with simple carbohydrates. This is due to the effect carbohydrates have on insulin release, and the insulin in turn helps muscle cell uptake of creatine. It has been suggested that a formula of roughly 35g of dextrose plus 5g of creatine monohydrate is the optimum for an effect. Studies in a range of athletes from different sports have shown creatine plus carbohydrates to produce better performance than creatine alone (Stout, *et al* 1997; 1997).

Some creatine and carbohydrate formulas also contain the amino acid taurine, which acts as an insulin mimicker, to aid creatine uptake; and disodium phosphate, magnesium phosphate and potassium phosphate, all of which play a role in the formation of CP. The effectiveness of formulas containing these ingredients is controversial

Many formulas are available which contain creatine plus carbohydrates, e.g. Phosphagen HP® (EAS), Cell-Tech® (MuscleTech), Creatine Xtreme® (Champion Nutrition). These companies claim this to be better than just consuming creatine with carbohydrate sources, like fruit juice or sugar. The types of carbohydrates that are used in these formulas are supposed to be optimal (roughly 35g per serving or creatine), but I feel the effect of having a glass of fruit juice or sugar with a creatine load may be as good.

How to Take Creatine

There are a number of theories as to the best way of supplementing with creatine, some say take in fruit juice; some say take with a hot beverage so it dissolves and is absorbed more easily; some advocate a loading and maintenance phase; some say only five grams a day. Studying all the data, and from experience, it appears the following may be optimal:

A creatine serving should be in a hot drink (tea / coffee) with a teaspoon of sugar with some fruit or fruit juice. Take it with a loading and maintenance phase, as clinical studies have clearly shown more benefit here (Greenhaff, *et al* 1993).

***Loading phase*:** 10g per day, as 2 x 5g servings for 5 days
5g per day, for 5 days
3g per day, for 7 days.

***Maintenance phase*:** 2g per day, for 5 weeks.

This may be followed by a period of rest from using creatine, or back on the loading phase. If you want to have some time off, have at least 2 weeks. Many companies who sell creatine claim the dosages need to be higher for optimum effects, but all they are trying to do is sell more, and I know I couldn't tolerate more than this without an intolerable upset stomach! There is no hard evidence that cycling creatine (i.e. periods without using it) is any better than using is constantly. Anecdotally, there are mixed reports about cycling.

Some 'experts' claim that creatine shouldn't be served in a caffeinated beverage, like tea or coffee. They say that caffeine inhibits optimal absorption of creatine due to its effect on carbohydrate take up by muscle, and there is sub-optimal hydration of muscle too. There is no evidence to substantiate these claims, and I really fail to see that caffeine with creatine is a problem. I enjoy a couple of caffeinated drinks a day to perk me up, but if you are still concerned that caffeine has a negative effect on creatine uptake, take it in decaffeinated tea or coffee.

I would not recommend the use of creatine four weeks before a bodybuilding competition, as, despite the fact that creatine is supposed to draw water from around the muscle to within it, it has been reported to give a smooth stage appearance. Again supplement companies claim it can be used pre-contest for its cell volumising effect. I wouldn't risk it.

Should I use Creatine?

Creatine monohydrate has been shown in numerous studies to be, safe, even in large quantities (Robinson, *et al* 2000). Side effects are temporary gastric upset and nausea, especially during the loading phase, which can be quite unpleasant. Also quite intense muscle cramps have been reported in many athletes, which could lead to injuries, and impair performance. Muscle cramps tend to be more prevalent in more energetic sports like athletics and football, rather than bodybuilding.

Creatine is the most researched of all sports supplements and is still raved about by many sports people of different disciplines, and definitely has a role in bodybuilding. However, despite the scientific hype, creatine is not the be-all-and-end-all of supplements in bodybuilding, as you can build an excellent physique without ever touching it. It may be worth giving it a try to see for yourself, and I do not doubt that you will see and feel positive results. Remember though, like many supplements, it is expensive.

Quality Weight Gain Formulas

Quality weight gain powders will always have their place in the bodybuilding market. I do not mean the ridiculously mega high calorie crash weight gain formulas full of simple carbohydrate and fats mentioned in Chapter 10; but the moderately high calorie, high protein formulas such as N-Large$^{2®}$ (ProLab Nutrition) and Pro-Mass® (Chemical Nutrition Products). Typically these are 5 - 600 calories per serving and approximately 50g protein, and can be mixed with water or skimmed milk.

Weight gain formulas are definitely not necessary for every bodybuilder, especially not for the hefty built endomorphic type physique. Nor would I recommend them for someone who is trying to keep their body fat down. However, quality weight gain powders are an invaluable aid for the skinny newcomer who struggles to eat enough food in order to put on quality weight. They are also useful off-season for more-advanced bodybuilders with a fast metabolisms and busy lifestyles to add a few more quality calories, which may otherwise be missed out on.

Like many bodybuilders, I have used mega high calorie formulas in the past, but wouldn't waste my money again. I do still use quality weight gain powders when I am in a bulking cycle, especially useful when I am too busy for a snack or meal, and I always keep a serving prepared in the fridge.

Multidextrose Powders

Multidextrose is a synthetic polysaccharide that our body treats like starch, i.e. a complex carbohydrate. Multidextrose is used by a range of sports people to help meet the high-energy demands of intense exercise, especially by tri-athletes. In bodybuilding it is invaluable for the lean hard gainer who struggles to eat enough carbohydrate each day. Just adding the powder to drinks, an individual can increase their intake of quality carbohydrate by 6 – 800 kcals each day. They are also useful for the busy bodybuilder, who can throw a made-up drink down his/her throat far more quickly than chomping away on a sandwich. Multidextrose powders are cheap, and useful for bulking up on.

Amino Acid Capsules

In Chapter 3, I discussed the importance of protein quality and how it is useful to mix protein sources. Often with busy lifestyles, it is not convenient to consume more than one different protein sources at a meal. Taking a few amino acid capsules with food will help ensure good protein quality at each meal. This is not necessary with whey or whole egg sources, as these are already high quality proteins.

Amino acid capsule supplements are not essential, but can be extremely useful for improving protein quality. Avoid amino acid tablets, as these have binders, and are put together by a super-hydraulic compression press. They are difficult to dissolve and are poorly absorbed; in fact, I would say they are a waste of money. Capsules are more easily digested, and the amino acids are more easily absorbed. Make sure that the capsule preparation you purchase contains the full array of free form and branch-chain amino acids.

Also a waste of money, are the sublingual amino acid drops. Supposedly, these are absorbed more readily and quicker so blood concentrations increase more effectively. This has never been shown to be true, and if you have any basic physiology knowledge you'll know that protein digestion doesn't begin until the stomach. Therefore, avoid these preparations too.

Amino acid capsules are not essential, but could be useful for more advanced bodybuilders to take with food, and maximise protein quality. They therefore, do have a place on the bodybuilding supplement market.

Glutamine

Glutamine is a non-essential amino acid, but during times of physical stress, it becomes essential, as the body is unable to manufacture enough. Glutamine is required in large amounts every day to maintain proper function of many organs and the immune system.

There are considerable amounts of research into the use of glutamine in sports, but with very mixed results. Glutamine is also used clinically, in the intensive care setting, to aid wound healing in burns, post surgery and sepsis patients. It is also the amino acid preferred as a source of energy for intestinal muscle cells to aid absorption of other nutrients. Its use in medicine is also controversial, with mixed reports, that it has significant benefits to critically ill patients (Lacey & Wilmore 1990; Roth, *et al* 1990; Heys, *et al* 1999).

Glutamine has other functions, including being involved in the manufacture of the powerful antioxidant glutathione (see Chapter 10), and has also been shown to increase growth hormone release (Welbourne 1995).

In bodybuilding it is used for the same reasons as in medicine, in that weight training stresses our bodies intensely. Some scientific evidence points to glutamine being of little use in sports, but anecdotal reports and other studies have shown significant benefits.

"When demands for glutamine are high and there is insufficient dietary glutamine…"

When demands for glutamine are high and there is insufficient dietary glutamine, the body cannot manufacture sufficient amounts, so it is taken from muscle stores. Therefore, not only do we have insufficient amounts for muscle growth, but glutamine is also taken from muscle. Exogenous glutamine is therefore anti-catabolic.

Also, the way in which glutamine is taken is debatable. Many quality MRPs are fortified with extra glutamine, and also some quality protein powders contain added glutamine over and above the source of the protein. It is probably best to consume a small amount of additional glutamine throughout the day. This is helped by spreading out consumption of MRPs, and by consuming some glutamine with meals. Studies have shown that 50 - 85% of supplemented glutamine is not absorbed (Phillips 1997), due to other amino acids competing for intestinal receptor uptake in absorption, so I would take one dose of one to two grams at least half an hour away from other protein sources. Take glutamine with carbohydrate, e.g. mixed in fruit juice. Glutamine has its place for the more advanced bodybuilder, in aiding recovery.

Supplement Bars

In my mind, these are the most useful 'supplements' available simply because of their convenience. Most of us have busy lifestyles, but still have to eat loads to build great physiques. Supplement bars can be eaten on the go, and these days there is great tasting range of quality nutrition bars available. Examples are Chemical Nutrition Products' Chemical Flapjacks® (conventional flapjacks with added protein), Peak Body's Pro-27® meal replacement bars, amongst others.

My main criticism of these has to be price; is there really a need for them to be so expensive? Supplement bars are very useful for the busy bodybuilder, especially if he / she is bulking up.

Pre-Workout Drinks

Energy drinks come in a vast array of different concoctions, some just sugar-based and some containing a range of stimulants like caffeine, guarana and ephedra (see Chapter 9). Do not confuse them with electrolyte replacement drinks, as discussed in Chapter 6, though some do contain electrolytes to help fluid absorption. They should also contain optimal levels of carbohydrate to aid fluid absorption.

Again, energy drinks are very expensive, but nice tasting and many feel they need them in order to train intensely after a hard day at work. Also, remember the importance of a good fluid intake from Chapter 6 in order to train maximally, and these drinks are a great way to hydrate.

"…these drinks are a great way to hydrate."

I will not recommend any particular types of pre-workout drinks; I'll leave that for you to decide which you prefer. Avoid the high sugar (glucose) ones, which are full of calories, as these can have a rebound effect on your energy levels and, in fact, cause sluggishness. To avoid stomach cramps, sip them before and during workouts, don't gulp!

GABA

Gamma-aminobutyric acid (GABA) is used by some athletes and bodybuilders, with mixed reports of effectiveness. It became popular after the gamma-hydroxybutyrate (GHB) scare. GHB was used as a growth hormone releaser and subsequently a recreational drug (see Chapter 10). GABA is a natural substance found in the same chemical pathway as GHB.

Taken before bed GABA gives deeper, better quality sleep, hence more GH is released and you feel better the next day. Some people like to use it pre-workout and claim it gives them a 'buzz' during training; I have tried this and it definitely made me feel worse. I don't know whether the increase in GH release is entirely true, as I could find few clinical studies, and those that do exist are poorly designed (Cavagnini, *et al* 1980; Acs, *et al* 1990), but the theory is sound. GABA does, however, definitely improve sleep quality, and it has been said you can get eight hours worth of sleep in six hours - useful for the busy-lifestyle bodybuilder; I know I benefit from it.

Watch out for its rather unpleasant side effect of shortness of breath and chest tightness about ten minutes after ingestion that lasts about five minutes. I don't know why GABA causes this effect, but it is uncomfortable and can be scary if unexpected.

GABA definitely has a place on the supplement rack as an aid to quality sleep, and it isn't too expensive. Don't use it too often, to avoid reliance, so a tub will last months.

Summary

In this chapter, I hope to have discussed which supplements I feel have a use, under certain circumstances, in bodybuilding. All these have a definite place in bodybuilding, although that place is not with every bodybuilder. I hope this chapter makes spending your money wisely a little easier. I'm sure there are many points that I haven't covered, so please ask me any questions at www.muscletalk.co.uk

Chapter 9
Supplements That May have a Role in Bodybuilding

The purpose of this chapter is to give you some background information about some other supplements that may have a use in bodybuilding. In some cases, I may express my opinion, but mostly I will just give you facts and let you decide whether the products are worth trying. All the products in the previous chapter are extremely useful for certain bodybuilders or lifestyles, none of the products listed in this chapter are that crucial for anyone. Some however, may have a role, but are by no way nearly as useful as the ten in Chapter 8.

Like I discussed in Chapter 7, despite being 'naturally occurring' products, some are controversially referred to as 'supplements', due to fact that they have drug-like actions. Some are banned in certain sports, and are illegal in some countries. They may then cease to be a 'supplement'.

The world of nutrition is constantly being researched, and improvements are always being discovered. Due to lack of good evidence for many supplements, I mostly have to rely on what users have said, either through ***www.muscletalk.co.uk***, through literature or from the network of athletes and bodybuilders I know personally.

Ephedra

This herbal supplement is extremely popular in sports and recreation, but is more commonly used in its drug form ephedrine hydrochloride. Ephedra is extracted form the Ma Huang plant in China and is very effective as a fat-burner due to its thermogenic action. It was first used thousands of years ago by the Chinese to treat respiratory ailments due to its bronchodialatary effects, for which it is effective as ephedrine hydrochloride is now in conventional medicine.

Ephedra is used all over the world as a slimming aid, a nasal decongestant and as a stimulant. Here, I'll ignore its respiratory effects and focus on its use in sport and bodybuilding. Ephedrine is really the main active component in ephedra. There are different strains of the ephedra herb of varying potency.

Ephedrine is a beta-adrenergic agonist; i.e. it targets the same receptors as the hormone adrenaline. The effects of ephedrine are to raise heart rate and thermic production all over the body. This is why it helps burn fat. Ephedrine also releases noradrenaline to the brain, exerting its stimulatory effect. Upon stimulation, adrenaline is secreted from the adrenal medulla gland into the blood, and in turn, the brain releases noradrenaline. This causes body temperature to rise and fat cells to break down, for immediately ready fuel for a fight or flight situation.

Ephedrine and ephedra are being used in the club scene as a stimulant to party and dance all night, or some drug dealers sell crushed ephedrine off as a cheap version of amphetamine sulphate (speed). This illustrates how big a demand there is for the supplement and the drug.

Studies have shown that 25mg of ephedrine can increase metabolic rate by nearly 10% (Astrup, *et al* 1992). Ephedra and ephedrine are very effective on their own for the above reactions (Pasquali & Casimirri 1993), but the effects are even more potent when combined with other stimulants including caffeine, guarana and white willow bark. Of particular interest is the ephedrine-caffeine-aspirin stack (eca), where all three compounds work synergistically to produce a very effective and strong effect. The eca stack is available as a drug containing ephedrine hydrochloride or as a herbal preparation (supplement) containing ephedra. The use of eca is also quite wide.

The effects of ephedrine and ephedra on muscle sparing during low calorie intakes are also well documented (Pasquali, *et al* 1992). Unfortunately, there is little documented evidence on the direct performance enhancing effects of ephedrine and ephedra in sports. This is due to the fact that ephedrine is on the International Olympic Committee's (IOC's) banned list, and the reluctance for more than minute doses in approval of studies, even of ephedra. However, you have only got to use ephedra or eca once to know that ephedrine works as a stimulant.

Ephedrine's effects as a slimming aid are threefold:

1. It is a thermogenic aid, i.e. it burns fat
2. It suppresses appetite
3. It is a stimulant providing more energy to perform even when you are on a very low calorie intake

Like ephedrine, ephedra too has side effects, despite being 'natural'. These include shakiness, disorientation, excessive thirst, perfuse sweating, wakefulness, polyuria and dull headaches. These are all dose dependant, and its appetite suppressing effects may also be negative if you are the type of bodybuilder who struggles to eat sufficient food in order to gain weight. Ephedra use can also make some people a bit short fused and aggressive, and this is even more so on the eca stack; avoid ephedra it if this is the case. As with any supplement, some people just don't get on with it very well, and don't like the way they feel on it; again, if this is the case with you, don't use it.

As ephedrine/ephedra tend to increase blood pressure and heart rate, avoid ephedra if you are diabetic, have heart problems, have thyroid problems or suffer with high blood pressure. Also, people with nervous conditions or those who are highly stressed or depressed should avoid it. Even if you are perfectly healthy, do not exceed the recommended dosage, or you'll suffer with insomnia (for the same reasoning, don't take it too late in the evening), anxiety or even panic attacks.

Also, with chronic use of ephedra, you build resistance to it very quickly. One study showed that one week using ephedra significantly depressed the beta-adrenergic response (Nelson, *et al* 1975), and the suppression was still apparent 36 hours after the last ephedra ingestion. Therefore in order to optimise its use a regimen of cycling is in order.

Using ephedrine alone, the amount needed to initiate an effect varies from 25mg to 100mg, but some users claim they need even more for an effect. This demonstrates reliance, and why I recommend ephedrine/ephedra are not used every day. For an effective safe dose, take between 420mg – 840mg of ephedra standardised to 6% ephedrine alone, which equates to the above in ephedrine hydrochloride. Take this a maximum of three times a day, though once may suffice, 30 minutes before exercising or before meals (as food lessens the stimulatory effect). If you use the eca stack, the doses I've suggested above can come right down.

Some supplement companies suggest one day on, one day off; I would disagree with this. It is better to use ephedra irregularly, and I would have at least two days free from it each week, and also suggest periods of a few weeks where you do not use it at all. *Please* do not overuse ephedra, I've seen so many people overdo it, and the true long-term effects of chronic use are not really known, but are likely to be liver problems. Using it the way I have suggested will minimise any chance of problems.

As you've probably noticed, I'm raving about ephedra, and so why haven't I included it in the Top 10 Supplements chapter? It certainly has a role in bodybuilding, for bodybuilders trying to lose fat, whether it is pre-contest or for general weight control, or as a stimulant for a great workout. It's also extremely useful to take ephedra after a hard days work when you have to go to the gym, because if you're too tired, you cannot train with true intensity. The reason why I don't consider ephedra to be a useful supplement, is simply because it is used much more in its drug form ephedrine hydrochloride, and is cheaper in this form, even on the black market. This is an illustration of the fine line of difference between a 'supplement' and a 'drug'. Essentially, ephedra and ephedrine are exactly the same, but as one is viewed as a 'herbal supplement' it is therefore legal. In eca formulas this is also the case.

Currently, the laws in many countries, including the UK and USA, are vague concerning ephedrine, but it is banned. The control of the herb ephedra is now being looked into, as it is essentially the same. We may see it too becoming illegal in the not too distant future. This is really likely in the USA.

"I do consider ephedra and the eca stack well worth using for many bodybuilders and athletes."

I do consider ephedra and the eca stack well worth using for many bodybuilders and athletes. As I will not condone the use of drugs in sport, ephedra-based formulas are the only effective natural alternative, but bear in mind that the effects are the same as taking banned ephedrine hydrochloride.

Guarana

The herbal supplement guarana seed is a stimulant containing high amounts of caffeine, containing 2 ½ times the amount found in coffee beans. It therefore has all the effects of caffeine, but is often used by 'health freaks' who view caffeine as bad (when it's just the same!). I like guarana as a stimulant, especially as a pick-me-up tonic, but don't overuse it.

Green Tea Extract / Catechin

Green tea is grown in China and it has a number of health benefits. Its caffeine content is lower than Indian black (normal) tea, and it is higher in antioxidant content. One prevalent antioxidant in green tea is the polyphenol catechin, which is now marketed as green tea extract nutritional supplement, as an antioxidant and as a fat-burner. A well-designed study in 1999 indicated that catechin was significantly effective in increasing 24-hour energy expenditure and fat oxidation in humans, independent of any effects of caffeine (Dulloo, *et al* 1999). Catechins may also have a small stimulatory effect, by inhibiting noradrenalin degradation. Catechins may also work well as a forth member of the eca stack.

Green tea extract supplements may contain catechin with caffeine and some other polyphenols, or just catechin alone. Catechin is also marketed as an inhibitor of the digestive enzyme lipase, thereby reducing fat digestion and absorption, like the actions of the weight control drug orlistat. There is no basis for this claim in any way, and it is another example of unsound marketing by manufacturers. However, as a thermogenic aid and fat oxidiser, green tea extract is effective and may have a use in bodybuilding, for keeping body fat levels down.

Green tea extract preparations are very expensive to be effective in the dosages required. Green tea extract doesn't get my vote as a top supplement, simply because I think it is better to drink green tea itself. This way you will get the above effects, plus benefits from an array of other antioxidants in the balance of nature. The problem is many people are fussy, and green tea, whilst palatable, is just not as nice as black tea! Bodybuilders have to consume so many supplement drinks a day, and they look forward to a nice refreshing cup of tea. Having to replace this with a less refreshing cup of green tea may not be desirable.

I try to drink a mug of green tea a day, and don't bother with the extract supplements. Have the tea with lemon juice, and leave the tea bag in to stew for 5 minutes to get as much out of it as possible. If you're not keen, try it with sweeteners. Do not add milk, as some amino acids in milk will bind catechins, and negate some of its positive effects.

Aloe Vera

I was tempted to put this with the Top 10 Supplements, but as clinical research for aloe vera is still in its infancy, I thought it pertinent to leave it in this chapter. Aloe vera is well known for its uses as an atopic preparation in hair and skin care, where it is conventionally recognised. Alternative practitioners claim aloe vera to also be a *'cure all'* product. Whilst this statement is more than a little extreme, aloe vera does seem to have a number of uses in attaining good health.

There are over 200 species of aloe, but only three or four have medicinal benefits, including *aloe vera barbadensis* and *aloe vera linne*. Aloe vera has been used as a medicinal herb for over 4,000 years by many cultures, including the Ancient Egyptians, Chinese and Indians. The mature aloe vera plant is harvested and extracts from the leaves, the inner gel and sap are preserved and bottled for sale as a supplement preparation.

There are 75 known ingredients of aloe vera gel including vitamins, minerals, sugars and amino acids (in too low doses for any effectiveness). There are enzymes which supposedly aid digestion and the inflammatory process; plant sterols which help control serum lipids and are involved in inflammation; lignin which gives aloe one of its skin-helping properties; saponins which act as anti-microbial, anti-bacterial, anti-viral, anti-fungal and anti-yeast, i.e. help fight infections; anthraquinones which are anti-inflammatory and pain killers, and are also laxatives; and salicylates, another anti-inflammatory agent. There are also a number of anutrients, many of which are antioxidants.

