

## How Australian Swimmers Peak

By Wayne Goldsmith and David Pyne PhD

Two of the most common features of the training programs of elite endurance athletes including swimmers and athletes are:

- 1) the periodisation of training volume and intensity and**
- 2) the transition from training to racing.**

Periodisation can be defined in simple terms as the division of the annual training plan into smaller and more manageable phases of training. This approach permits one aspect of fitness to be the focus of training, while maintaining the others. In essence a periodised training program is really about being an organised and systematic coach. The transition from training to racing is commonly referred to as the taper and is characterized by a reduction in the volume of training and the development of race speed. **Both periodisation and taper lead to the peaking of performance necessary** for high-level and international competition.

This article focuses on some physiological aspects of the periodisation and tapering of elite Australian swimmers preparing for the 1996 Atlanta Olympics. We aim to share some of the ways that swimmers are prepared for major competition. A fundamental principle of preparing athletes is that **periodisation and tapering applies equally to all the different aspects of fitness** such as endurance, speed, strength, flexibility and power. From a physiological viewpoint, there are several reasons for a periodised and balanced training program leading up to major competition:

- A higher training load with excessive fatigue.
- Faster recovery and regeneration.
- Maintaining performances very close to their maximum for a long period of time.
- Correct peaking for the major competition of the year.
- Maintaining a basic level of fitness over a long period of training (or even a period of reduced training).
- A greater degree of specificity to be incorporated in training.
- A more efficient and effective taper (and super-compensation) process.
- More complete adaptation to training without two or three parts of the program interfering with each other when trained concurrently.
- Better planning for both major and minor competitions.
- More effective integration of sports science testing with the training program.

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A periodised training and tapering program is based on the principle of **overload-recovery-peaking**. This principle forms the basis of preparing swimming training programs with the aim of increasing the level of competitive performance.

The training program must provide an overload (stimulus) to force the body to adapt to a previously un-encountered level of stress. After sufficient application of the stimulus (in terms of magnitude and frequency), a period of recovery and regeneration will allow residual fatigue to dissipate. If the processes of overload and recovery are managed correctly a period of super compensation will occur so that performance is elevated to a higher level for important competitions.

**Tip:** The most important consideration is that peaking for performance is an active process. Put as much effort into the planning and execution of the tapering and peaking program as you do for regular training.

Most elite swimming coaches are familiar with the team periodisation and the various meso-, macro- and micro-cycles that are used to design a training program. These terms are used to establish a hierarchy of training within the overall program. Mesocycle refers to a long-term training phase lasting several weeks to months. In swimming this represents the entire 12 week preparation for a major national or international competition.

Most commonly, there is a two mesocycle year with peaks for the national swimming championships (normally held in March/April) and then the major international competition (eg. Olympics, Worlds, Commonwealth Games etc) held later in the year (July-September).

**The length of the mesocycle will depend on the specific training and/or competition objectives for the mesocycle**, and the individual swimmer's current fitness level. It is apparent that coaches of Australian swimmers are incorporating more variety more within the macrocycles that a few years ago.

**Tip:** The annual plan and the competition calendar are essential tools. To achieve extraordinary results you need an extraordinarily good training program. Last year's program may bring you last year's results.

The term macrocycle refers to shorter training blocks within the mesocycle. Typically these are 2 to 4 weeks in length. A number of macrocycles form a single mesocycle. Experience has shown that after several weeks of intensive or extensive work, most athletes require some period of recovery (and within macrocycles as well).

There are many types of macrocycle depending on the requirements of the program, coach and athlete. Just some examples used by swimming coaches are the introductory macrocycle (general training, low volume – low intensity), preparatory macrocycle (transition from low volume – low intensity to higher volume training), specific macrocycle (more specialised higher intensity training, with emphasis on improving competitive speed), and the competition macrocycle (competitive performance on a single or repeated basis).

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In each case, **the volume and intensity of work will vary according to the specific requirements of the program** and individual athlete. The better coaches (and swimmers) are always aware of "where they are up to" in the training program. Getting bogged down and stale in a long and arduous meso- or macro-cycle is not a very efficient approach to training. Athletes should not struggle with their training for more than a few days without some intervention.

