Biobanding

Training for high level sport in the youth category can be equally rewarding and challenging. The benefits of skill and character development, a sense of belonging and both physical and mental health benefits throughout the teenage years are invaluable. However, the potential for training associated illness and injury, mental health burdens and burnout whilst managing educational demands must be managed carefully to ensure athletes safely move into the elite adult field.

The relative age effect and talent identification

Could your birth date affect your ability to manage the demands of high-level sport and progress to an elite level?

The **relative age effect** describes a significant advantage or disadvantage gained from which part of the year an individual is born. Those born in September will start school in the UK and quickly turn 5 years old compared to those born in August starting school at a young 4 years. This can benefit those older in the year group, not only academically, but they may also be more advanced physically, socially and emotionally which affords a greater probability of being chosen for teams and competitive representation through the school sports system.

The relative age effect can also affect age group categorisation within national governing body competitions. For example, under 13, under 15 and under 20 year categories in ballroom dancing favours those older within the age band who benefit from physical and cognitive maturity, skill development, experience and training. Figure 1 shows the results of birth date on under 15 and 19 year selection for elite academy squads in Australian football. As you can see there is a far higher proportion of early born players selected, with over 40% of U19s selected from the oldest compared to less than 10% from the youngest quartile of birth ages.

Figure 1: The relative age effect in Australian football talent pathway.

What about you? When were you born in comparison to the academic year or the age group categories in your sport – do you think this may have affected your chance to progress, or can you see that in others? It can't all be down to birth age though surely, we don't all look the same at 14 years of age do we?

Physical Maturation

What can you observe in image 1 linked to potential performance and talent identification?

Image 1. The difference in physical maturation by age in a group of youth footballers.

Sports academies are the main route for adolescents to develop and the home for talent identification for elite senior teams. The challenge for youth performers is to a) enter the academy system and b) stay there through a critical period of growth.

Biological maturation (more commonly known as puberty or the adolescent growth spurt) marks a time of increased growth hormones to promote growth, leptin to alter body composition, calcitonin to mineralise the skeleton, an increased resting level of adenosine triphosphate (ATP) and creatine phosphate and development of the musculo-tendinous unit. On average this occurs around 12 in females and 13 in males however can vastly vary from performer to performer in the timing, rate and size of maturation change.

Measurement of biological maturation:
There are multiple ways to measure biological maturation and estimate rapid periods of growth.

- The largely outdated assessment of secondary sex characteristics using Tanner's scale of development. The placement of a child or adolescent on a sliding pictorial scale of breast or hair development was not only invasive and unethical but brought accuracy into question when the individual themselves or a parent made the assessment.
- The commonly used **Khamis-Roche method** to predict a percentage of adult height. The individual's sex, age, height and weight are inputted alongside the mother and father's height to a predictive equation to gain a predicted adult height (in cms).
  To calculate your predicted adult height use the Khamis-Roche Method here: The Khamis-Roche Method Calculator - Calculator Academy. From there you can calculate the % of your predicted height you have reached currently.

Under the control of genetics and environmental factors the difference in performers of the same age can be surprising and significantly affect their performance. Using well known and relatively easy methods, such as the percentage of predicted adult height (%PAH), to estimate the stage of biological maturation performers can be classified as early, average or late maturers.

Figure 2: The rate of growth by age and the location of the peak height velocity in early, average and late maturers (not sex specific).

Early maturers (as represented by the dashed first line in figure 2) experience the growth spurt earlier than average, and therefore are usually taller, heavier and have greater muscle mass. This leads to performance benefits such as, increased power output, momentum generation, speed and agility. This affords a clear advantage in team sports such as rugby, football, netball, tennis and baseball and consequently a greater chance of selection, time on the pitch/court, progression and ultimately success.

Discussion point:
Compare and contrast the sports which may favour youth performers who go through early maturation compared to those who go through late maturation.