These ingredients act synergistically mainly as anti-inflammatory agents in cases where inflammation is pathogenic, but promote favourable inflammation where it is advantageous. Aloe vera ingredients supposedly act on epithelial tissues (the layer of cells which cover a tissue, organ or cavity) like skin, gut lining, bronchial tubes, etc, and the immune system.

"…for aloe vera anecdotal reports are numerous and agreeable."

Now, although these ingredients are proven to have a role in these areas, direct effects of aloe vera on clinical outcomes or improved performance (since this is what we are looking at) are merely hypothesised, despite a number of studies. As you know I am not a strong believer in anecdotal evidence, but for aloe vera anecdotal reports are numerous and agreeable.

Aloe vera has been anecdotally reported to favour a number of inflammatory diseases including arthritis, cystitis, gastritis, back pain and many more disorders. It has also been linked to improving mood in depression, though its effects here are doubtful.

Vogler and Ernst (1999) systematically reviewed evidence. The results on skin healing, including post surgery wound healing (Fulton 1990; Schmidt & Greenspoon 1991), psoriasis (Syed, *et al* 1996) and radiation injuries (Williams, *et al* 1996), were mainly positive, though mechanisms of action are unclear. There is also evidence that aloe vera may have a role in controlling blood glucose (Yongchaiyudha, et al 1996; Bunyapraphatsara, et al 1996) and lipid levels (Nassiff, et al 1993). Vogler and Ernest conclude that more well-designed evidence is needed to be convincing.

In bodybuilding, I feel ingesting aloe vera orally, may be useful in reducing inflammation associated with joint injuries and also speeding recuperation after an intense workout. It is certainly not a *'cure all',* but may help general health. For a 'well' bodybuilder take about 25ml of quality gel daily, for a bodybuilder with disorders or long standing injuries try 25ml two times a day. You need to take aloe vera consistently and it is doubtful that any effects will be noticed for at least six weeks. Watch out for this herbal supplement in the future in both medicine and sports.

HMB

HMB, or *beta*-hydroxy *beta*-methylbutyrate, is quite a popular bodybuilding supplement, and there is some research to back up its effects. HMB is a water-soluble metabolite of the amino acid leucine, and is made by our bodies or obtained from food. It is present in small quantities in both plant and animal foods, and is also a constituent of breast milk.

HMB appears to upregulate the body's ability to build muscle and burn fat (Nissen, *et al* 1996). HMB is a precursor of proteins of muscle and the immune system in supporting maximal cell repair. Thus the muscle membrane can be more rapidly repaired after exercise-induced damage. Muscle growth is supported by having enough HMB available for membrane expansion. HMB may also reduce protein turnover, hence it has an anti-catabolic effect. Its lipogenic effects are poorly documented.

How much HMB is required depends on how much muscle you already have, i.e. a heavily muscled bodybuilder will require more than a newcomer to the gym. Doses somewhere between 1.5g and 5g per day have been indicated to be optimal. It is possibly best taken post training along with simple carbohydrates, in a loading and maintenance phase, like creatine. It is also suggested that HMB be cycled, as continued use may down-regulate its effects.

HMB is perfectly safe and side effect free. But, despite reasonable research it is just not raved about as much as other supplements, and it does not produce such dramatic initial changes that creatine monohydrate does. It is very expensive, due to the fact that manufacturers claim it to be costly to produce. It appears that HMB may have positive effects for bodybuilding, but is by no means a 'great' supplement and I would spend my money on other products.

Testosterone Boosters

Testosterone, for those that don't know, is the male androgenic hormone responsible for all male characteristics and for growth of muscles, amongst other functions. It is released primarily form the testes, but a small amount is also produced from the adrenal cortex, hence females also have a small natural testosterone level. It is a lipid, i.e. it's a fat-like substance, and has a four-carbon ring. All anabolic steroids are derived from testosterone.

"When they do get banned, I think you can say 'goodbye' to testosterone boosters altogether…"

Testosterone boosters are natural substances, classified as ***pro-hormones***, which, in theory, raise natural testosterone levels 2-3 times, and are said to be *'natural'* alternatives to anabolic steroids. Testosterone boosters are very controversial and some will probably be banned in most countries in the very near future; in fact laws have recently changed in the USA whereby products containing testosterone boosters must be labelled with proper warnings. When they do get banned, I think you can say 'goodbye' to testosterone boosters altogether, as consumers currently use them because they view them as *'natural'*. If they are banned they will be viewed as *'unnatural'*, so why use them when other 'unnatural' substances, like anabolic steroids, are more effective?

I've noted them in this chapter because they do 'work', but are not as effective as anabolic steroids (besides being marketed so) and are definitely not without side effects (in fact side effects are similar to those of anabolic steroids).

Let's examine some testosterone boosters:

- Dehydroepiandrostenone – DHEA

DHEA is naturally an androgenic hormone made in the adrenal cortex gland, and is two steps in the chemical pathway up from testosterone; i.e. it is a pro-hormone for testosterone. Other than being involved in testosterone manufacture, it has other direct functions including energy production, sexual maturation and muscle growth.

Clinically, DHEA is used to improve deficient immune systems. It is sold by lots of supplement companies, who report it to have numerous functions in sport. Its use has mixed reports in bodybuilding. Females and older athletes may benefit from it more, as natural DHEA levels diminish after 25 years old in males, and are much lower in females. As a supplement, it is only effective in people who have a lower level of natural DHEA, in which case it may lead to increased natural testosterone production, and has little use in subjects who use anabolic steroids.

I could find no proper evidence examining the direct effects of DHEA on improving muscle growth, but some bodybuilders claim it has had an effect. It is advised to be used with caution, and has reported side effects.

What positive evidence I have heard about DHEA has not been that amazing, but it may have a role in female bodybuilders and the over 40s. Quality research is definitely needed here for me to be convinced it has a role in bodybuilding.

- Androstenedione

Androstenedione is the next step up from DHEA in the chemical synthesis of testosterone. It has also been found naturally occurring in the pollen of Scotch pine trees, so may be classed as a dietary supplement. Reasonable amounts of androstenedione in the liver will be converted to testosterone, hence the theory that this supplement works. Clinical trials have shown raised testosterone levels with supplementation of androstenedione (Benendonk 1993), but there are no trials showing a direct link between androstenedione use and an increase in muscle strength or size, nor athletic performance in humans. People who I have known to use it have reported no notable effect, though many supplement 'gurus' report it to be better than its precursor DHEA.

- Tribulus Terrestris

Tribulus terrestris is plant which grows in some moderate and tropical climates of the world. It is being marketed as a testosterone booster, but works in a very different way to DHEA and androstenedione which provide the raw materials for testosterone production. I think this is the only testosterone booster that may get away without being banned, as it is a herbal supplement.

Tribulus terrestris raises natural testosterone levels by increasing the gonadotrophic hormone, luteinizing hormone (LH). LH is secreted from the pituitary gland in the head as part of a negative feedback mechanism to control testosterone release. Some scientific studies have demonstrated tribulus terrestris may have the potential to increase LH production. The studies have looked at increased sperm production, testosterone production and testicular maturation, and libido, in response to taking tribulus terrestris (Zarkova 1981; Dimitrov, *et al* 1991-1992). There are no studies which have found benefits to athletic performance or muscle building form taking tribulus terrestris, but some athletes have claimed an effect.

Many supplement companies have made wild, exaggerated claims about this product, unsubstantiated, including reduced risk of diseases and disorders, in the same way that claims are made about many 'alternative' products. It has been said, though that tribulus terrestris alone will not lead to any notable results in muscle gains, but as part of a stack with DHEA and androstenedione it may be more effective. DHEA and androstenedione provide the raw materials for testosterone production, whilst tribulus terrestris raises LH levels to promote their conversion to testosterone.

- Chrysin / Flavone X

This supposedly works through yet another mechanism to boost testosterone levels; it minimises the aromatisation of testosterone into oestrogen. Aromatisation is a natural process in the body, whereby the more testosterone that is present, the more is converted to oestrogen. This reduces testosterone levels, and with the raised oestrogen, some female- like side effects like gynecomastia (formation of breast tissue in males), water retention and increased fat deposition my be apparent. Theoretically, products which block aromatisation are therefore advantageous. It has also been said that Chrysin may work well with the other testosterone boosters in a stack to give a synergistic effect.

As I have already said there have been mixed reports on the effects of these *'natural'* testosterone boosters, and it is doubtless that their effects are in no way nearly as strong as anabolic steroids. Anabolic steroids are given such bad press, and if the testosterone boosters do work as well as is claimed, their effects will be similar, therefore they may too be reported in such a negative way.

I have never personally met anyone who has used these very expensive testosterone boosters and been pleased with results. In fact, I have spoke to many who have made no gains over and above what they were making without their use. Despite this, some clinical trials do suggest they may work to a degree, and I have read a few positive anecdotal reports. The claim is that they work better synergistically in a stack, which obviously works out very expensive, and if the side effects are the same as anabolic steroids then it would be much cheaper to use drugs!

Lipoic Acid

Lipoic acid is also know as lipoate, alpha-lipoic acid and thioctic acid, and is a co-enzyme for some chemical reactions in the body. As a supplement, it is said to aid the anabolic hormone insulin in its actions. *In vivo*, lipoic acid has a role in glycolysis, which is the process of conversion of blood sugar into energy. Lipoic acid supports the activity of enzymes in mitochondria (small energy producing structures within cells) in muscle cells.

Lipoic acid is produced naturally in the body in sufficient amounts for its actions, but like creatine, some studies suggest that by supplementing with it, there is improved utilisation of blood sugar. Most studies have been performed clinically on diabetics, and lipoic acid has been demonstrated to improve blood sugar level control (Passwater 1995), by aiding muscular uptake of sugar for storage as glycogen. In diabetics, studies have also suggested that whilst there is an increase in glucose uptake by muscle cells, there is actually a decrease in glucose uptake by fat cells at the same time (Tritschler 1995). The result of this may be more energy production in muscles and less fat stored in the body.

There are few tests on healthy, exercising subjects, but the hypothesis is that it will work in the same way. Remember from Chapter 3, where I discussed insulin not only aids glucose uptake by cells, but also uptake of amino acids? Well, lipoic acid may also aid insulin here. Lipoic acid may therefore help to build muscle, lose fat, speed recovery and give fuller, more pumpable, muscles.

Like insulin, there is the side effect with lipoic acid of hypoglycaemia, i.e. low blood sugar levels, especially when you have not used the supplement before. Symptoms may be fatigue, intense hunger, jitteriness, confusion, anxiety and sweating (like those experienced by diabetics who do not plan their insulin dose correctly). Therefore, on commencing its use, start on a low dose and build up gradually. Always consume carbohydrate foods after taking it.

Whilst I do not know anyone who has used this product, the theory behind its action is sound, and it may be a useful aid in muscle building. Direct research on supplementing with lipoic acid on improving performance parameters is needed to be conclusive. Like always, however, it is very expensive.

Glucosamine Sulphate and Chondroitin Sulphate

Both glucosamine and chondroitin sulphate are very popular nutritional supplements in the treatment of osteoarthritis. Glucosamine is a precursor to glycosaminoglycan, which is used in cartilage formation and repair. Chondroitin sulphate is the most abundant glycosaminoglycan in cartilage, providing it with resiliency.

Glucosamine has been extensively studied for years in the treatment of osteoarthritis and its benefits are controversial, but tend to lean towards it having a beneficial effect (Conn *et al* 1999). Recent reviews have indicated little benefit, and argue that results of well-designed studies are inconclusive, evidence being mainly anecdotal and therefore weak (Chard & Dieppe 2000). However, I would disagree, and it has been indicated that glucosamine is a fairly powerful anti-inflammatory agent for joints (Taphadinhas, *et al* 1982) and also a useful cartilage regenerator (Drovanti, *et al* 1980).

Chondroitin sulphate has been shown to inhibit enzyme breakdown of cartilage (Acs, *et al* 1990), and has been reviewed to have a favourable effect on arthritic parameters (Gaby 1999).

Glucosamine and chondroitin sulphate have been sold as supplements to strength athletes for years, as long term training causes some wear to joints; we've all experienced injuries from time to time. Research has suggested that glucosamine and chondroitin supplementation may help weight training injuries too, at a dosages of 500 – 1,000 mg and 200 – 300 mg respectively, three times daily with food. They stack well together for a synergistic effect, and are often found together in supplement preparations.

Avoid bogus supplements like shark cartilage that are marketed for joint pains, but contain ineffective dosages of glucosamine. However, there appears to be reasonable evidence that glucosamine and chondroitin sulphate alone or stacked together can help the osteoarthritic bodybuilder get back to having some reasonable workouts, and may also have a role for all strength athletes when we experience joint troubles.

RNA

RNA, or ribonucleic acid, is a base component involved in many functions in cells, including protein synthesis. It is used as a supplement clinically and in sports nutrition. The theory behind it is that it helps to support the immune system during times of metabolic stress. There is excellent data of its benefits in improving clinical outcome in critically ill patients (Khun *et al* 1995; Kemen *et al* 1995; Atkinson *et al* 1998; Heys *et al* 1999), but little as to its uses in weight training stress.

I have a feeling that RNA supplementation may have a place in bodybuilding, and some MRPs contain it, but much more research is needed.

Cranberry

Cranberry juice is recommended in health medicine for treating urinary tract infections and bladder problems, and is effective (Weiner & Weiner 1994). Cranberry not only kills the bacteria causing infections, but also prevents them from sticking to cells. Cranberry juice and cranberry extract pills are being used in bodybuilding to 'detoxify' the kidneys.

I cannot see a role in sports *per se*, but forget the pills, and, as cranberry juice also contains lots of other useful nutrients and anutrients, it cannot hurt to have a glass now and again.

Milk Thistle / Silymarin

Milk thistle, or silymarin, is a herbal supplement used by steroid-taking bodybuilders as a liver detoxifier, as the use of anabolic steroids (which are metabolised in the liver) can put tremendous strain on the liver. Studies have shown much improved liver enzyme levels in athletes who use drugs in sport when using milk thistle, compared with those who do not (Neuman, *et al* 1991). Silymarin is also a potent antioxidant.

"Milk thistle has a role in bodybuilding as a liver detoxifier."

Milk thistle has a role in bodybuilding as a liver detoxifier. It is available in its pure form, or with a combination of other herbs in the product LIV 52®.

Alanine

Alanine is one of the amino acids broken down and released in huge quantities during intense exercise. Like glutamine, alanine plays a role in cell volumising (Rivas, *et al* 1995), and it is also a source of glucose during exercise to stabilise blood glucose levels.

As whey protein is very high in alanine, a good intake of whey means you need not supplement alanine separately, and some supplements are also fortified with extra alanine. If you're not using whey or a supplement fortified with alanine, an extra two grams right after training may exert a benefit.

Arginine

Arginine is used as supplement in its own right in the clinical setting, and is added to some specialist intensive care feeds for post trauma patients, and has been shown to enhance wound healing, regulate hormone activity and potentate immune activity (Heys, *et al* 1999; Efron 2000). All these parameters are applicable to bodybuilding.

In the 1980s bodybuilders used arginine supplements, as a scientific study indicated that large doses of arginine increases growth hormone secretion (Valetto, *et al* 1996). Since then arginine has bee shown to have no effect on this parameter.

As arginine has an important role in feeding the critically ill patient, I feel it may have a bodybuilding application in its own right. More research of arginine's effects on muscle growth and athletic performance are needed, in the meantime, consume a high quality, varied protein diet.

Tryptophan

Tryptophan is an essential amino acid, sold as a supplement in its own right as it is a very effective sleep aid. Consumed in gram amounts before bed, tryptophan affects the neurotransmitter serotonin, which induces sleep.

Most protein foods don't contain very high amounts of tryptophan, but levels are relatively higher in carbohydrate rich foods. Milk is quite high, which is why the oldwives remedy for insomnia is a glass of milk at bedtime.

Tryptophan as a supplement became banned in the late 1980s in many countries, including the UK and USA, as it was found to cause a rare blood disease in genetically susceptible individuals. Amino acid complex preparations also have to limit the amounts of tryptophan they contain. A loophole in the law means that tryptophan can still be purchased as a supplement in health food stores, but it is labelled for use in animals only.

Insomniacs really do rate tryptophan as a sleep aid, so I guess there must be some merit in this. However, it is of no benefit to individuals who have no trouble sleeping at night, and does not induce a deeper sleep in the way GABA does. As a bodybuilding aid, it may be a helpful supplement if you struggle to get to sleep. Remember that quality sleep is imperative to bodybuilding, as this is the time when we grow and rest to re-energise ourselves for tomorrow's workout.

Essential Fatty Acids

I discussed the different types of fat in Chapter 4, but as you now know, a low fat diet is not necessarily the ideal diet. You need to include omega-3 and monounsaturated fats for an optimal healthy diet.

If everything is normal, there are only two essential fatty acids (EFAs) – linoleic acid (an omega-6) and alpha linolenic acid (an omega-3), but for optimal health, some other fatty acids may become conditionally essential. It is therefore good to consume diets rich in eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA) and arachidonic acid also, as these three are physiologically important (DoH 1991).

EFAs have a number of vital roles in the body, including as structural components of cell membranes and as part of the structure of prostaglandins, which have a variety of functions, including regulating steroid hormone production. Studies have shown that in very low fat diets there is a decrease in blood testosterone levels (Reed, *et al* 1993; Ingram, *et al* 1987), and even small decreases in fat intake below moderate fat intake levels, have shown a small reduction of testosterone production (Hamalainen, *et al* 1983). I do not intend to advocate loads of fat in order to boost testosterone levels, but I am demonstrating that too low fat diets for too long a period can adversely effect performance, and this is mainly due to insufficient intakes of EFAs.

Good intakes of EFAs may also decrease catabolism and increase growth hormone secretion (Dray, *et al* 1980), and of course, as discussed in Chapter 4, there are health benefits from consuming the right types of fat. EFAs have also been demonstrated to improve the action of insulin (Borkman, *et al* 1993; Phillips, *et al* 1994) and enhance the oxygen use and energy transformation required for optimal performance (Brison, *et al* 1981; Warner, *et al* 1986).

All sounds great, doesn't it? Well, why have I put EFAs in this chapter, and not in the Top 10 supplements list? Many bodybuilders consume flaxseed, linseed, evening primrose and borage oils to supplement some of these fatty acids. All of these are rich in one or more, but not all, of the aforementioned five fatty acids. This has lead to supplement companies producing 'designer fats' that contain rich amounts of all the above fatty acids. Some bodybuilders make up their own concoctions by combining some of the above fats. In my professional opinion, it is generally not necessary to supplement your diet with any of the above fats, provided you are getting adequate intakes from your diet. I would recommend:

- a serving of naturally oily fish three or four times a week, for example mackerel, salmon, trout, pilchards, sardines, kippers or sprats
- Include monounsaturated fat food sources, like olive or rapeseed oil. This could be via a high monounsaturated spread or olive oil in recipes or salads. Alternatively try one teaspoon of virgin olive oil per day (in a glass of fruit juice to hide the taste).
- Eat a balanced, varied diet, which may include some higher fat foods sometimes. Don't eat these foods too often, especially if you are trying to lose weight.
- If you cannot do any of the above and are struggling with your gains, it may be worth trying some of the above fats to supplement EFA intake.

Conjugated Linoleic Acid

Conjugated linoleic acid (CLA) occurs naturally in many foods, particularly in beef, turkey and some dairy products. It is a form of the essential omega-6 polyunsaturated fatty acid. It has been shown to be an anti-carcinogen, to reduce adverse catabolic effects of immune stimulation, to enhance growth, to improve blood lipid profiles (Belury & Vanden 1997) and to act as an antioxidant. It has also been indicated that CLA may enhance fat loss and increase lean body mass (Pariza, *et al* 1996; Chin, *et al* 1994). It has therefore been postulated that CLA is a growth factor in some animal species and maybe humans.

It is not truly known how CLA works but there are theories. It may have positive effects on certain chemicals in the immune system, like cytokines and prostaglandins. Muscle growth and fat loss cannot be optimised when these two chemicals are not in line.

Another theory is that CLA may be involved in the way nutrients are used by the body, by altering nutrient flow through cell membranes.

CLA is being marketed as a fat burner and muscle-tone enhancer supplement to athletes, bodybuilders and everyone. Bare in mind that most of the studies have been performed on animals, so are really only weak evidence when applying the data to humans. More research is also needed to elucidate what dose is optimal, somewhere between two and six grams a day. Like creatine, it is impossible to obtain enough in order to give a desired result from foods alone.

CLA needs far more well designed research in order to get my 'seal of approval', and I wouldn't recommend its use yet. But I keep an open mind to it, and you may wish to give it a try. I'd be interested to know what you think.

MCTs

MCTs are medium chain triglycerides, i.e. different to long chain triglycerides (LCTs), as in regular fats. Due to their different chemical configuration, MCTs are absorbed and processed differently to normal fat. LCTs have to be broken down in digestion, combined with a protein and shuttled through the lymphatic system to the liver. In the liver fats are broken down to free fatty acids, which are either stored as body fat or used as fuel. MCTs enter the bloodstream directly, and can be immediately used for energy; i.e. they're like a more energy-dense form of dietary carbohydrate.

"MCTs …can be immediately used for energy…"

MCTs can be bought as a liquid fat, and whilst not necessary by any means, can be useful for the hard gainer who struggles to eat enough for sufficient energy.

Summary

I'm sure there are many more supplements on the market that I haven't mentioned. All I'd say is, if you haven't heard of it, be careful. Before you spend your hard-earned cash do some research, look in books and on the Internet and post topics on **www.muscletalk.co.uk** *and we'll see if we can help.*

Look out for supplements that don't contain what their label says they do, inferior imitations of reasonable products, supplements that are based on a false premise, ones based on alternative science, and supplements based on little or no research of any description to back up claims.

Chapter 10
Waste of Money Supplements

You should now be familiar with the bodybuilding supplements that are great, ones that are okay and the ones that need more research. But, what about the others? And there are *loads* of others!

I have reviewed a considerable amount of literature (if any exists) for the supplements listed in this chapter, but can see no use in bodybuilding. The reasoning behind my judgements may be through lack of evidence, poor theory or just plain bullshit!