**Tip: Make sure your athletes are able to train at close to race speed when required. This is achieved by the careful management of endurance, speed and recovery.**

The term microcycle refers to a short-term training block within a macrocycle. Most commonly swimming training microcycles are planned around a standard 7-day training week. Coaches and athletes are creates of the modern working week and most swimmers have to fit their training programs around work, education and family commitments. However coming in to important meets such as the Olympics, the training schedule takes precedence and the day of the week, weekends and public holidays become less important.

The microcycles represent **the specific plans and strategies needed to achieve the broader objective of the macrocycle**. The microcycle consists of the individual (daily) workouts and again these are based on the objectives of the macrocycle.

**Tip: Plan broad details for a mesocycle, fine details for a microcycle, and adjust details on a daily basis.**

In our experience (and many others of course) one of the fundamental principles that underpins the periodisation of training is **that volume of training is increased before the intensity of training**. This principle applies to meso-, macro- and micro-cycles alike. Most coaches are familiar with the concept that a foundation of aerobic fitness is established easily in the mesocycle or competition season. After this initial period of increasing training volume to build endurance, the emphasis of training switches to the **development of speed** and anaerobic capacities. It is often observed that this base level of fitness can be re-established fairly quickly (4-6 weeks) in those swimmers with an extensive training background. This has implications for older more mature swimmers who are returning after a break.

However it is much more efficient for swimmers to maintain a basic fitness program during the off-season. A reasonable level of fitness can be maintained on about 30% of the full training volume ie. a swimmer who normally undertakes 10 training sessions per week, should be able to maintain a base level of fitness for several weeks by just training 3 times per week. In this case, it is important to maintain some intensity in the work (up to and including threshold level) as volume and duration are reduced.

**Tip:** Although the requirement for aerobic work applies to the middle distance and distance events, even the shorter sprint events may benefit from this type of training.

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This principle of volume first, then intensity, also applies to **strength and muscular endurance**. In a fashion similar to that for endurance training, strength programs are often based on an initial period of volume training (lighter weight – many repetitions) before intensity training (heavier weight – fewer repetitions) is undertaken. On this basis, a typical 4 week strength program (eg free weights, machine weights, circuits) for endurance athletes could take the form of a 2 week macrocycle of volume training and then a 2 week cycle of intensity training. While some coaches and swimmers place a heavy emphasis on strength training, it is clear that strength alone is not highly correlated with swimming performance. Other factors like muscular power, muscular endurance and muscle elasticity, and of course, swimming technique, should not be overlooked.

**Tip:** A more effective approach is to have a broad-based conditioning program. Too much concentration in one area eg weight training and neglect of others eg flexibility or cross training, may be a limiting factor.

In terms of designing microcycles the volume first, intensity second principle is also valuable. One approach that we have found to be successful is the use of three-day microcycles. The first variant involves two training sessions a day for the first two days, followed by a single session on the third day. In some circumstances in swimming, where three training sessions a day are used, the second variation takes the form of three sessions a day for two days and then two sessions on the third and final day. In both versions, the first day is largely aerobic in nature, with a **gradual decrease in volume and increase in intensity** as the microcycle proceeds. The emphasis is on increasing speed from day to day, and athletes generally find this easier if the training volume is decreasing. Many swimmers (and coaches) like to finish each microcycle with a quality or speed session.

**Tip:** Be proactive: make and dictate the move from volume to intensity, endurance to speed and training to racing.

Another feature of planning is the relationships between duration and intensity. Generally speaking the lower the intensity of cycles, the longer the duration, perhaps up to 7 days. For higher intensity work, shorter 2 – 4 day training cycles are used. Variation of training distance and intensity within cycles is important. Early in the program, microcycles may involve higher intensity training for athletes already fatigued. The thinking is that this will provide a greater stimulus for adaptation. Later on, when the emphasis is on competition specific speed, it is usually better to undertake **high intensity training in a fresh condition** in order to facilitate higher speeds.