By calculating the %PAH the estimated position on the growth curve can be plotted. Up to around 80% of PAH a performer is considered pre-pubertal, 91% pubertal and 99% post-pubertal – as shown in figure 2 these points correspond to the start, high point and end of the growth peak. 85% of PAH is considered an important indicator of the opening of a critical window, especially for musculoskeletal development, in which physical training must be carefully balanced to maximise strength and speed while preventing overtraining and overuse injuries. As our growth rises from our feet and ends with the broadening of our shoulders the first potential injury to watch out for is Severs disease - inflammation of the calcaneal growth plate associated with repetitive stress, which corresponds to around 85% PAH, and the second Osgood Schlatter's disease - inflammation of the patellar ligament associated with repetitive strain, at around 90% PAH.

A potential solution: Bio-banding

As performers can experience this critical growth window early, on time or late it could be concerning to train age category players together and pitch them against each other in competition. For example, two 13-year-old football players on the pitch in competition, one early and one late maturer, the early maturer may accelerate faster to every ball, pass the ball with more force and use their muscularity to win tackles. A well-researched potential solution is bio-banding.

Bio-banding is a process of grouping performers by biological maturity rather than birth age. This is a well-researched idea whereby scientists have worked alongside the football industry with specific projects in the south of England. As a consequence %PAH has become a popular metric which coaches, managers and talent scouts are aware of.

Figure 3 shows 4 players in each age category which when assessed for biological maturity are re-categorised into new bio-banded groups. Although playing in birth age categories can force late maturers to work physically harder to keep up and be noticed, it also may allow early maturers to sit back which could be a problem in later years. Biobanding players into biological maturation groups could even these differences out, foster more holistic development and provide significant advantages to all performers involved both in terms of training and competition. This could be the answer to getting all players to achieve their potential, the right players making the elite teams, protecting the longevity of players, and removing the loss of talent early.

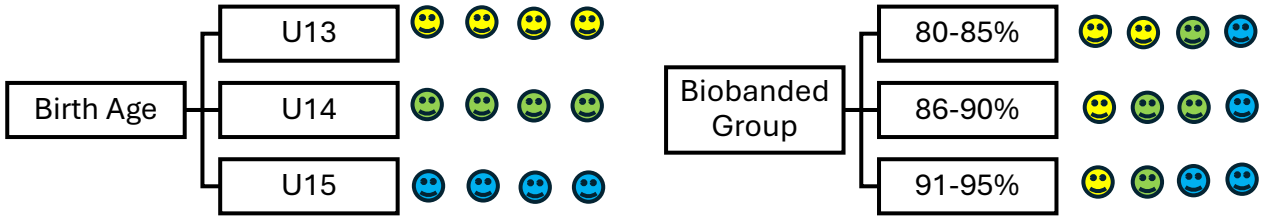

Figure 3. A visual representation of how 4 players in each age group may be re-grouped based on biological maturity.

Research has shown the results of bio-banding on early and late maturers to include;

For Early Maturers (played up)	**For Late Maturers (played down)**
Increased physical challenge (higher accelerations, speed and power from all players)	Increased time to use and develop technical and tactical skills (increased cognitive time, decision making and communication)
Increased technical challenge (due to the removal of physical superiority)	Increased confidence and self-esteem during play however challenge to confidence and self-esteem overall to be 'played down'
Challenge to confidence and self-esteem increases resilience and work rate to be noticed	Potential to increase communication and leadership skills (and be given roles of responsibility)
Appropriate strength and conditioning, training and injury prevention strategies to developmental stage	

In an interview in 2017 Jesse Lingard remarked: "When I was in the U18s I had to play U16 level football. But United always said to me that I was a late developer and that I needed to be patient. They always thought I'd be 22 or 23 when I played

for the first team. Those were the words of Sir Alex Ferguson. I listened to him and trusted his words and now I'm a regular for Manchester United."

Key Terms	
Relative Age Effect	The bias presented by date of birth within age-based sport categorisation.
Biobanding	A process of grouping performers by biological maturity rather than birth age.

Want to know more?
Check out Professor Sean Cumming, an expert on growth and maturation in sport and exercise
Watch this video from Bath Rugby Academy:
https://www.youtube.com/watch?time_continue=8&v=gP_YsxgGjqg&embeds_referring_euri=https%3A%2F%2Fhubblecontent.osi.office.net%2F&source_ve_path=Mjg2NjY
Have a read this article: Adolescent player development within institutional constraints in academy football - Megan Hill, Siobhan Mitchell, Joe Brookman, Darragh McGee, Sean P Cumming, 2025

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