Pyruvate

Pyruvate is a naturally occurring product in the body, and is the end product of glycolysis, being the gateway substrate into the Krebs cycle (also known as the citric acid cycle). The Krebs cycle is a cycle of chemical reactions in order to produce ATP or its direct precursors, i.e. it is involved in energy production.

Pyruvate as a supplement is supposed to increase cellular respiration, i.e. speed up the Krebs cycle, therefore promoting ATP production. This may also inhibit fat production (Stanko & Adibi 1986). In reality, there is little evidence that it actually does this, although major drug companies are involved in research. There is no evidence that supplementing with pyruvate will help a bodybuilder achieve his or her goals. However, properly designed research may reveal different outcomes, but this is a way off.

Creatine 'Boosters'

Creatine boosters claim to contain Krebs cycle intermediates, B vitamins and a small amount of creatine. They are marketed with the theory that by supplying the raw materials that are required for the manufacture of creatine leads to more creatine production. This is not the case, as natural creatine production is controlled by a feedback mechanism, and no matter how much of the raw materials are available, if there is no stimulus to produce it, production will not occur. The only way therefore to boost creatine stores is to consume exogenous creatine.

Mega-High Calorie Weight Gainers

"The hottest new bodybuilding supplement was the one with the highest calories…"

Back in the late 1980s and early 1990s the bodybuilding supplement industry went through mega-calorie mania. The hottest new bodybuilding supplement was the one with the highest calories, ranging from products of 1,500 to 3,000 kcals per serving (there was even one of 10,000 kcals!). The theory was that calorie intake was the limiting factor for muscle growth, which we know not to be true, but I have to admit, in my naivety, I was caught out and regularly used them!

Calorie content was so high because the products were made up of fat and simple sugars and a serving size was huge. They contained vitamins and minerals and reasonably high protein, but of inferior quality. Drinks were to be made up with full cream milk, as much as one or two pints, to achieve the calorie total claimed on the packet. Extra full cream milk increased the total and saturated fat content further, and also raised lactose content of a product which was already high in lactose – hard work for even the most hardy of digestive systems. These products were also often unpalatably sweet and, due to the bulk, left you feeling bloated and unable to eat food for hours afterwards – undesirable for a bodybuilder. Many bodybuilders are still confused about these products when trying to gain weight but, in truth, all they do is help gain fat.

Most of these have now been withdrawn from the market, but a few are still available. These are *not* to be confused with the moderate calorie weight gain drinks that I discussed in Chapter 8, which contain quality protein and are low fat, and are a valuable contribution to the bodybuilder who struggles to eat enough to gain weight. Rather than using mega high calorie weight gain drinks, the hard gaining bodybuilder would be better using MRPs, quality weight gain powders and multidextrose powders.

Anabolic Mega Packs

These were trendy in the late 1980s and early 1990s. They consisted of sachets of a mixture of amino acids, vitamins, minerals, fatty acids and other substrates supposed to work together to pack on size with 'steroid-like effects'. Yes, readers, your author fell for this one too, and wasted loads of money on expensive, low dose micronutrient and amino acid complex supplements.

Pregnenolone

This is marketed as another testosterone booster, as it is a precursor in testosterone synthesis. The problem is that pregnenolone is also a precursor to other steroid hormones, including progesterone, cortisol and aldosterone, all of which are disadvantageous to a bodybuilder. Which hormone pregnenolone ends up as is governed by the pituitary gland in the head, via negative feedback. If there is no stimulus for testosterone production, then testosterone will not be produced from the increased levels of pregnenolone. Conversely, higher levels of cortisol or the other hormones could be produced if there is a stimulus for their manufacture and pregnenolone is present. In this case, not only may this supplement be of no use to a bodybuilder, but it may, in fact, be catabolic. Avoid it.

Mexican Yam Extract

Mexican yam extract or dioscrorea does nothing for bodybuilding. As a herbal bodybuilding supplement it is claimed to boost DHEA and testosterone levels, as it contains plant sterols. It is marketed as a testosterone booster supplement and 'a natural form of DHEA', but since DHEA is supposed to be natural anyway, Mexican yam extract has no use. Aside to this point, it is ineffective anyway, as Mexican yam extract doesn't contain DHEA. Don't waste your money!

Colostrum

Naturally, colostrum is a constituent of breast milk. It is rich in insulin like growth factor-1 (IGF-1) and other growth nutrients. It helps the new-born's immune system and digestive enzymes. However, as a bodybuilding supplement it is totally useless because any digestive system that is more than a few weeks old will destroy any useful factors, other than a few vitamins and minerals.

GHB

"GHB is…, in fact, lethal and avoid it at all costs!"

GHB or gamma hydroxybutyrate is not only a 'supplement' that I would say is useless, it is, in fact, lethal and avoid it at all costs! It became popular in the 1980s as it 'knocks you out' causing better, deeper sleep – an advantage to bodybuilders. Also, deeper sleep causes more growth hormone secretion. Since then it has become abused on the recreational drug scene too, and in the UK and USA has been rightly banned and classed as a drug. It is now illegal to manufacture and distribute GHB.

Interestingly, GHB has been nicknamed GBH because of its 'knock out' ability. It causes an almost 'euphoric state of mind, which is why its become abused. But if you take too much, you get projectile vomiting and can pass out quite quickly, in fact there are many reported deaths from GHB directly, or with it as part of a recreational drug cocktail. It is also called 'G' or 'Liquid X' on the streets. Its effects are addictive and can ruin lives. It is also one of the date-rape drugs, as it dissolves easily in drinks and leaves the victim immobilised.

One problem is that GHB can be made quite easily at home with varying strengths. I know a few guys who used this a few years ago and none of them will touch it again. One friend took it and ended up in hospital critically ill, and in my naivety, I too used it and felt dizzy and unable to stomach even water for 12 hours. The thing is, you can use this stuff a few times and feel OK; I felt great the next morning. Then one time it can all go inexplicably wrong with the same dose or even less.

This is completely different from the supplement GABA (see Chapter 8), which is one step up in the chemical chain form GHB. GABA makes you sleep better, but is much milder and has no potentially lethal side effects.

Despite the fact that GHB may give you a good night's sleep, anything that has the potential for these side effects is a no-no in bodybuilding. If I had to pick out a supplement that was the worst ever, it would be GHB. Avoid GHB at all costs, and if someone tries to sell you it, it's illegal so report him or her to the police. I hate it!

Beta-sitosterol

This is a plant sterol supplement, marketed in bodybuilding to assist in the production of various hormones. It doesn't.

Plant sterols are being used to control cholesterol levels now and are added to some spreads. Here they do have an effective role, but this is really of no benefit in bodybuilding.

Diosterol

This is another plant sterol. No evidence that it does anything, nor any theory; it doesn't do anything!

Smilax Officianalis

This is a herb that contains plant sterols, and like the other waste of money plant sterols, smilax has no use in bodybuilding. It is marketed as a product that leads to increased testosterone production, but, as the body lacks enzymes to convert plant sterols to testosterone, it does absolutely nothing.

Glandulars

The use of glandulars in nutrition and bodybuilding has been popular for many years; probably longer than I've been around! Basically, they are freeze-dried extracts of glands like bull's testes in the theory that you are taking in anabolic hormones. Glandulars are destroyed in digestion before being absorbed so any potentially active component will be lost.

Some companies sell neonatal glandular extracts, as glands from embryonic tissue are supposed to have higher activity levels of hormones. But this is just a variation to make the scam more effective!

Orchic Testosterone Extract is an extract of powdered bull's testes, and is another variant on the glandular theme. It is supposed to contain active testosterone and is taken sublingually. This stuff has never been tested and doesn't do squat.

There are no studies that show any benefit of using glandulars in bodybuilding or any other sport. They are a complete waste of money

Digestive Enzymes

Digestive enzyme preparations have been available in health food shops for years. There is a place for digestive enzyme preparations in medicine in individuals with deficiency in gut enzymes, for example in sufferers of cystic fibrosis who require enzyme preparations for effective assimilation of food in order to obtain adequate nutrition. Digestive enzymes also have a place in post gastro-intestinal surgery patients, and in people with lactose-intolerance, where a preparation containing the enzyme lactase may be required for proper digestion of milk sugar in order to help prevent side effects of too much lactose.

For healthy individuals, there is no need for digestive enzyme, and there is no evidence that these preparations will improve the efficiency of utilisation of nutrients.

Desiccated Liver

Desiccated liver tablets have also been around for years and used to be raved about by bodybuilders and strength athletes. They are formed by vacuum drying at low temperatures, in the view that vitamins and minerals for the liver will be preserved and also contain some amino acids. The problem is that the liver is a detoxifying organ so effectively you're supplementing with rubbish as well. Also it is doubtful that the tablets will break down well in the gut.

FRAC / Gamma Oryzanol

FRAC (ferulic acid) and its related compound gamma oryzanol have been advertised as being anabolic agents. Claims have been made of studies comparing FRAC with high doses of anabolic steroids, and that FRAC is nearly as good. The thing is these studies don't seen to be available, and who would authorise a study with subjects taking very high doses of anabolic steroids? I just cannot see them being effective. In fact studies have shown actual decrease in luteinizing hormone levels when supplementing with FRAC, which would lead to a reduction in testosterone production.

Pantocrine

This Russian supplement is an extract form the antlers of the male spotted deer, and is supposed to increase muscular performance, but there's no evidence to say that it does. In fact, there is reason to believe that taking pantocrine orally or via injection could cause anaphylactic shock (a severe allergic reaction).

Ecdysterone

A necessary hormone for an insect, and is marketed as a bodybuilding supplement. I can't see how it can work in humans, let alone if it does.

Dong Chong

Dong Chong or Jing Zhi Dongchongxiacao is marketed as a thermogenic stimulant. It is an extract from a Chinese fungus, and does give speed-like effects. Unfortunately, the effects are nothing like ephedra, and it may even be catabolic.

Shark Cartilage

This became popular after it was marketed as a possible cure for cancer, as sharks were supposedly the 'only animals that don't get cancer'. Well, sharks can suffer from cancer, and there are no legitimate studies to support the use of shark cartilage as an anti-cancer agent.

Bodybuilders are interested in shark cartilage because of its alleged effects on promoting the healing of damaged cartilage, as it contains glucosamine. But taking shark cartilage in the whole form doesn't do anything. Don't waste your money, despite the fact that when you're injured you'll try anything. You'll be better off using glucosamine sulphate (see Chapter 9).

Inosine

Inosine is a nucleic acid, and occurs naturally in every living cell. It is used as a supplement in the hope to increase energy and exercise endurance. A study by Starling, *et al* (1996), found no benefit from inosine supplementation on aerobic or anaerobic performance. Infact they found that inosine actually lessened endurance due to a raised uric acid level. There is no real evidence to show supplementation with inosine will help bodybuilders or any other athletes.

Dibencozide

Dibencozide is synthesised in the body from vitamin B12, and is involved in protein synthesis and in the formation of red blood cells. It was shown years ago to help children who are not thriving properly to gain weight (Stopozyk 1969), and hence supplement companies have hypothesised that it will also help healthy athletes gain muscle. It is now not used very much as athletes realised it doesn't do anything.

Exsativa

This is a blend of oats, nettle root and vitamin C. It is claimed to increase testosterone levels and be an aphrodisiac. But, there is neither evidence, nor theory and it doesn't work.

Coenzyme Q10

"…it appears to do absolutely nothing in respect of athletic performance…"

Coenzyme Q10 (CoQ10) plays a crucial role in energy production in the body, and has antioxidant characteristics (Spigset 1994; Weber, *et al* 1994). But it appears to do absolutely nothing in respect of athletic performance; despite being marketed this way. Studies have shown no benefits in any exercise parameters between subjects supplemented with CoQ10 and those who were not (WHO/FAO 1989; Snider, *et al* 1992). It may even have negative effects and cause cell damage, due to it having pro-oxidant activity in supplemental doses (Malm, *et al* 1996), as I discussed in Chapter 5. It is very popular in health food shops, but is really a money waster, so don't bother with it.

Hydroxy Citric Acid

Hydroxy Citric Acid (HCA) is sold as a supplement due to its action as an appetite suppressant, and as it inhibits the action of the enzyme ATP-citrate lyase in the liver. This enzyme catalyses the conversion of dietary carbohydrate into fat (Hunt & Groff 1995). Studies on animals have shown its benefits to weight control as they eat less and make less fat. There is no good human data, and anecdotally, there are few opinions. To be honest, I don't think there's any benefit at all from using an HCA supplement.

Chitosan

This is a fibre supplement derived from the shells of crustaceans. It is supposed to block absorption of fat in the gut. Side effects are bad stomach-ache, diarrhoea and fatty stools. Also, there is risk of deficiency of fat-soluble vitamins. I wouldn't recommend its use for anyone, especially bodybuilders.

Brewer's Yeast

This supplement has been around for years as a health aid, and is especially used by vegetarians and vegans. It is basically yeast cells cultured and dried, to give a rich source of some B vitamins and some minerals. I've never been a fan of Brewer's Yeast, and it certainly has no bodybuilding applications.

Chromium

Many bodybuilders use the micromineral chromium as a supplement believing that it is useful in reducing body fat. In the body chromium acts as a cofactor in insulin action, and deficiency in chromium (rare) does indeed play a role in the development of glyceamic abnormalities, and altered fat and muscle metabolism. Studies on type 2 diabetics have indicated supplementing with at least 200 micrograms of chromium daily can significantly decrease fasting glucose levels and improve glucose tolerance, so are, thus, beneficial (Mossop 1983; Anderson, *et al* 1987; Abraham, *et al* 1992; Anderson 1992).

Insulin resistance can lead to increased body fat and can impair proper muscle metabolism. One study indicated that chromium supplementation can help these parameters, but it was on subjects who were sedentary, overweight with a poor diet, and so not applicable to the athlete or bodybuilder (Katts, *et al* 1991). A study on footballers showed no benefit, and urinary excretion increased, i.e. a saturation point was reached (Clancy, *et al* 1994).

Chromium, usually as chromium picolate, is present in so many 'weight loss formulas', and is raved about by so many bodybuilders. I fail to see why. If you are consuming a good diet there is just no need to literally 'piss all your money away'!

ZMA

"ZMA is supposed to be a hot new bodybuilding supplement trend."

ZMA is supposed to be a hot new bodybuilding supplement trend. It contains highly bio-available forms of zinc, magnesium and vitamin B_6. It's supposed to support muscle strength. No evidence here and I cannot see how it helps, if you're consuming a good diet.

Phosphatidylserine

Phosphatidylserine (PS) is promoted as an anti-catabolic supplement, as it has been shown to reduce cortisol (a catabolic hormone) levels after exercise (Monteleone, *et al* 1992). Hypothetically, this could help recuperation, but there is no evidence to show it does, so leave this supplement on the rack.

Alpha-Ketoglutarate

In vivo Alpha-ketoglutarate (AKG) is a Krebs cycle intermediary substrate, so is involved in ATP production. It is also a direct precursor of glutamine in its synthesis (Goldberg & Chang 1978). Theoretically supplementation with AKG should lead to more energy and more glutamine, both beneficial to a bodybuilder. Unfortunately, *in vivo* things do not work so clear cut, as other factors have to come into play.

It has been suggested that supplementing with AKG may even be better than supplementing with glutamine because of the intestinal cells high demand for glutamine mean much is used up here, whereas nearly all AKG can be absorbed into blood and be taken to other tissues. The problem is that the effects of AKG on exercise performance are not proven, merely hypothesised. I wouldn't use it, but you may want to give it a try.

Ornithine Alpha-Ketoglutarate

Ornithine alpha-ketoglutarate (OKG) has been weakly shown that it may help slow protein loss in critically ill post trauma patients. As always this led to possible bodybuilding implications. Not applicable in this case though, so forget it.

Phosphate Supplements

Studies have shown that when athletes supplement their diets with phosphates they significantly increase their endurance (Rupp, *et al* 1983; Wilkes, *et al* 1983; Costill, *et al* 1984). Sodium phosphate acts as a buffering agent to reduce the production of lactic acid in anaerobic exercise. Anaerobic exercise is when muscles do not use oxygen, but instead use lactic acid, which causes muscles to fatigue, as is the case in weight training. Thus using phosphates may help you to train that bit more before the onset of fatigue.

Phosphates may also be important in sports as the are used to form creatine phosphate (CP), and lack of phosphates will mean CP cannot be formed, no matter how much you supplement with creatine monohydrate.

However, studies are not of great design, and a varied balanced diet should provide a good intake of phosphates for the above functions. No bodybuilding applications here, though phosphates may be of limited us to endurance athletes.

Glutathione

Glutathione (GSH) is a powerful antioxidant, naturally occurring in the body. Intense exercise reduces the body's natural level of GSH by 40% in muscle cells and 80% in the liver (Pyke, *et al* 1986). Supplementing with other antioxidants has been shown to help preserve GSH levels, as the other antioxidants help quash free radicals. However, whether or not a direct GSH supplement works is an area of debate. Animal studies have indicated a use (Tritschler 1995), but human studies failed to show any benefit.

As I have discussed in Chapter 5, I generally argue against supplementation with antioxidants, as long as you are eating a very good quantity of varied food sources. I certainly do not suggest the mega doses that some bodybuilding nutrition 'experts' suggest. But if you do wish to take amino acid antioxidant supplement, I would definitely not use GSH, rather use other antioxidants like vitamin E or selenium, which in turn help preserve GSH levels.

Cyclo Histidyl-Proline Diketopiperazine

Cyclo Histidyl-Proline Diketopiperazine (CHP) is a naturally occurring cyclic peptide that acts as an appetite suppressant. Levels of CHP in the blood have been shown to be a strong indicator of appetite (Battaini & Peterkofsky 1980), and high levels correspond with a small appetite.

CHP has also been demonstrated to have an effect on food preference (Antelman, *et al* 1975), and helps to turn off cravings for fatty foods. CHP may have implications for people trying to lose weight if used correctly, and in turn this may have implications for the dieting bodybuilder. Unfortunately, yet again, there are no conclusive studies showing the direct effect of CHP supplementation on weight control.

Gelatin / Type 2 Collagen

Gelatin or, more specifically, the constituent of it, type 2 collagen, has been demonstrated to slow progress of arthritis (Trentham, *et al* 1993). Type 2 collagen supplementation therefore has a role in the arthritis sufferer who wishes to weight train. From this companies are marketing type 2 collagen as a supplement to help prevent any degeneration of joints which may occur as a result of weight resistance exercise, i.e. healthier joints. This latter hypothesis is not proven.

Ketoisocaproic Acid

Ketoisocaproic acid (KIC) is a metabolite of the branched chain amino acid leucine, and may have some anabolic and protein-sparing properties (Flakoll, *et al* 1991). It is more likely that any possible positive effects are attributed to another metabolite of KIC and leucine, i.e. HMB (see Chapter 9). So, if you want these effects, give HMB a try which *may* have benefits, don't bother with KIC.

Sodium Bicarbonate

Sodium bicarbonate or baking soda is not only used in cookery, but also in sports nutrition. Early studies have indicated benefits (Wilkes, *et al* 1983; Costill, *et al* 1984), but more recent ones have shown none (Parkhouse & McKenzie 1984; Kozak-Collins, *et al* 1994). Sodium bicarbonate supposedly acts as a buffering agent neutralising bi-products of exercise, helping muscles to function at optimum levels for longer. The side effect of using it is stomach-ache and gastric disturbances, obviously bad for working out on.

As far as bodybuilders go, I don't know anyone who uses sodium bicarbonate as a supplement, and I certainly wouldn't bother.

Inositol and Choline

I have grouped these two unrelated compounds together simply because they appear together in bodybuilding supplement preparations.

Inositol is a water soluble natural constituent of cells. Inositol supplements used to be very popular due to supposedly helping to get a more pronounced muscle pump. It draws water into cells, thus aiding cell volumising. There is no evidence that supplementing with inositol increases blood concentrations notably, nor that increased blood concentrations are taken up with water by cells.

Choline is essential for proper neurological function, and is a functional component of cell membranes. It also helps transport fat from the liver. It is manufactured in the body from the amino acids methionine and serine. It is unclear whether our bodies are able to produce enough, but as it is abundant in food there is no real issue.

Phosphatidylcholine is a particularly biologically active form of choline used in medicine to treat liver dysfunction, and to reduce heart disease risk (Brook, *et al* 1986; Wojcicki, *et al*; 1995). Lysophosphatidylcholine is another form of choline, and is a food additive in bread. It is sold as a supplement for livestock as it increases nutrient uptake helping them to gain weight more easily. Hence lysophosphatidylcholine is also sold as a bodybuilding supplement, but I would recommend avoiding it.

Both choline and inositol are sold as a bodybuilding supplements on their own or in preparations together. I can see no use for bodybuilders to supplement with inositol, choline or its variations, although some MRPs and other supplements do contain them as ingredients.

Melatonin

This is a naturally occurring hormone produced form the pineal gland, which governs the body's clock. It helps us fall asleep, as it is involved in serotonin production, which helps us reach slumber-state.

It is marketed as a supplement to help sleep, so the benefit to bodybuilders would be a good night's sleep, to train hard, and grow well. Used as a supplement for this purpose it does work, but users claim it has a nasty side effect in that it gives vivid, often nasty dreams or nightmares. Individuals have reported to be freaked out, so this negative effect has made melatonin supplements unpopular and I wouldn't recommend using them.

Ginseng

Ginseng falls into the category of herbal supplements called *'adaptogens'*, which are supposed to help the body adapt to higher levels of stress. Ginseng is extremely popular in the health market and has been used for years. There is no research to say it does anything, but some people swear by it. I, however, remain sceptical and wouldn't recommend it.

There are different varieties:

- Indian Ginseng – (ashwagandha) – has been used as a 'vitaliser', and supposedly helps symptoms of various diseases.
- American Ginseng – (Panax quinquefolius) – was used by Red Indian tribes as a treatment for minor ailments and as an aphrodisiac. It does work as an effective laxative.
- Korean Ginseng – (Panax ginseng) – thought to improve performance, stamina and concentration.
- Siberian Ginseng – (Eleutherococcus senticosus) – is very popular, and is claimed to be an immunostimulator, amongst other effects

The problem is there needs to be *controlled* unbiased research into ginseng's actions. I cannot see *how* it works, as there is no hypothesis, let alone if it actually *does* work.