**Tip:** When peaking, the development of race speed should take priority over conditioning work on the track, road or in the gym.

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### Periodising to Build Endurance and Speed

A typical 12-week swimming preparation between national championships and the major international meet may encompass some or all of the following features:

#### **Macrocycle 1. Aerobic (Weeks 1 – 4)**

As in most training programs the initial phase involves the development of reestablishment of endurance fitness. This services as a basis for the subsequent development of aerobic and anaerobic capacities and, important, the functional utilisation of these capacities. By functional utilisation we mean increased running speed at a given metabolic load. Apart from the underlying physiological adaptations, improved endurance will lead to **an increased ability to cope with fatigue and more rapid recovery** from the stresses of speed training and competition. In particular, the aim is to develop the capacity and efficiency of the cardiorespiratory system. This process is largely achieved by high volume-low intensity training. Other adaptations include increased utilisation of fat as a fuel source, stronger ligaments, tendons and connective tissue, adaptations within slow-twitch muscle fibres, and improved neuromuscular control. The length of this phase will depend on several factors (eg fitness level of athletes, time available, objectives of mesocycle) but is normally between 3-4 weeks.

**Tip:** Control the intensity of training by speed (pacing), heart rate and perception of effort (by the athlete and coach) – don't neglect any one factor.

#### **Macrocycle 2. Aerobic/Anaerobic: (Weeks 5-8)**

In this macrocycle, the other primary components of aerobic training are developed. Assuming that low to moderate intensity endurance work is developed in the first microcycle, this cycle is characterised by an emphasis on anaerobic threshold training. For example, the AIS swimmers undertake up to 30% of work in this cycle at the level of anaerobic threshold, and up to 15% of maximal oxygen uptake and lactate tolerance work. Some coaches may think these levels are too low for middle-distance and spring athletes – the levels will vary for different sports and events. The total training volume is increased over Macrocycle 1 and there is a progressive introduction of shorter and faster intervals. The duration of the macrocycle is normally 2 – 3 weeks.

#### **Macrocycle 3. Transition: (Weeks 9-12)**

In many ways this is the key training phase. The aim is to develop the functional utilisation of the energy systems and capacities that were developed in the Aerobic Endurance and Aerobic/Anaerobic macrocycles. It is well documented that the factor that correlates most highly with endurance performance is the speed at anaerobic threshold or VO<sub>2</sub> max. This is an important point that is often overlooked. To illustrate this point consider the following example. Runner A is likely to perform better if their speed (eg. 19.5 km/hr) is faster than Runner B (eg. 18.5 km/hr) at the same relative anaerobic threshold (eg. 68 ml/kg/min). Improving the functional utilisation (speed at a given metabolic load) is achieved through training drills of higher intensity but shorter duration, at speeds close to and faster than competitive speeds. The high degree of

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aerobic fitness developed earlier will be maintained even though the emphasis of training is on higher quality intervals. This macrocycle is fairly short with an average length of 3-4 weeks.

**Tip:** Use speed-assisted drills: group work or pace work with similar or faster athletes, very slight downhill running or running with a tailwind.

### Macrocycle 4. Taper and Competition: Weeks 12-14.

The final macrocycle within the season (mesocycle) involves the taper period and the competition phase. Again the logic follows the preceding macrocycle and training is characterised by a further reduction in training volume, and the development of speed and power. In swimming, it is common to reduce the training volume by approximately a half (50%) to two-thirds (66%) of the peak weekly volume for the preparation. The key is to reduce the volume and sharpen the speed. For many sports, this process involves shorter intervals at faster than race pace eg for 100m swimmers, there would be an emphasis on 25m and 50m intervals at a faster than 100m race pace. It is important to maintain some aerobic training in this macrocycle and a common mistake is to reduce training mileage too rapidly. **Aerobic work is needed to support the taper and forms an essential part of the recovery and regeneration process prior to competition.**

**Tip:** The key of peaking is: reduce the volume and sharpen speed. Peaking is an active process of training and achieved by a well planned and executed training and recovery program.

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**Authors: Wayne Goldsmith & David Pyne PhD**

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