Geranium

Derived form the Bulgarian geranium sanguineum, this herbal extract is supposed to have antiviral effects. I don't know whether or not it does, but there's only very weak evidence. Despite being marketed as a sports supplement, it has no benefit.

Grape Seed Extract

Part of this is pycnogenol, which is a potent antioxidant. If you have a good diet with plenty of food sources of antioxidants, there is no need for herbal supplements of them.

Yohimbe Hydrochloride

This supplement has been extensively marketed as giving huge gains to bodybuilders, so why don't many bodybuilders use it? It is found as the chemical yohimbine hydrochloride in the yohimbe bark. Yohimbe has been used in medicine to treat male impotence and sex drive. Some studies have indicated that it is involved in reduced fat synthesis and increased fat mobilisation (Berlan, *et al* 1991; Muller-Wieland, *et al* 1994), but they are of extremely poor design. It may also help reduce blood clotting, and hence reduces risk of cardiovascular disease (Shah & Goyal 1994).

"Yohimbe is marketed to increase testosterone production, but it does not do this…"

Yohimbe is marketed to increase testosterone production, but it does not do this, and preparations may not contain viable doses for any effect. Lots more research is needed here to be convincing, but I cannot see that it has a role as a bodybuilding supplement.

Tumeric

Tumeric is a major ingredient in curry powder. The active constituent curumin has antioxidant and anti-inflammatory effects. It is also said to help to heal joints and protect the liver, but you'd have to have a lot. No research and I'm definitely not convinced.

Dandelion

As a herb, dandelion is an effective diuretic and contains a large amount of vitamin A. It is suggested that it has benefits to the liver (Sunsnik 1982). As a diuretic, it has a use in pre-contest bodybuilding, and its effects are comparable to furosemide (Racz-Kotilla, *et al* 1974), and is potassium sparing. It may work quite well, but there is no real research, and as there are effective alternative diuretics, I wouldn't use it. Remember that it may be a natural alternative to diuretic drugs, but still has side effects from this, so be careful.

White Willow Bark

White willow bark, or salix alba, contains a substance called salicin, and has been used for centuries to treat a variety of ailments. Salicin is part of a group of compounds called salicylates found in many foods and aspirin.

As to whether white willow bark has any real use in health needs more proper research, but it is unlikely to have any benefits in bodybuilding. Incidentally, a number of people suffer with intolerance to high amounts of salicylates, causing headaches and skin problems.

Flavenoids

I mentioned these in Chapter 5, when I discussed anutrients and their benefits. Flavenoids are a group of over 4,000 discovered flavone compounds. They are marketed as herbal supplement, which is why I've included them in this section. Flavenoids are potent antioxidants, contributing to the biochemical redox, which I mentioned in Chapter 5. They protect against free-radical damage in heart disease, some cancers, and other diseases. Some examples of flavenoids are proanthocyanidines, quercetins and catechin (the latter has another benefit, see Chapter 9). I've mentioned these three, because they are sold as antioxidant supplements in their own right. Generally, I would say 'no' to flavenoid supplements, and would suggest it is far better to eat a healthy balanced diet containing lots of foods of plant origin.

Ginkgo Biloba

This herb is supposed to aid mental focus, an action that is weakly supported by research (Auguet, *et al* 1986). It is supposed to improve blood flow to the cerebral cortex and help alertness, as well as enhance ATP synthesis and glucose uptake in the brain (Gebner, *et al* 1985; Allard 1986; Hindmarch 1986).

Keeping focused during training is crucial to maximum gains, as we all know, so this product is used by some bodybuilders. Unfortunately, it has a side effect that makes it useless, in that it gives terrible headaches. Maybe give it a try, but if you get a headache, it's not worth using it again.

Saw Palmetto

This is used medically to treat prostate enlargement, and has also been shown to have an anti-oestrogenic effect. One well-designed study indicated this benefit to a steroid-using bodybuilder, but the same study also demonstrated that saw palmetto also blocked testosterone receptor sites. So a no-no for bodybuilding.

Branched Chain Amino Acids

The branched chain amino acids (BCAA) are valine, leucine and isoleucine, and make up a third of muscle protein. All are essential amino acids, and are used up in extraordinarily high amounts during exercise, this is in part due to the fact that they are used to synthesis the amino acids glutamine and alanine, which are released in large quantities during exercise. BCAAs are also used directly for fuel by muscles, thus sparing other amino acids from being catabolised. Without adequate intakes of BCAAs, muscle cells will not heal and therefore grow, and, naturally, bodybuilders have greater requirements for BCAAs than 'normal' people.

Like glutamine and arginine, leucine has been heavily researched for its role in muscle repair and growth, both clinically, in post-trauma patients, and in sports nutrition. Studies have shown that supplementing with leucine in gram quantities may improve athletic performance, or post trauma patients have reduced loss of muscle mass (Chua, *et al* 1979; Marchesini, *et al* 1982). However, some studies, have shown no effect (Bloomstrand, *et al* 1991). The effects of leucine maybe through its metabolite HMB, see Chapter 9.

BCAAs are available in amino acid complex capsules, as the three together or individually. I can see no reason to supplement with BCAAs alone, as long as your protein intake is good and varied. Whey protein is extremely high in BCAA content, so if you include a whey protein powder, your intake will be plentiful, even by bodybuilding standards.

"I can see no reason to supplement with BCAAs alone, as long as your protein intake is good and varied."

Taurine

This conditionally essential amino acid, is the second most abundant free amino acid in muscle tissue after glutamine. Taurine is not actually part of muscle tissue, but exists within the pool within the muscle cell. Taurine is also involved in cell volumising and glucose metabolism. Again a diet with varied protein sources should supply sufficient protein and some supplement companies are adding taurine to products.

Ornithine

Like arginine, this was marketed as a growth hormone releaser. There is no real benefit of supplementing with ornithine on its own.

Lysine

Lysine is an essential amino acid, and is marketed as a bodybuilding supplement, but has no real use this way.

Tyrosine

Tyrosine as a supplement is marketed as a 'pick-me-up', as it blocks the absorption of tryptophan across the blood brain barrier. I don't know whether it does, and I could find no good evidence.

5-Hydroxytryptophan

5-Hydroxytryptophan (5-HTP) is an intermediate in the conversion process of the amino acid tryptophan into serotonin, which is involved in sleep enhancement. There is evidence indicating a link between oral supplementation of 5-HTP and serotonin production (Takahashi, *et al* 1975). It has also been shown to be an antidepressant.

As a bodybuilding supplement, I wouldn't bother with it.

Carnitine

"Those who rave about carnitine's effects, are probably on a calorie controlled diet anyway so would be losing weight."

As carnitine is an amino acid involved in shuttling fatty acids across membranes in fat breakdown, it has been marketed as a fat burning supplement, and became extremely popular, with many bodybuilders raving about it. Some studies claimed it has a role in fat and triglyceride metabolism (Pola, *et al* 1980; Pola, *et al* 1983), but these are small and unconvincing by design. Those who rave about carnitine's effects, are probably on a calorie controlled diet anyway so would be losing weight. I feel carnitine supplements as fat burners are a scam, so don't waste your money.

Acetyl-L-Carnitine

Acetyl-L-carnitine (ALC) has been hypothesised that it *may* help reduction in testosterone levels, but there are no good studies to show this. It is also claimed that ALC *may* have protective effects on brain and heart tissue and *may* even be involved in controlling blood lipids.

As a bodybuilding supplement, it is claimed to have anti-catabolic effects. These claims are unsubstantiated, and, judging by the fact that I have never heard of anyone who has used it (and I know a lot of bodybuilders who will try all sorts of supplements), means that its probably not worth trying.

Glycerol

Glycerol chemically is a carbohydrate, and the backbone of triglyceride structure, holding three fatty acids together. It is marketed as a supplement as an energy source and with water to prevent dehydration. It certainly has no bodybuilding applications. It may have a role in long distance endurance athletics like marathons and triathlons, but I have not delved into the research.

Summary

As you can see there are loads of supplement preparations out there that are marketed well, but do nothing. There are probably lots more, which I have omitted, as the bodybuilding supplement market is huge. If you do come across something, and am unsure, let me know through **www.muscletalk.co.uk**, *and I'll see what I can find out.*

Chapter 11
Sensible Buying of Bodybuilding Supplements

The past few chapters have looked at which supplements are possibly worth using, and which are a waste of money. The purpose of this chapter is to help you with your purchasing, as most supplement companies are extremely clever at marketing. They take every opportunity to get your money, and you'll be left wondering how they get away with it. But they do!

It's the same issue in the whole of the health supplement market, not just bodybuilding. The problem centres on legal regulation of 'health claims' and is very vague. In the UK the British Dietetic Association (BDA) is lobbying Parliament to change the laws to impose stringent guidelines, in order to protect the public.

You see it all the time in the magazines, a picture of a fat guy or a skinny runt, and then 'in just 8 weeks' a picture of someone resembling Brad Pitt or Ronnie Coleman. On the advert statements like 'This stuff is as potent as anabolic steroids'. Claims are often made with no valid science, just clever marketing. Remember, I have not always been in 'the know' about bodybuilding nutrition, and I have been ripped off too, at a time when I had much less money and it hurt me more financially, especially when I didn't get anywhere near the results I expected or desired. This is why it makes me *so* angry, when I see guys who get the 'bodybuilding bug' and will do anything to build a great physique and bodybuilding supplement companies play on that.

Below, I've listed a few of the common frauds and discussed them:

Supplements that don't contain what their Labels Claim

Yes, believe it or not, despite being listed clearly in the ingredients, laboratory studies have revealed some products do not contain what is listed! This is how they manage to sell their brand at a low price. This includes products which contain far less protein than is claimed (as high protein content is always a great seller), and hardly any of the active ingredient.

Unfortunately, I cannot name names, although I would love to, and I'm sure there are loads of companies that behave in this way, far more often than I've ever heard of. It is a plain breach of trades description. Many keen bodybuilders who have been buying supplements for years are now aware of this and stick to their faithful, more reputable brands, but the vulnerable are the newcomers, especially the young guys. It is quite often the case that when expensive products like creatine monohydrate, MRPs, whey protein and HMB are offered at discount prices, they don't contain what they say. Although I must make the point here that I strongly feel that the more reputable companies need not sell their quality products at such extortionate prices!

Fake Guarantees

Companies which offer a complete money back guarantee if their product doesn't 'work' have nothing to hide. The thing is supplements don't *'work'* they merely *'supplement'* a diet, and as I've said you don't need them to build a great physique, but they are extremely useful.

"…a reputable company should still stand by their money back guarantee and give a full refund if requested."

Money back guarantees have been around for years and are a great marketing ploy, as few people who don't get what they expect do actually reclaim their money. Also in nutrition there are so many confounding factors that its hard to prove if you were eating correctly and training hard whilst using formula X. However, a reputable company should still stand by their money back guarantee and give a full refund if requested. Unfortunately some companies do not! Companies have even been known to offer an 'unconditional money back guarantee', but send letters to clients explaining why they weren't eligible.

The plus side of this is that companies who behave in this way don't last long due to bad reputation, a bad reputation spreads rapidly through the bodybuilding community! Stick to reputable brands and heed their terms and conditions of a money back guarantee, i.e. keep receipts and packaging until you're happy.

Lack of Scientific Evidence

As you know, I only endorse supplements where there is at least a degree of plausible evidence. By rights any company that quotes something like 'clinical studies have proven…' should reference these studies in the advertisement. If they do not you are well within your rights to request the data form the company. Review the studies carefully, and bear in mind what I discussed in Chapter 1 about strength of evidence. Forget the quotes from users saying they benefited from it and how hard they struggled before, even if they really did benefit, there are too many confounding factors to make this plausible evidence.

There may genuinely be a study from which an advertisement makes a claim, but the study could be of very poor design, or the company may have deliberately misinterpreted the findings. Bigger and seemingly more reputable companies may be involved with research. Unfortunately, and this is also the case in medical research, this initiates extreme bias into the results, and the paper's discussion is often slanted in favour of the product in question. However, this need not always be the case, and some reputable companies do part fund unbiased double blind placebo controlled prospective randomised trials – the best!

Very rarely can clinical trials 'prove' that something works, as is frequently claimed. At best they can provide really strong evidence to suggest that there is a link between using the product and the desired outcome. Unfortunately, stating the latter does not have the same impact in an advert.

Companies go on and on about the tests they've performed on their products using chemical process names that only a laboratory worker would have heard of like high-performance capillary electrophoresis and gas chromatography. These mean nothing to the customer, just seek to impress.

Over Generalisation

"…in medicine, nutrition and bodybuilding there are too many confounding factors…"

This is another advertisers gimmick. You often see quotes like 'X produces mind-boggling results in every person that uses it…' This cannot be true, because, as I always say, in medicine, nutrition and bodybuilding there are too many confounding factors, like diet, training, lifestyle, rest, drug use, stress, etc, and nothing works for every person.

False Endorsements

Often you see pictures of your favourite champion bodybuilder holding a tub of product X, saying he uses it. Even if he does, quite often this product is new, so how did he use it to build his physique. He probably doesn't even use it, but even if he does now, I'd use something if I got paid to do so, wouldn't you?

'Reputable' Companies

I'm not going to name names of any goodies or badies. In my view every supplement company is guilty of some marketing scam at some point, but at least some companies do genuinely sell quality products, albeit at very expensive prices. Many companies are now claiming they have nothing to hide and are therefore more open with what they say, which is great, but again, I cannot help feeling that this is yet another, very subtle, marketing scam, trying to increase their credibility.

Some of the companies are run by well known supposed bodybuilding nutrition 'gurus', who come out with interesting facts, and go on about how reputable their company is. This really makes me wonder. If a company is so reputable, why shout about it? They also like to pick out a few of their reputable competitors and say that these companies are also pretty good, just to make themselves seen unbiased.

A true reputable company should not need to make any outrageous claims, as good reputation will increase their sales in the long term. All companies are, of course, in business to make a profit, but over the long term will realise this is from providing high quality products, excellent service, aim to satisfy customers wants and needs and to not give any bull shit.

Summary

I've aimed to outline a few tricks of the trade, and, in the previous chapters, I've covered the majority of the supplement products on the market, so you should know what's best for you. Now you should be armed with the necessary information to check your finances and purchase quality supplements to which you will benefit.

Key Points

- *Watch out for products which don't contain what they claim on the label*
- *Make sure the product carries an honest guarantee*
- *Ensure that there is research to back up claims, and that the research is plausible and well designed*
- *Forget products which over-generalise*
- *There's no need for false endorsements – ignore them*
- *No company is 100% reputable, though some do produce high quality products*
- *I've yet to find a quality supplement at a fair price!*

Chapter 12
Probiotics and Prebiotics
- How they Benefit the Bodybuilder

Over the last few years two new 'buzz words' have appeared in the world of nutrition – **probiotics** and **prebiotics.** They are classed as functional foods or nutraceuticles, i.e. foods that have a function in good health. What are they and why have they been shown to be good for us, and, more importantly, how can they benefit the bodybuilder?

Probiotics

All animals have colonies of bacteria residing in our intestines, which is of mutual benefit to both the bacteria and the host animal, as they help the host's digestive system work efficiently, by feeding off waste products in the bowel. Probiotics are live strains of these 'good' bacteria, e.g. *bifidus* and *acidopilus*. The bacteria are cultured in live yoghurts, powders or specially formulated probiotic drinks which contain one or more of the strains of these 'good' bacteria.

With food processing, pollution and antibiotic therapy, numbers of 'good' bacteria occurring naturally in our gut are reduced, so studies have shown, by actively consuming the bacteria in their live form, the size of the colonies in the gut can be increased, which improves digestion. Moreover, the numerous studies have also shown that with optimal numbers of 'good' bacteria, the immune system is significantly improved, increasing our ability to fight disease. Probiotics may also have a role in reducing the severity of allergies and food intolerances.

Prebiotics

Prebiotics are certain nutrients and constituents of food that our gut flora feed on, promoting growth of colonies, leading to an increase in their numbers. Prebiotics include fructo-oligosaccharides (FOS) and some other soluble fibres found in pulses, fruit and some cereal products. Thus, prebiotics also help digestion and the immune system.

Benefits of Probiotics and Prebiotics

Both probiotics and prebiotics increase the colony size of the gut's natural flora, and more and more people are including them in their diet to promote good health. The bodybuilder can also benefit, as he/she can digest their (large quantity) of food more easily helping to provide a more efficient influx of energy and protein.

Irritable Bowel Syndrome (IBS) is increasing in incidence these days, to varying degrees, due to stresses of modern living, pollution and large amounts of junk food in the diet. Pro- and prebiotics help the bowel operate more comfortably, reducing discomfort, helping the IBS-suffering bodybuilder to train with less distraction and digest his/her much needed food more easily.

Pro- and prebiotics also help strengthen the immune system to become more effective, possibly by leading to more efficient antibody formation. If diseases can be kept at bay, the bodybuilder can train harder and recuperate quicker.

You can obtain probiotics by eating live yoghurts, special powders or probiotic drinks like Yakult® (Yakult), Actimel® (Danone France) or LC1® (Nestlé SA). More recently, bodybuilding supplement companies have recognised the benefits, and are adding probiotics and FOS to their engineered nutrition meal replacement powders.

"I would certainly recommend everyone include probiotics and prebiotics in their diet…"

I would certainly recommend everyone include probiotics and prebiotics in their diet for good health, which is of doubtless benefit to any keen bodybuilder or athlete.

Key Points

- *Probiotics are live strains of bacteria cultured in yoghurts and some bodybuilding supplements*
- *Prebiotics are constituents of food which our gut flora feed on, promoting their growth*
- *Pro- and prebiotics are of strong benefit to bodybuilders, so include sources of them daily*

Chapter 13
Alternative Nutrition and Bodybuilding

'Alternative nutrition' may be defined as using non-conventional approaches and formulas in your diet, including formulas and regimens which do not have formal backing of conventional doctors and practitioners. There is a huge overlap, however, between alternative and conventional nutrition. I have already covered many 'alternative' products involved in bodybuilding nutrition, but as this is such vast subject, I felt it was necessary to mention the role of alternative nutrition in bodybuilding in a chapter of its own.

Alternative nutrition includes many of the supplements that I have previously discussed. In alternative nutrition, alternative medicine and alternative therapy, many of the procedures and products have been around for 1000s of years and are widely accepted as being effective. Often alternative therapies move over the boundary and into the conventional ideology following strong clinical studies that indicate effectiveness. Take probiotics for example; in the early 1990s, their use was regarded as 'alternative', but since there have been reams of well-designed studies strongly indicating effectiveness, they are widely used in conventional nutrition and medicine.

Some examples of alternative nutrition include herbal supplements, homeopathic supplements, Chinese medicine, products extracted from animals and plants, and certain regimens.

By now you should have a comprehensive understanding of bodybuilding nutrition. Many alternative supplements have been discussed earlier in this section along with more conventional products. I hope that you will be able to make your own judgements about 'alternative' products, if not, I hope you will know where to find out more information.

"…you *have* to keep an open mind about new treatments available."

I am a conventional practitioner, but as nutrition is such a vague topic, you *have* to keep an open mind about new treatments available. If I hear of something new, I try to find out more about it. Nine out of ten times the product turns out to be rubbish, based only on poor anecdotal evidence, but sometimes I continue to remain open minded, as in the case of aloe vera gel.

Homeopathic supplements

Homeopathic supplements are derived from animal, plant and mineral sources, and I have decided to put them under this chapter rather than a previous supplement chapter, because they are more 'alternative nutrition' than anything else.

Homeopaths believe that if you take something in large amounts it causes a negative reaction. They hypothesise that if you take small amounts of the same substance then it will cure you. In some instances this theory is used in conventional practice, for example vaccinations against diseases are frequently tiny amounts of the disease in question to promote antibody formation. Likewise homeopaths believe if you take minute amounts of a particular hormone, it will somehow stimulate the body to produce more of that hormone, and, according to them, the smaller the amount of compound in a homeopathic supplement, the more effective it is. The most effective homeopathic supplements are those which contain nearly zero amounts of the substance in question! Hmmm?!

Products are diluted so many times, as described on the label of products. Sometimes levels are so small they are not detectable. Now I'm not going to slate homeopathy, as in alternative medicine it has been shown to have a place, and many people treated by it will swear it has cured them, and I am in no place to argue. But, I can be a sceptic, as I am a conventional scientist, I need a plausible explanation, if not reasonable evidence, that something works.

Homeopathy, I believe, is supposed to work because the potions have a specific electromagnetic frequency, which somehow activate the body's 'vital forces' and allow it to heal or reach a desired goal. This doesn't make much sense to me, and it's more likely to be the placebo effect (i.e. believing something works, therefore you feel the benefit).

Maybe I'm wrong, but it's good to be sceptical. I cannot see that homeopathic 'supplements' have a place in bodybuilding nutrition, so watch out for these concoctions. I'll leave it to you to make up your own minds.

There is a place for alternative nutrition in bodybuilding, as there is in aspects of medicine. It is important to keep open minded, but do not be persuaded by clever marketing and weak anecdotal evidence.

Key Points

- *There is an overlap between alternative and conventional therapy*
- *Homeopathic supplements do not have a role in bodybuilding*
- *Keep an open mind about alternative therapies and supplements, they do have their place, but do not be misled*

Chapter 14
Gaining Quality Weight

In this chapter, I'm going to provide a few example meal plans for the different scenarios for gaining weight. Here I'm referring to gaining ***quality weight***, i.e. lean muscle mass with minimal body fat. I am frequently asked for examples of meal plans to suit people who are new to weight training and advice for the hard gainer type physique who wishes to pack on weight. I have also compiled a regimen for the competitive off-season bodybuilder who wants to bulk up with quality weight.

I do not believe in gaining unnecessary amounts of weight in the form of body fat at any time. Many bodybuilders believe it is necessary to do this, either in your early bodybuilding days, or during the off-season period, in order for your body to know what it feels like to be bigger! These individuals may put on two stones (28lbs / 13kg) or more above what I would consider to be desirable, and when it comes to contest preparation they may have to lose three or four stones! Not only is this unhealthy, in point of view of heart disease and other diseases, but also it is also counter productive to bodybuilding.

"You have to hold a little body fat to be healthy and gain weight…"

You have to hold a little body fat to be healthy and gain weight, but this need only be one to one and a half stones above competition weight, i.e. still really lean. Many big guys have done the 'over-bulking up' thing before, but have learned by their mistakes, and wouldn't do it again. In fact they have found that they are just as strong or even stronger at a leaner weight. This is probably due to more efficient respiratory function at lower body fat levels.

Figure 1 in Chapter 3 provided an example of a meal plan looking at protein foods only, so I could give a clear example of quality protein distribution. In this chapter I'll incorporate that information and into a range of other meal plans and discuss each one in turn. Like in Figure 1, I have totalled up approximate protein levels, but this is really only from the HBV protein foods, and not from the carbohydrate foods, so protein intake will actually be higher than the amounts stated. I have not totalled up calorie levels, because I do not encourage bodybuilders to count calories; there is no need, if you are not gaining weight sufficiently, just increase the portion size of what you eat.

Remember that all plans written in this chapter are merely a guide. **Do not** follow them rigidly every day. Eat a wide variety of different foods, and you may even include some junk food now and again.

Hard Gainer

Figures 2 and 3 are meal plans designed for the hard gainer or the individual new to weight training. These suit someone who is really lean, and struggles to gain muscle. Characteristics are an ectomorph-type physique, low body fat and muscle development. I have written them to suit a male bodybuilder, but they may be easily adapted for women, by merely reducing the portion sizes, as women have lower energy and protein requirements (DoH 1991). These plans suit anyone who wants to pack on quality muscle efficiently. Figure 2 gives an example of a regimen to gain weight whilst on a fairly tight budget, whereas Figure 3 gives an example of a regimen to gain weight if you have a little more money at your disposal. Both are very efficient, but Figure 3 is considerably more convenient.

Figure 2 : Example menu plan for someone wishing to gain quality weight on a budget.

Time	Food	Protein
Wake 7.30 am		
7.30	1 scoop whey protein in water	20g
8.00 breakfast	Large bowel wholewheat breakfast cereal	
	with 1/3 pint skimmed milk + sugar	15g
	2 slices wholemeal bread toasted + olive oil spread	
	½ portion weight gain drink with water and	
	multidextrose powder	22g
	100ml orange juice + 1 tblsp olive oil	
10.30	Sandwich (wholemeal bread + olive oil spread	
	+ filling*)	25g
	Fruit	
12.30	Tuna (95g) + 1 tblsp natural yoghurt	27 g
	½ small chicken breast (60g)	18g
	4 slices wholemeal bread + olive oil spread	
	Salad	
	Low fat yoghurt	7g
15.00	Sandwich (wholemeal bread + olive oil spread	
	+ filling)	25g
	Drink of skimmed milk – 1/3 pint	7g
	Fruit	
17.00	½ portion weight gain drink with skimmed	
	milk and multidextrose powder	27g
TRAIN		
18.30 (after training)	2 scoops whey protein in water	40g
19.30	Mackerel (95g)	20g
	½ small chicken breast (60g)	18g
	Either 2 medium jacket potatoes	
	or 200g boiled brown rice	
	or 350g boiled wholewheat pasta	
	Vegetables	
	Low fat yoghurt	7g
22.00	Large bowel wholewheat breakfast cereal	
	with 1/3 pint skimmed milk + sugar	15g
23.30	1 scoop whey protein in water	20g
23.30 bed		
	TOTAL PROTEIN	**315g**

*Examples of sandwich fillings can be seen on page 103.

Figure 3 : Example menu plan for someone wishing to gain quality weight with more money at their disposal.

Time	Food	Protein
Wake 7.30 am		
7.30	1 scoop whey protein in water	20g
8.00 breakfast	Large bowel wholewheat breakfast cereal with 1/3 pint skimmed milk + sugar	15g
	2 slices wholemeal bread toasted + olive oil spread	
	½ portion weight gain drink with water and multidextrose powder	22g
	100ml orange juice + 1 tblsp olive oil	
10.30	½ portion weight gain drink with skimmed milk	27g
	Fruit	
12.30	Tuna (95g) + 1 tblsp natural yoghurt	27 g
	½ small chicken breast (60g)	18g
	4 slices wholemeal bread + olive oil spread	
	Salad	
	Low fat yoghurt	7g
15.00	Full portion MRP* made in half water + half skimmed milk	48g
	Fruit	
17.00	½ portion weight gain drink with skimmed milk and multidextrose powder	27g
TRAIN		
18.30 (after training)	2 scoops whey protein in water	40g
19.30	Mackerel (95g)	20g
	½ small chicken breast (60g)	18g
	2 medium jacket potatoes	
	or 200g boiled brown rice	
	or 350g boiled wholewheat pasta	
	Vegetables	
	Low fat yoghurt	7g
22.00	½ portion weight gain drink with skimmed milk	25g
23.30	1 scoop whey protein in water	20g
23.30 bed		
	TOTAL PROTEIN	**345g**

*MRP stands for meal replacement powder (see Chapter 8).

Both plans are very high protein but are also contain varied quality protein sources, distributed regularly throughout the day. Figure 3 contains more weight gain powder and includes an MRP, which I omitted in Figure 2 due to the expense. I did, however, feel it was important to include some whey protein, weight gain drinks and multidextrose powder.

In addition to this, drink plenty of fluid, especially water frequently throughout the day. Always keep well hydrated. You may also enjoy a couple of cups of tea or coffee, but not at the expense of more nutritious drinks.

Both plans are just examples, please vary your food choices daily, using your nutrition knowledge and imagination. Have different sandwich fillings (see page 103). Including some junk food occasionally will do no harm, and in fact, will add variety to your regimen, and also valuable calories.

Vegetarian and Vegan Weight Gaining

"…I know lots of folk who build great physiques on a vegetarian *diet*…"

It is often said that you cannot be a successful bodybuilder and vegetarian. Well, I know lots of folk who build great physiques on a vegetarian diet, it just takes a little more consideration, especially in regard to protein quality. Now, here I am talking about *proper* vegetarians, i.e. lacto-ovo vegetarians, not those folk who eat tuna and still claim to eat a vegetarian diet!

Generally, vegetable proteins are of poorer quality than animal proteins. Milk and egg proteins can be eaten, so you may still take advantage of HBV proteins. The key to obtaining good protein quality lies in combining different protein sources, as discussed in Chapter 3. Also, bear in mind that some amino acid capsules and other supplements may contain the animal protein gelatin in their manufacture, which strict vegetarians will wish to omit.

True vegans will avoid ***all*** products of animal origin, so an adequate bodybuilding diet is really difficult. I have never come across a vegan bodybuilder, but in theory it is still possible, though a strict regimen will need to be followed, especially to ensure that a varied diet is still consumed. Remember also that many quality supplements are derived from animal products, for example creatine, whey protein, MRPs, so you will have to avoid these. If you are in doubt about any product, check with the manufacturer. As there are so many exclusions in the vegan diet, I strongly feel that isolated soya protein is an absolute *must* for the vegan bodybuilder.

Other great protein sources which vegetarians and vegans can enjoy are mixed beans, baked beans, hummus, tofu, quorn, textured vegetable protein (TVP), soya, coconut, oat and rice milk, and many more. Often these products do have a reasonable carbohydrate content too, useful for gaining weight, and are low in fat. Vegans would be wise to include seaweed or a vitamin B12 supplement daily, as without animal products their diets may be insufficient in vitamin B12.

The following two meal plans are adaptations of Figure 3 for the Vegetarian bodybuilder (Figure 4) and the Vegan bodybuilder (Figure 5):

Figure 4 : Example menu plan for a vegetarian wishing to gain quality weight.

Time	Food	Protein
Wake 7.30 am		
7.30	1 scoop whey protein in water	20g
8.00 breakfast	Large bowel wholewheat breakfast cereal	
	with 1/3 pint skimmed milk + sugar	15g
	2 slices wholemeal bread toasted + olive oil spread	
	½ portion weight gain drink with water and	
	multidextrose powder	22g
	100ml orange juice + 1 tblsp olive oil	
10.30	½ portion weight gain drink with skimmed milk	27g
	Fruit	
12.30	½ scoop whey protein in water	10g
	Low fat cottage cheese (100g)	12g
	or soya cheese (80g)	15g
	4 slices wholemeal bread + olive oil spread	
	Salad	
	Low fat yoghurt (150g)	7g
15.00	Full portion MRP made in half water	
	+ half skimmed milk	48g
	Fruit	
17.00	½ portion weight gain drink with	
	skimmed milk and multidextrose powder	27g
TRAIN		
18.30 (after training)	2 scoops whey protein in water	40g
19.30	Quorn burger (150g)	18g
	Baked beans (150g)	8g
	Reduced fat cheese (50g)	14g
	Either 2 medium jacket potatoes	
	or 200g boiled brown rice	
	or 350g boiled wholewheat pasta	
	Vegetables	
	Low fat yoghurt	7g
22.00	½ portion weight gain drink with skimmed milk	25g
23.30	1 scoop whey protein in water	20g
23.30 bed		
	TOTAL PROTEIN	**335g**

Figure 5 : Example menu plan for a vegan bodybuilder wishing to gain quality weight.

Time	Food	Protein
Wake 7.30 am		
7.30	1 scoop isolated soy protein in water	20g
8.00 breakfast	Large bowel wholewheat breakfast cereal	
	with 1/3 pint soya milk + sugar	9g
	2 slices wholemeal bread toasted + olive oil spread	
	1 scoop isolated soy protein with ½ pint	
	oat/coconut/rice milk and multidextrose powder	26g
	100ml orange juice + 1 tblsp olive oil	
10.30	1 scoop isolated soy protein with ½ pint	
	oat/coconut/rice milk and multidextrose powder	26g
	fruit	
12.30	½ scoop isolated soy protein in water	10g
	Hummus (200g)	15g
	Mixed beans (200g) & salad	15g
	4 slices wholemeal bread + olive oil spread	
	Soya yoghurt (150g)	7g
15.00	2 scoops isolated soy protein with ½ pint	
	oat/coconut/rice milk and multidextrose powder	46g
	Fruit	
17.00	1 scoop isolated soy protein with ½ pint	
	oat/coconut/rice milk and multidextrose powder	26g
TRAIN		
18.30 (after training)	2 scoops isolated soya protein in water	40g
19.30	Quorn burger (150g)	18g
	Baked beans (150g) + tofu mince (100g)	16g
	Either 2 medium jacket potatoes	
	or 200g boiled brown rice	
	or 350g boiled wholewheat pasta	
	Vegetables (inc. seaweed)	
	Soya yoghurt	7g
22.00	1 scoop isolated soy protein with ½ pint	
	oat/coconut/rice milk and multidextrose powder	26g
23.30	1 scoop isolated soy protein in water	20g
23.30 bed		
	TOTAL PROTEIN	**330g**

Again, remember both plans are merely a guide. Eat a variety of different protein sources, complex carbohydrates and fruit and vegetables every day, and plenty of water. If you are still not gaining sufficient weight, increase portion sizes of protein and carbohydrate foods; if you are starting to hold a little body fat, reduce portion sizes of carbohydrate foods slightly. A little bit of junk food now and again will do no harm.

Off-Season Bulking up Bodybuilding

This next meal plan (Figure 6) is meant for the experienced competitive bodybuilder who has already built a great physique. Following a cutting cycle, e.g. for a competition, he/she may wish to bulk up a bit and pack on quality weight. This will mean holding a little body fat, but still staying in reasonably good condition, and, I wouldn't recommend much more than bulking up to one to one and a half stones (14-21lbs / 6-11kg) over competition weight.

This meal plan is only suitable for an individual with a motivated lifestyle to bodybuilding, as it requires forward planning. I have noted only approximate portion sizes, as naturally, we are all different and some of us may gain muscle bulk easier than others; you will have to establish what portion size you will require. Carbohydrate portion sizes will vary, and protein amounts will need to be adjusted accordingly (see Chapter 3). However, I do not believe in mega-calories, like the guys who eat 7-8,000 calories a day. You will need a high calorie intake compared to Mr Average but nowhere near this level, if quality foods are eaten regularly. The key to bulking up is by quality protein intake and regular complex carbohydrates.

"…vary your choice of food and quantities eaten."

Your diet may include some fatty and sugary foods, which there is no harm in including when bulking up. In addition to weight training, I recommend light cardiovascular training two or three times a week, to help circulation and health. Remember that this is a guide and it is imperative that you *do* vary your choice of food and quantities eaten.

Figure 6 : Example menu plan for an enthusiastic off-season bodybuilder.

Time	Food	Protein
Wake 7.30 am		
7.30	1 scoop whey protein in water	20g
8.00 breakfast	Large bowel wholewheat breakfast cereal	
	with 1/3 pint skimmed milk	15g
	½ portion MRP in water	21g
	100ml orange juice + 1 tblsp olive oil	
10.30	High protein supplement bar	25g
	½ scoop whey protein in water	10g
	Fruit	
12.30	Tuna (95g) + 1 tblsp natural yoghurt	27 g
	½ small chicken breast (60g)	18g
	4 slices wholemeal bread + olive oil spread	
	Huge salad	
	Low fat yoghurt	7g
14.30	1 scoop whey protein in water	20g
	Fruit	
16.30	1 scoop whey protein in water	20g
	2-4 rice cakes	
17.45	1/2 portion MRP in water	21g
TRAIN		
18.30 (after training)	2 scoops whey protein in water	40g
19.30	mackerel (95g)	20g
	½ small chicken breast (60g)	18g
	Either 2 medium jacket potatoes	
	or 200g boiled brown rice	
	or 350g boiled wholewheat pasta	
	Vegetables	
	Low fat yoghurt	7g
22.00	½ portion weight gain drink + ½ scoop whey	
	protein powder in water	33g
23.30	1 scoop whey protein in water	20g
23.30 bed		
	TOTAL PROTEIN	**345g**

As you can see, this is a high protein regimen with quality protein consumed regularly throughout the day. Amino acid capsules may also be added to ensure protein quality further. The plan includes five servings of fruit and vegetables, and is also high quality carbohydrate regularly. Carbohydrate intake may need to be adjusted according to how your body responds.

'Protein Only' Days

'Protein only' days are a very useful technique for shocking the metabolism and helping bulking up. I would only suggest this procedure for the intermediate and advanced bodybuilder, not the newcomer or hard gainer. Generally, you should be consuming a bodybuilding diet much like the one in Figure 6 or the deluxe plan in Chapter 16, varying your food choice and portion sizes. The procedure involves having one, two or three consecutive days every six to eight weeks where you consume extremely low amounts of carbohydrates and base you diet on protein foods only. Include a small amount of complex carbohydrate at breakfast and at the evening meal, for example one slice of bread, and you must avoid fruit. Most of your carbohydrate intake will be from the small amounts in your vegetables and from MRPs.

The idea behind this technique is to 'shock' your metabolism into fasting mode. Your body needs regular carbohydrate intake to keep the metabolic rate working efficiently, so if these foods are omitted, the rate will slow down. Regular quality protein intake is imperative to maintain muscle mass. The meal plan below in Figure 7 gives an idea of this technique. It is also essential that you up the intensity of your workouts for this short period, and maybe also include some more intense cardiovascular exercise to help glycogen deplete.

'Protein only' days are easy to follow for one day, but by day two, you will be craving carbohydrate foods and feeling weak. If you choose to follow it for three days your body may go into ketosis, a condition whereby your body uses ketones for energy (see Chapter 18). For the two days following this technique, go back onto your regular eating pattern, with high intakes of simple and complex carbohydrate foods, in fact eat whenever you are hungry, and you *will* be hungry!

Although during the depletion phase you will lose a little weight, have little strength and generally feel awful, on the days following you will gain a few pounds, feel strong and great. It is also a great appetite stimulant technique. You must not have 'protein only' days too often, otherwise you will not get the benefit of its in bulking. You must also try this when you have no outside distractions for a few days. It is very similar, though not as strict, as the carbohydrate depleting and loading technique used in pre-contest bodybuilding, discussed in Chapter 18.

Figure 7 is merely a guide, but the principles are plenty of high quality protein food regularly, very low carbohydrate intake and plenty of vegetables to fill up on.

Figure 7 : Example menu plan for protein 'only' days.

Time	Food	Protein
Wake 7.30am		
7.30	1 scoop whey protein in water	20g
8.00 breakfast	1 slice of dry toast	
	1 MRP in water	42g
10.30	½ scoop whey protein in water	11g
	1 small chicken breast (120g)	36g
12.30	Tuna (95g)	22g
	½ small chicken breast (60g)	18g
	Huge salad	
3.00	½ scoop whey protein in water	11g
	1 small chicken breast (60g)	36g
5.00	1 MRP in water	42g
TRAIN		
6.30 (after training)	2 scoops whey protein in water	40g
7.30	Tuna (95g)	22g
	½ small chicken breast (60g)	18g
	1 tblsp brown rice	
	Huge salad / vegetables	
10.00	½ scoop whey protein	11g
	½ small chicken breast (60g)	18g
11.30	1 scoop whey protein in water	20g
11.30 bed		
	TOTAL PROTEIN	**365g**

The other great thing about the protein 'only' days is that you really enjoy eating afterwards!

Key Points

- *There are a variety of techniques and eating regimens to suit the different circumstances for gaining quality weight and muscle mass*
- *It is possible for the hard gainer to gain weight, and this may be done on a budget*
- *Vegetarian and vegan bodybuilders can enjoy their food whilst still gaining muscle efficiently*
- *Dedicated bodybuilders need careful consideration to their eating*
- *'Protein only' days are a useful method for stimulating the metabolism as an aid to bulking up*

Chapter 15
Losing Body Fat Whilst Gaining Quality Weight

There are many individuals who carry some body fat, which they want to lose, but still desire to gain quality weight, in the form of muscle, at the same time. There is a myth that you cannot gain muscle and lose weight at the same time. I see so many newcomers and experienced bodybuilders who do efficiently lose fat and gain muscle simultaneously.

"There is a myth that you cannot gain muscle and lose weight at the same time"

It is true that if you are dieting extremely strict, then it is not possible to gain muscle at the same time as losing body fat, as there is insufficient energy reserves for muscle growth. Here the priority is in maintaining muscle mass. But, for the main, with gentle dieting and high protein intake you can successfully lose fat and grow, reaching your bodybuilding objective, i.e. looking good.

You are probably aware of the obsession with scales in bodybuilding; so many people ask 'what are you weighing at the moment?' In my view it doesn't matter *at all* what you weigh, it's what you look like, as, after all, bodybuilding is a sport of aesthetics. There are also a variety of methods of measuring percentage body fat; most of which are very poor in accuracy and precision. So forget your weight, and forget your percentage body fat, go on what you look like in the mirror and what people you trust tell you. This is far more important.

You often hear of loads of faddy diet regimens that guarantee weight loss in the dieting industry. Some of these do work, most don't, but all are not healthy and are inefficient. In effective weight loss the basic principles remain, in that you have to eat a healthy balanced diet with a calorie deficit in energy intake. Meals must be small and regular, and in order to keep growing, it is essential to keep protein intake high. The key to effective weight reduction lies in carbohydrate intake, i.e. it should be low, *but not omitted*. Consume starchy carbohydrate foods regularly, but in small portions only. You will also have to be that little bit stricter in avoiding treats and junk food.

"…exercise preferentially burns fat whilst maintaining muscle mass"

Weight training whilst trying to lose body fat and gain muscle, must remain intense. You will be able to continue to train hard as your calorie intake will not be mega low, and you'll be including regular carbohydrates. In addition, I strongly recommend including gentle cardiovascular exercise three or four times a week, as exercise preferentially burns fat whilst maintaining muscle mass. Aerobic exercise ideally should be done on a different day or a different time of day to weight training so as not to interfere with energy and nutrient levels required for muscle growth. Try to do 30-40 minutes of cardiovascular work, consisting of maybe two or three exercises. Intensity should be low, and about 55 - 60% maximum heart rate. This has been shown to be the optimum level for mobilising fat reserves whilst maintaining muscle tissue. In practice, this is a level so when you cease exercising you feel slightly warm and just out of breath, i.e. you are not panting, nor are you breathing normally.

You can calculate you maximum heart rate by the following equation:

Maximum heart rate = 220 – your age in years

For example, a 30-year old man's maximum heart rate will be about 190 beats per minute (bpm), so he should train aerobically at about 105-115 bpm. Many hi-tech cardio equipment machines have heart rate monitors on them, which can be useful.

The meal plan in Figure 8, gives a vague example of a suitable regimen for losing body fat whilst gaining muscle mass. Like previous examples, it is merely a guide, and as everyone is different, you may need to alter portion sizes depending on how you respond. You may also wish to use some of the more effective fat burning supplements, as discussed in Section C, but these are ineffective alone; you must still be consuming a calorie-deficit healthy diet.

The plan in Figure 8 is high and regular in quality protein, low but regular in quality carbohydrate, low in fat, but including essential fatty acids, high in fluid (essential) and includes sufficient amounts of fruit and vegetables. You must also drink plenty of fluid.

Figure 8 : Example menu plan for a bodybuilder who wishes to lose body fat, whilst gaining muscle mass.

Time	Food	Protein
Wake 7.30 am		
7.30	1 scoop whey protein in water	20g
8.00 breakfast	1-2 slices wholemeal bread + olive oil spread	
	½ portion MRP + ½ scoop whey protein in water	31g
	100ml orange juice + 1 tblsp olive oil	
10.30	1½ scoops whey protein in water	30g
	2 rice cakes	
	Fruit	
12.30	Tuna (95g) + 1 tblsp low fat natural yoghurt	27 g
	½ small chicken breast (60g)	18g
	1-2 slices wholemeal bread + olive oil spread	
	Huge salad	
15.00	1½ scoops whey protein in water	30g
	2 rice cakes	
	Fruit	
17.30	½ portion MRP + ½ scoop whey protein in water	31g
TRAIN		
18.30 (after training)	2 scoops whey protein in water	40g
19.30	Mackerel (95g)	20g
	½ small chicken breast (60g)	18g
	Either 1 small jacket potato	
	or 50g boiled brown rice	
	or 75g boiled wholewheat pasta	
	Vegetables	
22.00	1 scoop whey protein in water	20g
23.30	1 scoop whey protein in water	20g
23.30 bed		
	TOTAL PROTEIN	**305g**

This meal plan should give a steady loss of body fat, and if you are training hard, you will gain muscle too. It is also reasonable in portion size, so should help in keeping you feeling full up and satisfied.

Key Points

- *It is possible to lose fat and gain quality muscle at the same time*
- *Forget weighing yourself and measuring your percentage body fat, go by what you look like*
- *To lose fat and gain muscle, keep carbohydrates regular but low, and protein intake regular and high*
- *Forget any faddy regimens – eat sensibly*
- *Cardiovascular exercise is crucial to make fat loss effective – train at 55-60% maximum heart rate*
- *Some supplements are useful aids in losing fat, but are useless their own, you must be eating correctly*

Chapter 16
Deluxe Meal Plan

In this chapter, I have compiled a Deluxe Meal Plan for the highly enthusiastic off-season competitive bodybuilder incorporating many useful supplements. This regimen is very expensive, and you may wish to include some or all of the following supplements:

- MRPs
- Whey protein powder
- Complete nutrition electrolyte replacement drinks
- Creatine
- Glutamine
- GABA
- Pre-workout drinks
- Supplement bars
- Amino acid capsules
- Ephedra, eca, guarana
- Aloe vera gel

I have tried to distribute the supplements for optimum use.

Figure 9 : Example of a deluxe meal plan.

Time	Food	Protein
Wake 7.30 am		
7.30	1 scoop whey protein in water	20g
8.00 breakfast	Large bowel wholewheat breakfast cereal	
	with 1/3 pint skimmed milk	15g
	½ portion MRP in water	21g
9.00	20ml aloe vera gel	
	100ml orange juice + 2g glutamine + 1 tblsp olive oil	
	Tea/coffee + skimmed milk + sugar + 2-5g	
	creatine monohydrate	
	Fruit	
10.30	High protein supplement bar	25g
	½ scoop whey protein in water	10g
12.30	Tuna (95g) + 1 tblsp low fat natural yoghurt	27 g
	½ small chicken breast (60g)	18g
	4 slices wholemeal bread + olive oil spread	
	Huge salad	
	Low fat yoghurt	7g
	4-6 amino acid capsules	

14.30	1 scoop whey protein powder in water Tea/coffee + skimmed milk (+ sugar + 5g creatine monohydrate*) Fruit	20g
16.00	1/2 portion MRP in water	21g
17.30	Complete nutrition electrolyte replacement drink 2-4 rice cakes	13g
17.45	Pre-workout drink / ephedra / eca / guarana	
TRAIN		
18.45 (after training)	2 scoops whey protein in water	40g
19.30	Mackerel (95g) ½ small chicken breast (60g) Either 2 medium jacket potatoes or 200g boiled brown rice or 350g boiled wholewheat pasta Vegetables Low fat yoghurt 4-6 amino acid capsules	20g 18g 7g
20.30	Mug green tea with lemon juice	
22.00	1 MRP in water Fruit + 4 rice cakes	42g
23.30	GABA in low sugar fruit cordial 1 scoop whey protein in water	 20g
23.30 bed		
Middle of night (if wake)	1 scoop whey protein in water	20g
	TOTAL PROTEIN	**364g**

*creatine loading phase only

In addition to the above consume plenty of water throughout the day. This is a high protein regimen with quality protein consumed regularly throughout the day. Amino acid capsules are included to ensure protein quality. The plan includes five servings of fruit and vegetables, and is also high quality complex carbohydrates regularly. Carbohydrate intake may need to be adjusted according to how your body responds.

"Amino acid capsules are included to ensure protein quality."

At 9.00 am I have noted the time to take many of the supplements, as this is away from other food intake, and those taken here will not interact with each other. Take glutamine powder at this time, and remember that MRPs and complete nutrition electrolyte replacement drink also contain high amounts of added glutamine.

Creatine is noted down for the loading phase, adjust doses according to the regimen described in Chapter 8. The sugar in the tea / coffee and the fruit will supply sufficient simple carbohydrates to optimise absorption of creatine.

The regimen includes a pre-workout drink and stimulants before training, but these are entirely optional, and do not take them all! I've also include GABA to improve sleep, but don't consume this everyday.

This deluxe meal plan is again just an example, and please vary the food choices, as variety is so important. Including some junk food occasionally is fine. This regimen is only designed for the highly dedicated bodybuilder off-season. It requires forward planning and self-discipline. Use the information you have learned from this ebook and other research to adapt it to suit your lifestyle.

Key Points

- *A deluxe meal plan needs forward planning and discipline*
- *A range of nutritional supplements can be incorporated into your regimen*
- *Timing of meals and snacks is important for optimum use of nutrients*
- *Vary from this plan – variety is essential*

Chapter 17
Snack Ideas

I thought this chapter was important to include, because good quality healthy snacks, high in protein are crucial to bodybuilding, especially if you are rushed or trying to bulk up. Being adventurous with your food is important to stop boredom, and many people still consider eating to be a pleasure; why lose this pleasure, just because you want to build a great physique?

Sandwiches

Sandwiches or rolls can be filled with a wide range of different fillings to make them exciting and tempting. Be generous with these fillings as they are a good source or protein, and have two or more different fillings at each snack to combine protein sources.

Some tasty examples are listed below, but experiment and you'll come up with your own:

- Tuna with low fat natural yoghurt and sweetcorn
- Chicken or turkey slices with lettuce
- Lean ham and tomato
- Egg and cress
- Low fat cheese
- Cold lean roast beef or pork
- Cottage cheese and pineapple
- Low fat cream cheese / cheese spread supplement salad
- Salmon and cucumber
- Quorn deli slices

One slice of bread with a topping like sardines, sliced meat or cheese with salad makes a great 'open' sandwich, for a change.

If you have a good appetite a double decker will hit the spot. This is 3 slices of bread with a different filling at each level.

For the more adventurous of you a sandwich pudding is a great small meal or snack. Cut up a made sandwich and place in an oven dish; pour on egg and skimmed milk mixed up and bake until golden (about 180 C for 30 minutes).

Cheese, fish, baked beans can be served as a toasted sandwich, which is easy to prepare, and an enjoyable change.

Jacket Potatoes

Jacket potatoes are another great healthy snack with can be high in protein (if you have a generous filling), or either high or low in carbohydrates depending on the size of your potato. Great fillings are baked beans plus tuna mixed together, cottage cheese with tuna, chicken and sauce. Always serve your potato with olive oil spread (for monounsaturated fats) melted across it and a side salad. Jacket potatoes also make a great accompaniment to any meal, especially if you need to increase your carbohydrate intake.

Other Snacks

Other than sandwiches and jacket potatoes there are loads of other great snacks that are also nourishing and convenient include:

- Ploughman's with cheese and ham
- Baked beans with tuna on toast
- Rice or pasta with sweetcorn and tuna and some natural yoghurt
- Breakfast cereals and skimmed milk – some guys like to pour their MRPs or protein shakes over their cereal instead
- Fish / poultry / meat salad and bread

These are just a few snack ideas – I'm sure you'll come up with loads more. So, enjoy your food!

Chapter 18
Bodybuilding Competition Preparation

The more advanced bodybuilders amongst you may wish to compete in bodybuilding competitions, indeed some of you may already have. Competition preparation is an entirely different ball game to off-season training or early stages of bodybuilding. The aim is to be as super defined, striated and full in appearance as possible, whilst maintaining muscle size and a healthy look, as well as being in proportion.

If you would like to compete for the first time, do make sure you are ready both physically and mentally. Seek trusted advice from others who are experienced in competing; their trained, honest eye will be an invaluable aid in attaining your desired appearance. If you do not carry enough muscle, then wait and do some serious training; if you haven't given yourself enough time before the date of the show, then wait for another. Do not try to kid yourself that you are big enough, or that you have enough time, as the standard of bodybuilding competitors these days is ***very*** high and continually rising, even in junior, first time and novice categories. You do not want to make a fool of yourself by being too small, or being too fat!

"…avoid any outside distractions during the weeks in the run-up to the show…"

It is also imperative that you try to avoid any outside distractions during the weeks in the run-up to the show, and preparing for this contest will be the only thing that matters to you for a few weeks. Bodybuilding will become the most important thing in your life for the pre-contest period (if it's not already!), and total dedication is required.

Different Regimens

There are a number of different regimens that are used in bodybuilding competition preparation, many of which are effective. I will discuss some of these, but will only go through in detail one method that I have found to be most effective and efficient in a range of competitor standards.

The principles are generally the same, in that you need to have a high regular protein intake, with a low fat and carbohydrate intake. This is coupled with more cardiovascular exercise to increase the calorie deficit further. Some people like to have a day a week on high carbohydrate intake for personal gratification and to kick start the metabolism (which I recommend). Some people don't follow the low fat principle and consume as much as 40% energy as fat throughout the preparation period. However, all regimens are consistent in that there must be a calorie deficit and high protein, in order to lose fat and maintain muscle. Also, during the final stages, the body's water balance needs to be adjusted in order for fluid to be taken from around the muscle to within it, to make the muscle fuller and improve definition.

The length of the contest preparation period or 'diet' varies from individual to individual but usually ranges form 8-12 weeks, depending on how hard the individual diets and how much body fat is needed to be lost. It is better to be safe, and reach your desired body fat level early, then hold the weight you are at, than to be too late and have to crash diet at the end and lose muscle size. Contrary to popular belief, it ***is*** possible to gain muscle during the early stages of dieting, and then to lose none in the latter stages.

I will discuss a regimen in detail, basing it around a 10 week preparation diet, as I will assume you have heeded my tips from the remainder of this ebook and only have 1 – 1½ stones to lose to be in tip-top condition. If you feel you have less to lose (you are one of those lucky 'forever-lean' folk!), you may be able to prepare in 6-8 weeks. I am assuming you are using a variety of appropriately recommended supplements, and are already eating a high, regular, quality protein diet, with fairly high and regular carbohydrates, some fat, plenty of fruit and vegetables, loads of fluid and are training really hard and enthusiastically.

You may wish to continue to use some supplements and nutraceuticles like aloe vera and probiotics during the early stages, but these may need to be excluded during the last two or three weeks pre-contest.

The regimen I have described is merely an example and is in no way intended to be ideal for everyone. Keep a strict diary of all factors involved in your contest preparation for the whole pre-contest period, and learn from this for next time. There is no right or wrong way; it's how you look on the day that's important. Use your first show as a learning curve, and you ***must*** be the judge, as you know your body better than anyone else.

Psychology and Contest Preparation

Remember competition dieting puts extreme stress on your body and takes a lot of mental discipline. Despite the fact that you will be more defined as you lose body fat, you may experience psychological changes due to the fact that you'll be craving carbohydrate foods, and will be very tired. Your mental state may be worsened by the use of stimulant and lipogenic supplements like ephedra.

As the contest preparation will be the most important thing in your life you may also become 'obsessed' with your physique and with what you are eating. This will be worsened by the confusion that you are now trying to lose weight, when you are usually striving to gain weight. Psychologists have associated this condition with bodybuilders, and named it ***muscle dysmorphia*** (Hurst, *et al* 2000). It is more pronounced during contest preparation.

With low glycogen stores in your muscles you will appear 'flat', making you feel smaller, when this is not actually the case. If you have a day of eating increased amounts of carbohydrates you may be a little fuller, with the spin off of positive mental effects. If the negative psychology becomes too much, and thoughts start to adversely affect your performance, I suggest wearing long sleeve baggy clothes at all times, especially when working out. Only strip off to let your trusted friends look at your progress, which is important to assess how well you are doing and to see if you need to hold back a bit, or diet a bit harder.

The First Stages

Its not a bad idea for a couple of weeks before you start to diet properly, to break into your contest preparation regimen gently. Continue to eat well in respect of quantity, but cut out any fatty and sugary foods and junk food treats, which I previously said it was okay to include now and again. During this time, plan what you are going to do so you are completely ready to start properly. As most bodybuilders are habitually big eaters, during this period they often lose a little fat anyway; a great motivational aid for the coming diet. This period should not be hard and you should not be hungry. Train as normal.

Eight to ten weeks out (or as appropriate) commence the pre-contest diet properly. The basis of this next stage of preparation is to continue to consume high protein foods as before, and cut carbohydrate intake right down, whilst maintaining a regular intake of starchy foods. This is similar to Figure 8 in Chapter 15, for those people who wish to lose fat whilst gaining weight, but the protein intake will be higher, and you will need to be more disciplined. It is still possible to gain muscle during this time. Fruit and fruit juice intake should also be low, due to the simple sugar content, so make up for this by consuming plenty of non-starch vegetables, to ensure a good intake of vitamins and minerals. Red meat now and again is also useful for variety and great protein quality.

If you use creatine monohydrate off-season, make sure you are not on the loading phase during the pre-contest diet, i.e. load up 12-15 weeks before the show. You may remain on creatine up to week four pre-contest. Do not take creatine with carbohydrate, though, as this is a source of unwanted simple sugar and calories you can do without; you may not get optimal muscle uptake, but there will still be sufficient absorption for this time. Continue to take creatine in a hot beverage and I suggest the use of a sweetener to mask the taste.

Figure 10 is a meal plan for this period from the onset of the diet up to the four week pre-contest mark.

Figure 10: Example menu plan of pre-contest preparation form the onset to 4 weeks pre-contest.

Time	Food	Protein
Wake 7.30 am		
7.30	1 scoop whey protein in water	20g
8.00 breakfast	1-2 slices wholemeal bread	
	½ portion MRP + ½ scoop whey protein in water	31g
9.00	50ml orange juice + 2g glutamine + 1 tblsp olive oil	
	Tea/coffee (+ dash skimmed milk) + 2g creatine	
	Supplement + sweetener	
10.00	1½ scoops whey protein in water	30g
	rice cakes	
12.30	Tuna (125g)	30g
	½ small chicken breast (60g)	18g
	1 slice wholemeal bread	
	Huge salad	
	4-6 amino acid capsules	

15.00	1½ scoops whey protein in water 2 rice cakes	30g
17.30	Full portion MRP in water	42g
TRAIN 18.30 (after training)	2 scoops whey protein in water	40g
19.30	Mackerel (95g) ½ small chicken breast (60g) Either 1 small jacket potato or 50g boiled brown rice or 75g boiled wholewheat pasta Vegetables 4-6 amino acid capsules	20g 18g
20.31	Mug green tea with lemon juice	
22.00	½ portion MRP in water	21g
23.30 23.30 bed	GABA in low sugar fruit cordial 1 scoop whey protein in water	20g
Middle of night (if wake)	1 scoop whey protein in water	20g
	TOTAL PROTEIN	**340g**

You should increase your cardiovascular work considerably during this time. If you weight train four times a week in the evening, I suggest doing a cardio session for 30 minutes on six mornings and on two of the evenings where you do not weight train. Have one day a week, completely exercise free, where you must relax. Cardio should be at the 55 – 60% of maximum heart rate level, as described in Chapter 15. Some competitors opt to do a lot more cardio, so they don't have to diet so strictly.

Weeks Four and Three Pre-Contest

"If your diet is too low in fat intake you will not burn body fat efficiently…"

At this time a few more things need to be excluded, and replaced by suitable nutritional substitutes. This is the time when you should exclude all dairy-derived products, i.e. milk (yes, in tea and coffee), yoghurts, whey protein and MRPs. It is still important to keep your carbohydrate intake low but regular, and include monounsaturated fat and oily fish for omega-3 PUFAs. If your diet is too low in fat intake you will not burn body fat efficiently, and it could also have a detrimental effects on muscle mass. For this reason, I suggest another serving of olive oil (two in total) to up the fats a bit.

It is crucial to include plenty of vegetables to fill up on and to provide vitamins and minerals. It is not essential that you combine protein sources from this period on, as you are not looking to gain muscle just maintain. But protein intake should remain high and even more frequent, preferably every two hours that you are awake. Best protein sources are chicken, turkey and both white and oily fish. Pulses can be eaten in moderation, but not too much due to the carbohydrate content. Red meat may be eaten occasionally to vary protein quality. It may also be useful to have another two-gram serving of glutamine, to help minimise any potential catabolism.

By this point you will have been on a very low calorie intake for some time, and too low carbohydrate intake for such a long period of time may lead to adaptation by the body and your metabolism will be slower. Exercise will help hype the metabolism, and it is also a good idea every 7-10 days to up your carbohydrate intake for a 24 hour period (say to 200-300g) to give your metabolism a kick-start. This will also help you mentally.

Fluid intake should be plentiful, so drink water whenever you are thirsty. Weight training should be as hard as you can and still intense, by this time is unlikely that you will still be building muscle, although you can still efficiently maintain size, and although you are losing weight, you will appear bigger due to increased muscle definition. Continue with regular cardiovascular work during this time.

Cease the use of creatine monohydrate during this period. I still suggest taking amino acid capsules with meals to help ensure protein quality. GABA may still be used as a sleeping aid on some nights.

Figure 11: Example menu plan of pre-contest preparation from weeks 4-3 pre-contest.

Time	Food	Protein
Wake 7.30 am		
7.30	½ small chicken breast (60g)	18g
8.00 breakfast	Tuna (150g)	35g
	1-2 slices wholemeal bread	
	5-6 amino acid capsules	
9.00	50ml orange juice + 2g glutamine + 1 tblsp olive oil	
	Tea/coffee (black) + 2g creatine + sweetener	
10.00	1 small chicken breast (120g)	36g
	2 rice cakes	
12.00	1 small chicken breast (120g)	36g
	1 slice wholemeal bread	
	Huge salad	
	5-6 amino acid capsules	
14.00	Tuna (150g)	35g
	2 rice cakes	
16.00	1 small chicken breast (120g)	36g
	50g boiled brown rice	
17.30	½ small chicken breast (60g)	18g
TRAIN		
18.30 (after training)	1 small chicken breast (120g)	36g
19.30	Mackerel (125g)	26g
	½ small chicken breast (60g)	18g
	Either 1 small jacket potato	
	or 50g boiled brown rice	
	or 75g boiled wholewheat pasta	
	Vegetables, inc. small amount pulses	5g
	4-6 amino acid capsules	
20.30	Mug green tea with lemon juice	
21.30	1 small chicken breast (120g)	36g
23.30	50ml orange juice + 2g glutamine + 1 tblsp olive oil	
	GABA in low sugar fruit cordial	
	1 small chicken breast (120g)	36g
23.30 bed		
	TOTAL PROTEIN	**371g**

You will notice that the total protein intake is considerably higher here. This is to prevent catabolism of muscle tissue, which after strict dieting, and loads of exercise for weeks, is likely. Protein is consumed at least every two hours. I have suggested chicken and tuna mostly, but do vary the sources, and, if you are on a tighter budget, turkey is generally cheaper.

Week 2 Pre-Contest

By this time you will probably be feeling very low in energy, and should be 2-3lbs maximum above your lowest weight, if you are not there already. If you have not reached this level, then you will need to take drastic measures and cut your carbohydrate right down for a few days and exclude olive oil. Protein intake may also need to be dropped a little, which may result in a little muscle loss, but this is necessary in order to harden up more. However, if you are on target, there is no need to reduce protein intake nor omit the olive oil, and you may continue to diet and exercise much in the same way as you have done in weeks four and three pre-contest.

Apart form re-evaluating yourself, the only other change should be sodium manipulation. The object of this is so the physique doesn't show any water retention on the day of the show. During this week you need to actually *increase* your sodium intake and continue to drink plenty of fluid. This will lead to more water retention, so when sodium and fluid is restricted prior to the show, there will be a rebound effect and you will lose all the excess water. The recommended intake of sodium for a healthy adult is 1,600mg a day (DoH 1991), and bodybuilders generally consume less than this amount. Start to eat more high sodium foods this week.

The Last Week

This week involves the fine tuning of your physique in order to peak at the right time. Timing is crucial and the chances of you getting it perfectly right on the first time you prepare for a show are slim, so the diary is particularly important this week.

Let's assume the show is on the Sunday, with prejudging at 12 noon, and an evening show at 6pm.

Monday, Tuesday and Wednesday

Monday, Tuesday and Wednesday are based around high sodium and carbohydrate depletion, with increasing fluid intake.

High sodium intake is achieved by adding table salt to your food, using tomato ketchup to liven things up, consuming tuna canned in brine (as opposed to water) and spreading yeast extract (e.g. Marmite) on things, like bread and salad. This trick has been shown by many bodybuilders to be very effective, coupled with manipulation of some other minerals and electrolytes.

Alongside sodium manipulation consume five litres of water on Monday, six litres on Tuesday and eight litres on Wednesday. The water may be any sort, tap water is fine.

Some bodybuilders also suggest mega doses of vitamin C in the last week of preparation due to its diuretic effects. It has been known for competitors to consume vitamin C supplements of more than 10 grams a day, which I feel, is excessive.

The science of carbohydrate depletion and loading has been looked extensively as it used in many sports, not only bodybuilding. Athletes use the technique for attaining optimum glycogen levels in muscle for performance, whilst bodybuilders use the technique for maximal glycogen so muscles appear rounder and fuller. For every one gram of glycogen that is stored in muscle, a further three grams of water is drawn into and held within muscle. This is beneficial for cell volumisation, a fuller appearance and more energy. It also helps to minimise water stored around the muscle that would smooth the appearance and reduce muscular definition.

There are a number of regimens of the carbohydrate loading procedure, but the one I advocate is based on a number of studies where muscle glycogen has been measured and shown to be higher (Wootton 1988). It used to be thought that during these three days, near-zero carbohydrate should be ingested, and training should continue as normal. Research has demonstrated that keeping the same carbohydrate intake and using exercise to rid the muscles of glycogen is more beneficial when you come to reload. Remember that you are already on a reasonably low carbohydrate intake. Continue with this and consume complex, high fibre sources in small amounts, as before, at regular intervals throughout these three days.

Carbohydrate depletion is therefore achieved by exercise. You should train your whole body in these three days, using moderately heavy weights, a high number or repetitions and sets to complete or even negative failure (i.e. when you can't even do the movement with assistance). Train so each muscle group is completely exhausted and you yourself are incredibly low on energy. Cardiovascular exercise will also help to deplete. Train legs on Monday, chest and back on Tuesday and arms and shoulders on Wednesday. By Wednesday, you will be physically and mentally exhausted, and your body will be in a ketotic state. Ketosis is a metabolic condition where the body uses ketones (alternative end products of fat metabolism) for energy, as there is too little energy available from glycogen stores and insufficient glucose is synthesised from protein and fat stores. Ketones are necessary for brain and heart muscle to function. You will know you are in a ketotic state as, not only will you be exhausted, but your breath will have a slight smell of acetone (paint stripper) or a little like 'pear drops'.

You will hardly be able to function physically or mentally by Wednesday (and we call bodybuilding a 'healthy' sport!) and most competitors, when they are not training merely practice their routine, or relax and sleep. Avoid unnecessary distractions, just focus upon the coming show.

Protein intake should continue to remain high, and don't forget vegetables – especially useful for filling up on. Continue with olive oil, amino acids and glutamine.

Thursday

This is the first day of carbohydrate loading and sodium depletion. It is important to cut out sodium as much as possible here, i.e. no added salt and eat foods of low sodium content only. Drink seven litres of water on Thursday, but it should be of a low sodium variety; some of the French mineral waters (non-sparkling) are ideal. Some bodybuilders buy purified water with no mineral content, but this can be expensive. Also take some mineral supplements to prevent cramps and dehydration: calcium 1,000mg, magnesium 500mg and potassium 600mg per day. Continue with the vitamin C (if desired), olive oil, amino acids and glutamine.

Carbohydrate loading should begin when you get up on Thursday. Consume either a 200g portion of well-cooked brown rice or a hot medium jacket potatoes (not cold or reheated, as the starch in cold or reheated potatoes is not absorbed as efficiently as freshly cooked ones), two hourly all day. Consume protein with each meal too, not forgetting vegetables. Broccoli or cauliflower are the preferred vegetables pre-contest.

"Exercising at this time will defeat the object of loading…"

It is absolutely imperative that you do *no significant amounts of exercise from this point on*. This includes doing no weight training, nor any cardiovascular work. It's too late for any significant fat loss now; carbohydrate loading is the priority. Exercising at this time will defeat the object of loading, and will stop super-volumisation of the muscles. The reason for super-volumisation is that from depleting and then reloading there is a super-compensation of carbohydrate stores with glycogen and the associated water; if you just load without depleting, glycogen stores would not be as full as they could be.

Friday

Thursday, but with six litres of low sodium water during the day. Mineral supplement dosages should be the same. If you are already feeling loaded with carbohydrates; you may want to cut back to consuming carbohydrates from two hourly to two and a half or three hourly.

Saturday

On Saturday consume carbohydrates as above until about lunchtime, which should be your last carbohydrate loading meal. Again minimal sodium and you should drink one to two litres of low sodium water in the morning. Minerals should be as above on Saturday.

In the afternoon, only sip water when you are thirsty, not allowing yourself to get too dry, but don't drink more than a couple of glasses. Only consume very minimal servings of carbohydrates, but protein should continue to be regular and high, with vegetables.

In the evening, drink two glasses of dry white wine. This is for the diuretic effect of alcohol, which is actually quite potent. Due to your nutritional and hydration state, you'll find that you will feel drunk quite easily. This will, however, help you sleep.

Go to bed early, as you may find yourself waking frequently during the night needing to urinate.

Sunday – The Big Day

Breakfast should be a tablespoon of rice with chicken or turkey accompanied by a glass of dry white wine. Two hours later have more rice and chicken or turkey. Again only sip water during the morning.

About two hours before you are due to go on the stage (for prejudging) you may start to consume simple carbohydrates. It doesn't matter if you eat fatty foods at this point. Chocolate is great. Don't overdo it though, or you may bloat your abdomen or make yourself sick. Consume chocolate at regular intervals.

You may wish to use ephedra or eca before going on stage, in which case take an hour or so before. Some people suggest baby food, sweets or mint cake before competing, all of which are fine, but I feel chocolate is sufficient.

Twenty minutes before you are due to go on stage (check with the organisers the exact time for your category), have a tot of spirit, e.g. whiskey, brandy or rum. This has the effect of dilating the veins, helping a more vascular appearance, and also helps to calm the nerves for any potential 'stage-fright'. About 15 minutes before, take 200-400mg of niacin, for its vasodialation and flushing effect too (if you haven't used this before, be careful as it can be uncomfortable and may surprise you). Some competitors also like to take GABA before going on stage.

Remember to warm up and stretch before going on stage. Posing on stage will be the hardest workout of your training career, at a time where you are near dehydration and prone to muscle cramps.

After the pre-judging, if there is one, just consume what you want in the afternoon, sipping fluid, but not overindulging so as to bloat yourself. Repeat the pre-stage tips before the evening show.

After the evening show, treat yourself!

Figure 10: Summary of the main changes, stage by stage of a pre-contest diet.

Pre-diet	Cut out junk foods and don't overindulge
First Stages - week 4	Low carbohydrate, high protein, low fat
Week 4-3	Cut out dairy products, creatine Increase olive oil and glutamine Every 7-10 days higher carbohydrates
Week 2	Re-evaluate and adjust accordingly Start to increase sodium
Week 1 - Monday	Very high sodium starts Vitamin C Carbohydrate depletion 5 litres water Exercise very intensely
Tuesday	6 litres water
Wednesday	8 litres water
Thursday	Cut out sodium Calcium, magnesium, potassium Low sodium mineral water – 7 litres Carbohydrate load
Friday	6 litres water Re-assess carbohydrate intake
Saturday	1.5 litres water in the morning, sip in the afternoon Minimal carbohydrate Dry white wine in the evening
Sunday	Wine in the morning Small amounts of protein and carbohydrate Chocolate Spirits, niacin, (ephedra/eca), (GABA) Stretch and warm up

Another Show Pending?

In many cases bodybuilders like to do a few shows in one season, while they are 'dieted'. For this reason you may have another contest in one or two weeks or even the next day. If you have a show the next day, don't overindulge after the first show, have some protein, white wine and go to bed. Repeat the procedure for the morning of the show.

If you have a show in one week, you'll need to carbohydrate and sodium deplete in the same way, so get started the next day. If you have a show in two or more weeks, have a day of treats (without going mad), then get back on track, and make any adjustments you need to make before carbohydrate and sodium depleting. Evaluate how you looked; if you peaked too early or too late, adjust your final weeks plan accordingly, and refer to your diary.

All the best in your show!

Key Points

- *If you want to compete, make sure you're ready*
- *Contest preparation will affect you psychologically*
- *Carbohydrate intake should be low but regular, protein intake should remain high*
- *Supplement use will need to be adjusted at different stages*
- *Fluid manipulation is crucial to maximise definition*
- *Carbohydrate loading is an extremely useful technique*
- *Re-evaluate your physique regularly*

Chapter 19
Bodybuilding When You Are Ill

Despite the healthy physical appearance of bodybuilders, we too suffer from the run-of-the-mill illnesses. We start to feel ill and panic sets in, because, not only do we see it as a time where we cannot train and progress, but if the illness affects the appetite, we may actually lose size! In reality though, there will be minimal losses from a common cold, tummy bug or food poisoning. Even with a dose of influenza for a couple of weeks there may be some catabolism, but this will be easily got back when you restart training and eating properly. Don't weight yourself as you will have lost weight, your glycogen stores will be low and much of weight loss will be water; the scales could make you depressed.

What to do

The initial advice is don't panic, accept the illness and rest up. I would advise against weight training as this will use up energy and nutrients needed to fight the illness, and will be more stress on the system. If you have a cold, for the early heavy stages don't train, then go back to the gym, and train as you can manage without overdoing it. Remember to keep warm if you come out from the gym sweaty.

Some illnesses will not affect appetite, in which case, continue with your normal good diet including plenty of fluids. If your appetite is diminished, eat small and often of whatever you can – junk food is ideal at this time because its full of valuable calories and is tasty. The hardest situation is if you are nauseous or vomiting. During nausea, eat what you can and often fluids are tolerated fine, even if food isn't. The ideal recommendation would be to consume protein drinks or MRPs, but I don't know about you, if I'm not feeling great the mere thought of them makes me feel worse, even though I generally find them quite palatable when I'm well. Generally sugary drinks are a great source of valuable fluid and energy, sip them as tolerated. Fizzy drinks may relieve nausea but they can bloat if gulped and may cause regurgitation. Flavoured milk shakes are also useful and enjoyable at these times. If you can eat, dry foods and crisps are generally better tolerated.

"The ideal recommendation would be to consume protein drinks or MRPs, but I don't know about you, if I'm not feeling great the mere thought of them makes me feel worse…"

We've all had those illnesses when we can't even stomach water despite being extremely thirsty. The advice here is *don't even try*, the mere thought can make you worse! Each hour just try a sip of water or suck on an ice cube, if this stays down progress firstly to a small glass of water, then to a sugary drink. The first foods tried should be toast or a plain biscuit, eventually progress to a small meal.

Diarrhoea will also affect your nutrition; it is vital here to try to stay well hydrated. Sip fluids as frequently as you can tolerate. Electrolyte fluid replacement drinks (see Chapter 6) may also be useful. If you have a raised temperature it is also important to drink plenty and try to stay in cool environment.

Don't rush back to the gym too soon! It may be better to wait an extra day rather than have further setbacks. If you continue to suffer from sickness and diarrhoea for more than 24 hours seek advice from your doctor.

Remedies?

Many alternative nutritionists will try to convince you that certain supplements, therapies or vitamin and mineral preparations will help you get better sooner. In truth there is little evidence. The most common example of this has to be mega-doses of vitamin C and the common cold. Vitamin C is required for a healthy immune system, but this is easily achieved at a very low intake. There is *no* evidence that vitamin C supplementation will help recovery from a cold. I would, however, strongly advocate a balanced varied diet with maybe a higher intake of fruit and vegetables during a cold to ensure a good intake of all vitamins and minerals.

Many herbal supplements have been discussed in relation to illness in Chapters 9 and 10, but evidence that they do anything to help is poor. Pro- and prebiotics have been researched considerably and there is good evidence that there is reduction in frequency of illness, illness intensity and illness duration with regular intake of probiotic formulas.

The best advice if you are ill during bodybuilding is to rest up, and eat a balanced varied diet where you can.

Key Points

- *Accept small illnesses – there will be minimal losses in size*
- *Eat and drink what you can tolerate*
- *Keep well hydrated – especially if you have diarrhoea or raised body temperature*
- *Rather than taking bogus remedies, eat a well balanced diet*

Chapter 20
Bodybuilding in Population Subgroups

In this section I'm going to discuss the relevance of bodybuilding and bodybuilding nutrition in a few subgroups of the population, rather than just your 'average' adult man or woman (if there is such an individual!). The groups mentioned should take into account special considerations; otherwise they may be at risk of poor health.

Bodybuilding during Pregnancy

If a bodybuilder finds out she is pregnant, I would suggest that she tone down her training to using light weights only, at low intensity. It is important to seek advice from your doctor, health visitor or midwife concerning exercise. If the pregnancy is planned and you are actively trying for a baby, I would also reduce training intensity, as intense exercise can raise natural testosterone levels in women affecting the reproductive hormone balance.

Remember, it is crucial to heed the nutritional guidelines for pregnancy, including the following:

- Eat a wide variety of foods
- Eat regularly
- Don't eat too many fatty and sugary foods
- Consume plenty of fibre
- Don't drink too much alcohol
- Avoid too much vitamin A
- Consume sufficient folic acid for a healthy baby

You also need to consider iron and calcium intake, as there is a high demand for these micronutrients. Weight gain is also important to consider. The ideal weight gain is 9 - 13kg (1.5 – 2 stones) during pregnancy. Very little weight gain is expected in the early months. Too much excess body fat is difficult to lose afterwards, so it is wise to control it. If you are overweight prior to becoming pregnant, then eat sensibly during the pregnancy to minimise any further weight gain.

If you use any bodybuilding supplements, I would suggest stopping them during pregnancy and lactation. Also, do not follow a too high protein diet, as this may adversely affect the foetus's kidneys.

After giving birth, remember that your body has been severely stressed. Rest well, and leave weight training until you are certain yourself that you are completely ready. Do not revert back to a bodybuilding diet and intense training until you are fully recovered, and then break back into the routine gently. If you are anaemic, then iron rich foods and supplementation may need to be considered.

If you have any issues about getting back into bodybuilding following pregnancy, discuss them with your health visitor or a dietitian.

Breast-feeding has been shown to be the most effective way of burning fat held around the thigh and gluteus region, even more so than exercise and dietary manipulation. Therefore, if you can breast-feed, do so, especially if you have gained more weight than desired during the pregnancy. Mother's milk is extremely high in whey protein and other important growth factors like IGF-1. Why not give the little chap a head start? – he / she may be a bodybuilding star of the future.

The Younger Bodybuilder

It is a debatable area as to what age can someone begin heavy weight training. To be safe, it is generally recommended that a teenager doesn't begin heavy weight training until he / she is fully-grown, in order to avoid stunting of growth or abnormal joint development. Unfortunately this is often the time when he / she may be bullied at school and want to build him- or herself up. There is no specific age you can put on when an individual is fully grown, as there is considerable variance. I would therefore say that a teenager could train quite hard from about 16 years old, but not with full intensity until 18 years or more. It is okay to introduce children to very light weight training from about 11 or 12 years, and this can help give them confidence and build up a good circulation for when they are older. Exercise as a whole is encouraged in children, and strength gains from even light weight training, become apparent quickly.

The good thing about getting the younger athlete involved in an exercise programme, is that food choice is positively affected. Teenagers opt for more healthy foods and start to learn the benefits of health eating, at a time when they usually go for kebabs and burgers! As far as a bodybuilding diet goes, don't go for too high protein intakes, as the kidneys may not be fully developed, but the adolescent may choose higher protein and carbohydrate foods. I would suggest a healthy balanced diet with five or six meals a day to feed their growth. A quality weight gain powder or MRP may be introduced in small amounts if the teenager is unable to eat enough. They may also enjoy pre workout drinks and supplement bars. Other more technical supplements are probably best withheld until he or she is older.

Nevertheless, some light weight training and a good healthy diet at a younger age may build a good foundation for harder training later.

The Older Bodybuilder

"…competitive bodybuilding can be enjoyed well into the 50s and even the 60s…"

The great thing about bodybuilding is that it is a sport that has a long lifespan. Even competitive bodybuilding can be enjoyed well into the 50s and even the 60s, whereas in other sports you generally retire in your 30s. You can even start weight training at a late age and still make excellent gains.

As we age the metabolic rate slows down and we are more likely to gain weight, especially around the mid-section. This means that we have to watch what we eat more, and try to stay active. A normal bodybuilding diet can be eaten all through your training career, but you may have to be a little more careful with carbohydrate intake, keeping intakes of starchy carbohydrates smaller but still regular. All supplements can still be taken (DHEA has been linked to slowing the ageing process – though I'm far from convinced by this!). It is still important to eat a balanced varied diet with plenty of fruit and vegetables.

I have seen many guys compete and win even in their late 50s, with mind-blowing physiques by *any* standard.

Bodybuilding in Long Term Ill Health

Individuals who may wish to body-build or weight train, may, unfortunately have health problems which affects their ability to train and / or eat an appropriate diet. Seek advice from your doctor and dietitian, especially if you are losing weight and struggling to eat just eat what you can. If you are ill, health is more important than bodybuilding, but it must be appreciated that some bodybuilders live for the sport and losing this aspect of their life can be devastating for them in itself. My advice is to try to get through the illness as best as you can, trying to eat well. If you can get back into the gym at some time work back into it gently.

I have come across bodybuilders with chronic kidney disease and cases of severe digestive disorders which meant major bowel surgery, who have still managed to get back into training and have redeveloped great physiques. They do have to take more care with their diet, but careful planning, and trying things slowly has lead to improvements. Remember that bodybuilders are a highly motivated bunch.

Bodybuilding with Disabilities

Obviously it depends on the nature of the disability, but there is no reason why a disabled person cannot enjoy bodybuilding as much as anyone else. There are many wheelchair bound athletes who use bodybuilding to build up strong arms to help them in competitive wheelchair racing. I have also seen guys with one leg compete on stage against the non-disabled, and the judges have taken this into consideration.

Arthritis can be disabling and hard to train round. It generally presents with good and bad days, but, depending on the type of arthritis, weight training may not adversely affect the condition. Some supplements may be useful, e.g. glucosamine, chondroitin and aloe vera, as discussed in Chapter 9. Consult your doctor though, and do not train if an exercise aggravates your joints.

As far as diet goes, it depends on the nature of the problem, but people with limbs missing have a permanently slightly raised body temperature which increases calorie requirements, but may keep body fat down. Other than that enjoy a healthy bodybuilding diet, and keep training hard.

Key Points

- *A pregnant bodybuilder should follow sensible nutrition and exercise advice during and after her pregnancy*
- *Bodybuilding can begin at 11 or 12 years, but shouldn't be hard training until 18 years plus*
- *Bodybuilding is a sport which can be enjoyed for many years*
- *People with long-term illnesses should be sensible about getting back into training.*
- *It is often possible to train around disabilities*
- *Everyone should watch their nutrition, and eat sensibly according to their needs.*

Chapter 21
Closing Points

I hope you've found ***Informed Bodybuilding Nutrition*** an educational and enjoyable read. You will now have an excellent understanding of what to eat in order to pack on quality muscle and improve your strength. As I said in Chapter 1, the object was for you to make up your own minds on bodybuilding nutrition issues, and your minds should be wide open to the quest of wanting to find out more. The science of bodybuilding nutrition is ever changing, so I hope this ebook has been a valuable aid to your learning. Most of the fundamental issues (and a lot more) should be clear now and ready to apply into your bodybuilding lifestyle everyday.

I've covered the concepts of healthy eating and its importance to us, and macronutrients and micronutrients and their relevance to different individuals. I've discussed supplements that are great, those that are all right, those that need more research, and those that are a waste of money. I'm sure there are more supplements not mentioned, if not there soon will be – I'll keep you informed in updates. You will now be able to judge which supplements are good value for money and of use to you.

I've tried to cater for all nutritional needs of bodybuilders with my eating regimens and example meal plans. We've also looked into nutraceuticals and alternative nutrition issues, and much more. If you are looking to compete, pre-contest nutrition has been discussed extensively too. There *is* more out there in the growing science of bodybuilding and the MuscleTalk forum will keep abreast of these issues as they are brought to our attention.

I hope to have cleared up some of the conflicting advice bodybuilders continually hear, and to have educated you to be able to make your own ***informed choice***. As I have previously said, I in no way meant to give individual advice, but intended to educate the enthusiastic bodybuilder to learn for his- or herself. Bodybuilding is a science, and those keen enough to find out more and put things into practice, will get better results. Remember, ***the more you know, the more you'll grow!***

It's now up to you, if you come across anything you're not sure about or have any questions from this ebook, raise it on ***www.muscletalk.co.uk*** and I, and other experienced members, will look into it.

You've learned lots from ***Informed Bodybuilding Nutrition*** but the lesson continues, so I'm going to end on the same note as I did in Chapter 1, other than saying I hope you keep a strong mental attitude in order to achieve your bodybuilding goals (whatever they are):

'No one knows your own body better than you do, so you will have to go away, continue to learn and try things'.....

HAPPY LEARNING

Glossary of Relevant Terms

A number of complex words, scientific terms and jargon are used in this ebook. I have given a brief description of these significant terms in this section, so you have a reference when you come across the terms in the main text.

Actin: One of the contractile proteins of muscle fibres.

Additive Effect: Refers to when researchers are measuring the effects of two or more substances in a single study. Additive effect means the combined effect of two or more factors is equal to the sum of their individual effects in isolation. For example, creatine monohydrate supplementation, by itself, may enhance lean body mass by six pounds over a four-week period; HMB supplementation, by itself, may increase lean body mass by two pounds over a four-week period. If their effects are additive, subjects may gain eight pounds in a four-week period when the two products are used in combination.

ADP (Adenosine Diphosphate): ADP is formed when ATP is broken down within mitochondria of cells to provide energy. In order to recreate ATP and replenish cellular energy stores, ADP must combine with creatine phosphate.

Aerobic: Means requiring oxygen. Aerobic metabolism occurs during low intensity, long-duration exercises, like jogging.

Aetiology: The basis of how a disease or disorder occurs.

Alcohol: An organic compound formed by the fermentation of carbohydrate containing one or more hydroxyl group. We all love this, but not advantageous to the bodybuilder.

Amino Acids: Nitrogen containing, carbon-based organic compounds, which are the simplest units of protein.

AMP (Adenosine Monophosphate): AMP is formed when ADP is broken down within mitochondria of cells. In order to recreate ATP and replenish cellular energy stores, AMP must be combined with two molecules of creatine phosphate.

Anabolic Steroids: Synthetic versions of the male hormone testosterone. They promote anabolism and male characteristics. Anabolic steroids speed up protein synthesis, reduce catabolism, and increase muscle mass and strength in athletes who train with weights. Steroids not only exert their effects on muscles but also affect many other parts of the body, which may lead to side effects.

Anabolic: Refers to promoting growth or anabolism.

Anabolism: The actual building process of tissues. It might occur through the body's own natural reactions to muscular work and proper nutrition or through the introduction of erogenic aids. Anabolism occurs by taking substances from the blood, which are essential for growth and repair and using them to stimulate reactions that produce tissue synthesis.

Anaerobic: Means without oxygen. Anaerobic respiration in muscle tissue occurs during explosive activities like weightlifting or sprinting.

Anecdotal Evidence: Evidence reported by individuals based on observations and experiences, and is weak evidence.

Anti-Catabolism: The halting of cellular breakdown in the body. Slowing down the breakdown of cells favours new muscle growth.

Antioxidants: Nutrients or anutrients that minimise tissue oxidation and help control free radicals and their negative effects.

Anti-Proteolysis: A specific type of anti-catabolism: namely, the slowing or halting of protein breakdown in the body.

Anutrients: Substances found in food, which are not required to live, but may have some nutritional or health benefit.

Assimilation: The process by which food is digested, absorbed and utilised by the body.

ATP (Adenosine Triphosphate): A high-energy molecule stored the mitochondria of cells. When energy is required, ATP is broken down to ADP and AMP and free phosphate to provide this energy. This is the case in muscle cells that need energy in order to contract. ATP can be thought of as the actual fuel that makes muscles move.

Atrophy: A reduction in the size or a cell or tissue, due to lack of nutrition, disease or lack of use. For example when muscles breakdown.

Basal (Resting) Metabolic Rate (BMR / RMR): The level of energy expended by the body at rest sufficient to support the metabolic processes necessary for life.

Bioavailability: The ease at which nutrients can be absorbed and are available to tissues.

Biochemical Reaction: Refers to the broad range of chemical reactions which take place in all living organisms. For example, the conversion of blood sugar into energy, the effects of testosterone on muscle cell growth, and nerve impulse reaction.

Biological Value (BV): A measure of protein quality, assessed by how well a given food or food mixture supports nitrogen retention in humans.

Body Composition: The percentage of your body composed of water, bone fat mass, muscle mass and other constituents. We are mostly interested in fat mass and fat free mass.

Branched-Chain Amino Acids (BCAA): These are essential amino acids named so due to their structure. They are valine, leucine and isoleucine, and make up a third of muscle protein.

Buffer: A substance that minimises changes in hydrogen ion concentration (pH). They may help metabolic acidosis or lactic acid build up.

Carbohydrate loading: A technique whereby muscle glycogen reserves are increased in greater than normal amounts by a combination of exercise and diet.

Carbohydrates: Organic compounds containing carbon, hydrogen, and oxygen, and are a very effective fuel source for the body. Different types of carbohydrates include starches, sugars and fibres. Carbohydrates are classified into monosaccharides, disaccharides, oligosaccharides and polysaccharides, depending on the number of single unit sugars in the chain length. Carbohydrates contain four calories per gram.

Catabolic: The opposite of anabolic, meaning breakdown of tissue. Catabolic states occur with disease, infection, injury, intense training, strict dieting, and immobilisation.

Catabolism: The breakdown or loss of muscle and other bodily tissues.

Chelating Agents: Soluble organic compounds that can fit certain metallic ions into their molecular structure. These are often used to increase the absorption of minerals within the body.

Cholesterol: Waxy fat, made naturally in our bodies by the liver, and is an essential part of living tissues. Too much cholesterol builds up on the walls of arteries including those which supply the heart (coronary arteries) and is implicated in the aetiology of heart disease and stroke. It is a vital component in the production of many steroid hormones, plays a vital role in proper cell-membrane structure and functioning and is a substrate for bile-acid synthesis, among other functions. There are different types of cholesterol, including HDLs and LDLs.

Coenzyme: A substance that works with an enzyme to promote that enzyme's activity.

Complete Proteins: Proteins that contain all essential amino acids.

Cortisol: A hormone released form the adrenal cortex and is involved in inflammation control and the immune response to trauma and infection. From these functions it is a catabolic hormones in the body. Suppressing cortisol production at key times may help bodybuilders avoid excess muscle breakdown. But, you need some cortisol to survive.

Creatine Phosphate (CP): Inorganic phosphate carrier that binds with AMP and ADP to form ATP. Supplementing with creatine monohydrate helps increase muscle CP reserves.

Cytokine: Describes a broad range of molecular protein messenger cells. The cytokine family includes interleukins, interferons, insulin-like growth factor-1 (IGF-1), among others. Cytokines act directly on cells and are very potent agents that can elicit massive changes in cellular function.

Deficiency: A sub-optimal level of one or more nutrients that are essential for good health. Deficiency of one or more nutrients can be caused by poor nutrition, increased body demands or both.

Dextrose: Another name for glucose, when glucose is referred to as a ‘standard’ value (see glucose).

Dietary Fibre: The ingestable portion of plants, including cellulose, lignin, pectin. Also know as roughage, non-starch polysaccharide (NSP) and fibre.

Dietetics: The science of nutrition.

Dietitian (Dietician): One who practices dietetics, such as me!

Dipeptides: Protein chains of two amino acids.

Disaccharide: A carbohydrate compound made up of two sugars. Examples are sucrose (table sugar), lactose (milk sugar), and maltose.

Diuretic: Describes any product that increases the amount of urine excreted by the body. Natural diuretics include alcohol and caffeine, but there are drug diuretics too.

Drug: The generic broad term for any substance which, when introduced into the body, changes one or more of its natural physical or mental functions. Drugs are used for the prevention, diagnosis and/or treatment of disease, as well as the relief of symptoms.

Efficacious: Means producing the desired effect, i.e. it works.

Electrolytes: Substances that, in solution, are capable of conducting electricity. These charged particles are present throughout the body and are involved in many activities such as regulating the distribution of water inside and outside cells in the body. Examples include potassium, sodium and chloride.

Elemental Nutrition: This is nutrition made up solely of simplest units of nutrition, i.e. amino acids, monosaccharides, fatty acids, vitamins and minerals.

Empirical Data: Information based on observation and experience, not scientific reasoning, also known as anecdotal evidence. Empirical data is not accepted as scientifically sound.

Endogenous. Refers to things that occur naturally in the body, i.e. something which your body produces naturally.

End-Product: The resultant compound formed from a chemical process.

Energy: The capacity to do work. The energy in food is chemical energy: it can be converted to mechanical, electrical, or heat energy. Energy is sometimes measured in calories (kcal) or kilojoules (kJ).

Enzyme: A protein molecule that acts as a catalyst in thousands of chemical reactions in the body, including digestion of food, hormone production and muscle cell repair.

Epidemiological Evidence: Studies on the effects of substrates on populations or groups of people. There are different types including retrospective, prospective, case-controlled, etc. Strength of evidence depends on study design.

Ergogenic: Refers to something that can increase muscular work capacity, i.e. performance-enhancing. Natural supplements that can increase some aspect of athletic performance are said to be erogenic aids.

Essential Fatty Acids (EFAs): Fats that our bodies cannot synthesis, so we must obtain them through diet.

Exogenous: Refers to things originating outside of the body, i.e. something we ingest orally, inhale or inject.

Experimental Evidence: Labroraty-based studies, which show the direct effect of administering a substance on a subject. Experimental studies provide a plausible theory from which other studies can follow.

Fat: Body fat (adipose tissue) or dietary fat. Fat is a group of organic compounds including triglycerides, sterols and steroids, more correctly know as lipid.

Fat-Free Mass (FFM): Refers to all other portions of the body other than fat. Also referred to as lean body mass (LBM).

Fatigue: A condition resulting from when the rate of energy re-synthesis cannot keep pace with energy utilisation, and physiological and metabolic processes are impaired.

Fat-Mass (FM): Refers to the amount of fat in body composition.

Fatty Acids: The simplest units of fat that vary in chain length and saturation.

Fibre: See Dietary Fibre.

Free Radicals: Highly reactive molecules possessing unpaired electrons that are produced during metabolism of food and energy and contribute to the molecular damage and death of vital body cells. Free radicals may be a factor in ageing and many diseases and may ultimately contribute to death.

Free-Form Amino Acids: Structurally unlinked, individual amino acids freely present in tissues or blood.

Fructo-oligosaccharides (FOS): A type of soluble fibre that acts as a prebiotic, found in many foods especially fruit.

Fructose: The main monosaccharide found in fruit.

Fuel: The chemical substance from which energy is derived.

Full-Spectrum Amino Acids: Supplements that contain a combination of all of all amino acids present in protein synthesis.

Functional Foods: These are foods that have no nutritional value *per se*, but have been developed through research and have a function in good health. Also known as nutraceuticals.

Glucagon: A hormone is responsible for helping maintain proper blood sugar levels. It is secreted in response to a fall in blood sugar levels, and activates glucose production in the liver and regulates the release of glycogen from muscle cells.

Glucose: The simplest sugar molecule, and is the most frequently occurring monosaccharide in the diet. It is the main sugar found in blood and is used as a basic fuel for the body.

Glycaemic Index (GI): A measure of the extent to which a food raises the blood sugar (glucose) level as compared with other carbohydrates, particularly glucose.

Glycogen: A polysaccharide that is the storage form of glucose in animal cells, in liver and muscle cells.

Glycolysis: The breakdown of carbohydrate into smaller compounds into ATP and substrates that may enter the Krebs cycle.

Growth Hormone (GH): A hormone is released by the pituitary gland. GH is the principle hormone controlling growth. It promotes muscle growth and the breakdown of body fat for energy. GH levels are high in children and in teens but diminish greatly after age 20.

High Density Lipoproteins (HDLs): A sub-category of cholesterol, typically thought of as 'good' cholesterol. HDL cholesterol is the form that is typically used to clear fats from the system.

Hormones: These regulate various biological processes through their ability to activate or deactivate enzymes. Hormones can be made of proteins (e.g. insulin, growth hormone) or lipid (e.g. testosterone, cortisol).

Hydration: The restitution or normal fluid reserves.

Hydrolysis: A chemical reaction where water reacts with a substance to change it into another substance or substances.

Hyperglycaemia: High blood glucose level, in a normal individual above 6 mmol per litre of blood.

Hyperplasia: An increase in the number of cells if a tissue, thus increasing its size.

Hypertonic: A fluid where the osmotic pressure is greater than that of what it is being compared to, in this case, normal body fluids.

Hypertrophy: When cells increase in size. For example, muscular hypertrophy is the increase in size of the muscle cells.

Hypoglycaemia: Low blood glucose level, below 3mmol per litre of blood. The effects of a hypoglycaemic attack include anxiety, fatigue, perspiration, delirium, and in severe cases, coma.

Hypotonic: A fluid where the osmotic pressure is less than that of what it is being compared to, in this case, normal body fluids.

In vitro: Refers to experiments done in the laboratory.

In vivo: Refers to experiments and what actually happens in the body as opposed to in the laboratory.

Incomplete Proteins: Proteins that lack or are low in one or more of the essential amino acids.

Insulin: A hormone secreted by the pancreas and aids the body in maintaining proper blood sugar levels and promoting glycogen storage. Insulin secretion speeds the movement of nutrients through the bloodstream and into muscle for growth. It is also involved in amino acid uptake by muscle cells.

Ion-Exchange Filtration: A complex, thorough process of filtration used to obtain only the highest quality product. This is used in quality whey-protein products.

Isotonic: A fluid where the osmotic pressure is equal to that of what it is being compared to, in this case, normal body fluids.

Ketones / Ketone Bodies: Intermediate products in fat metabolism. They are used as an energy source for critical organs and muscles during periods of fasting or very-low carbohydrate intakes.

Kilocalorie (kcal): The most commonly used unit of energy, more commonly just referred to as '***calories***'. 1 kcal = 1,000 calories = 4.184kJ.

Kilojoule (kJ): The metric unit of energy (see Kilocalorie for conversion).

Krebs Cycle: The series of reactions catalysed by enzymes whereby pyruvate (formed from prior pathways) and other substrates are oxidised to CO_2 and water generating ATP.

Lactate / Lactic Acid: Produced from glucose during anaerobic metabolism. When oxygen becomes available, lactic acid can be completely broken down to carbon dioxide and water. Lactic-acid build-up is a primary cause of muscle fatigue.

Lean Body Mass (LBM): see fat-free mass.

Limiting Factor: A factor that prevents a process or reaction from taking place. For example, a lack of protein in the diet can be a *limiting factor* for muscle growth.

Linoleic Acid: An essential fatty acid and, more specifically, an omega-6 polyunsaturated fatty acid. Good sources of this fatty acid are safflower oil and soybean oil.

Linolenic Acid: An essential fatty acid and, more precisely, an omega-3 polyunsaturated fatty acid. It is found in high concentrations in flaxseed oil.

Lipid: Another term for fats-related substances, including triglycerides, steroids, cholesterol.

Lipogenic: This means making body fat.

Lipolysis: Refers to the breakdown of body fat by enzymes. This results in stored fat being used as fuel by the body.

Lipolytic: Describe something with fat-burning effects.

Low-Density Lipoproteins (LDLs): A sub-category of cholesterol, typically thought of as bad cholesterol. Too high LDL levels have bee associated with heart disease.

Luteinizing Hormone (LH): A hormone that stimulates the testes to make testosterone in males, and in females induces ovulation.

Macrominerals: Minerals required by the body in relatively large or gram quantities, e.g. calcium, phosphorus.

Macronutrients: Nutrients that we ingest in large quantities, include proteins, carbohydrates, fats, and water.

Malabsorption: Inadequate absorption of nutrients from the digestive tract, resulting in deficiencies.

Meal Replacement Powders (MRPs): A category of supplements which contain protein, carbohydrates, vitamins, minerals, and other key nutrients which are used to replace a regular-food meal for purposes of weight loss, weight gain, or increasing dietary nutrient intake. They are also referred to as total-nutrition products, engineered foods or superfoods.

Metabolic Rate: Refers to the rate you convert energy stores into working energy in the body. It describes how fast your 'whole system' runs. Metabolic rate is controlled by a numerous factors, including muscle mass, nutrient intake, exercise, age, disease state, use of drugs, and others.

Metabolism: Refers to the utilisation of nutrients and oxygen by the body. It's the process by which substances come into the body and the rate at which they are used.

Metabolites: Intermediates in metabolism.

Micronutrients: Nutrients which we ingest in relatively small amounts, including vitamins and minerals. Micronutrients are typically ingested in gram quantities or less.

Minerals: Naturally occurring, inorganic substances that are essential for human life and play a role in many vital metabolic processes.

Mitochondria: Specialised structures within cells with specific capability to oxidise substances. They are the sites of most metabolic pathways, resulting in the production of ATP and energy.

Monosaccharide: The simplest form of carbohydrate, i.e. one sugar molecule. Examples are glucose and fructose.

Monounsaturated Fats: These contain one open spot on the chain length. As a percentage of total fat intake these have been shown to be beneficial, and include olive and rape seed oil as good sources.

Muscle Fatigue: The failure of a muscle to continue to perform work, caused by muscle ATP depletion.

Myosin: One of the contractile proteins of muscle fibres.

Natural (1): Refer to foods or supplements that are not highly refined and which do not contain artificial flavours or colours. The word 'natural' has no legal definition in food supplementation.

Natural (2): Gym jargon for athletes who have not used anabolic steroids or other banned erogenic aids for a particular period of time.

Neurotransmitter: A substance released at the end of nerve cells when a nerve impulse arrives there. Neurotransmitters diffuse across the gap to the next nerve cell and alter the membrane of that cell in such a way that it becomes less or more likely to fire. Examples include adrenaline and serotonin. Adrenaline is responsible for the 'fight or flight' response and is an excitatory neurotransmitter; serotonin is the opposite-it makes you sleepy.

Nitrogen Balance: Refers to a person's daily intake of nitrogen from protein equals the daily excretion of nitrogen. A negative nitrogen balance occurs when the excretion of nitrogen exceeds the daily intake and is often seen when muscle is being lost. A positive nitrogen balance is often associated with muscle growth.

Nitrogen: This is an element that distinguishes proteins from other substances and allows them to form various structural units in our bodies.

Nutraceuticals: see functional foods.

Nutrients: Components of food that help nourish the body, i.e. provide energy or serve as building materials. Include carbohydrates, fats, proteins, vitamins, minerals, water, etc.

Nutrients: Substances conveying, serving as or providing nourishment required by the body for healthy function.

Nutrition: The study of food and its chemical components.

Off-The-Shelf (OTS): Refers to substances that do not require a prescription to be attained legally, nor need they be requested in a pharmacy.

Oligopeptides: Peptide chains of a few amino acids in length.

Oligosaccharides: Carbohydrate chains of a few simple sugars in length.

Omega-3 Fatty Acids: A type of polyunsaturated fatty acid, the '3' designates where the first double bond is located in the fatty acid carbon chain. These are abundant in fish oils, for example Linolenic acid.

Omega-6 Fatty Acids: A type of polyunsaturated fatty acid, the '6' refers to the first double-bond on a fatty acid chain which is located at the sixth carbon acid. For example linoleic acid.

Optimal Nutrition: Means the *best possible nutrition.* Distinct from adequate nutrition, this term describes people free from marginal deficiencies, and who are not at risk for such, and sufficient amounts of nutrients and anutrients to reduce risk of disease and maximise performance.

Over-The-Counter (OTC): Refers to substances that do not require a prescription to be attained legally, but must be requested in a pharmacy, who will provide instructions on usage.

Oxidation: The addition of oxygen to compound, primarily taking place in mitochondria where substances are fully combusted. It is the process of cellular decomposition and breakdown.

Oxygen Debt: Deficiency of oxygen in working muscles when performing exercise that is so demanding the cardiovascular system cannot deliver oxygen fast enough to the muscles to support aerobic metabolism. The debt must be repaid by rapid breathing after the activity slows down or stops. Oxygen debt leads to anaerobic metabolism, which leads to lactic acid build up and muscle fatigue. It is when you are out of breath.

Pathogenic: Potential to cause a disease or disorder and its related signs and symptoms.

Peptide: A compound made up of two or more amino acids. Protein molecules are broken down into peptides in the gut and absorbed in that form.

Performance: In respect of sport refers to the capacity to perform work in relation to that specific activity, includes time, speed, intensity, distance, etc.

Physiological: Pertaining to all the functions of an animal or man.

Phytochemical: Means 'plant chemical', and used to refer to a broad spectrum of bioactive plant compounds which may have some health benefits.

Pineal Gland: An endocrine gland that functions mainly in the secretion of melatonin and a few other hormones.

Placebo Effect: Refers to when people use a substance believing it works, thereby it does (or is believed to) produce the desired effect.

Placebo: A harmless, inactive substance which may be given in the place of an effective drug or substance, especially to control groups in clinical studies, to test if the drug or compound in question is effective.

Polypeptides: Proteins formed by the union of many amino acids.

Polysaccharides: Carbohydrates containing a large number of sugars. Starch, glycogen, multidextrose, and cellulose are examples.

Polyunsaturated Fats: These contain more than one open spot on the chain length. As a percentage of total fat intake these may be beneficial, and include sunflower and soya oil as good sources.

Polyuria: Excessively large production of urine, meaning that you need to go to the toilet more than usual.

Prebiotics: These are certain nutrients and constituents of food that our gut flora feed on, promoting growth of 'good' bacterial colonies in our gut, leading to an increase in their numbers. Prebiotics include fructo-oligosaccharides (FOS) and some other soluble fibres found in pulses, fruit and some cereal products.

Precursors: Compounds from which another compound is formed. For example, the hormone androstenedione is a direct precursor to testosterone production in the body.

Probiotics: These are live strains of 'good' bacteria, e.g. *bifidus* and *acidopilus*. The bacteria are cultured in live yoghurts, powders or specially formulated probiotic drinks which contain one or more of these strains.

Pro-Hormones: Chemicals that are direct precursors to hormone production. For example DHEA is a pro-hormones to testosterone.

Prostaglandins: Chemicals produced in the body which exhibit a wide range of actions on things like blood pressure, water balance, immune system reactions, inflammation, etc.

Protein Digestibility-Corrected Amino Acid Scoring (PDCAAS): A highly accurate method of assessing protein quality, taking into account the profile of essential amino acids of the protein in question, as well as its digestibility in humans, rather than in rats. It is the method of assessing protein quality adopted by the World Health Organisation / Food and Agriculture Organisation (WHO/FAO) and the US Food and Drug Administration (FDA).

Protein Efficiency Ratio (PER): A measure of protein quality assessed by determining how well a given protein supports weight gain in laboratory animals: namely, rats.

Proteins: Nitrogen-containing compounds found in all animal and vegetable tissues. They are made up of amino acids and are essential for growth and repair in the body. One gram of protein contains four calories.

Psychological: Pertaining to the mind and thought process.

Pure: Used to refer to supplements that are unaltered; i.e. have no other ingredient in them except that which is stated on the label.

Saturated Fats: These are bad dietary fats. They are called saturated because they contain no open spots on their chain. They have been shown to raise cholesterol levels in the body, as a percentage of total fat intake.

Semi-Elemental Nutrition: This is nutrition of partially digested nutrients, including amino acids and oligopeptides, mono- and oligosaccharides, fatty acids, vitamins and minerals.

Stacking: Refers to taking two or more compounds at once in an attempt to maximise results.

Starch: A storage polysaccharide in plants and the only one digestible by humans.

Sublingual: Means to ingest something beneath the tongue.

Substrates: Chemical substances or compounds changed in an enzyme-controlled reaction; fuels in metabolic pathways.

Sucrose: More commonly known as table sugar and is derived from sugar cane or beet. It is a disaccharide of fructose and glucose. Eating sucrose elicits a rapid insulin response.

Supplement: A term used to describe a preparation that has nutritional value of contains a 'natural' substance reported to have health benefits with little or no side effects. Supplements are used as part of a person's diet to supply adequate or optimum levels of a nutrient, anutrient or nutraceutical.

Synergistic Effect: Refers to the outcome when things a number of substances work in unison with one another, and the overall effect is greater than the sum of each substance used on its own. One compound could enhance or multiply the effectiveness of another compound. For example B-vitamins; creatine plus carbohydrates; the ephedrine / caffeine / aspirin (eca) stack.

Synthesis: The formation of a new product from other compounds.

Testes: The male reproductive organs. A pair of endocrine organs found in males that secrete the hormones that regulate male characteristics, mainly testosterone.

Testosterone: An androgenic / anabolic hormone produced primarily by the testes, responsible for male characteristics including muscles anabolism.

Thermogenic: Refers to something that causes heat production. Taking a thermogenic agent will speed up the metabolism, raise core body temperature, and accelerate fat mobilisation.

Trace Elements: Minerals essential to the body but only in minute amounts, e.g. selenium, copper.

Triglyceride / Triacyleglycerol (TG): The scientific name for common dietary fat. TGs consist of a backbone of glycerol connected to three fatty acids. Triglycerides are also called fats or lipids.

Tripeptides: Protein fragments of three amino acids in length.

Turnover Rate: The rate of collective processes of synthesis and degradation of a compound or group of compounds.

Unsaturated Fats: These lack one or more carbons, and are divided into polyunsaturated and monounsaturated fats.

Up-regulate: Means to increase. For example, creatine monohydrate appears to have the ability to up-regulate muscle's ability to replenish energy stores.

Vitamins: These micronutrients are organic compounds that are vital to life. Many vitamins function as coenzymes, supporting a multitude of biological and biochemical functions.

VO_2 Max: This is the maximum volume of oxygen an individual can consume per unit of work. It is used as a measure of an athlete's cardiovascular efficiency and performance capacity.

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