

## **Sport science, sport development, scientific service and education in the promotion of IPC swimming.**

### ***Summary***

IPC Swimming, sport development, scientific service, coaching education and sponsoring are all interrelated. Furthermore, each of these topics have clear parallelisms with able bodied swimming and the emphasis in ones thinking needs to be placed on swimming and not disability. Nevertheless, a distinguishing factor in IPC swimming is classification. A hinder to progress in the past was the perception of many that Paralympic swimming is “Adapted” physical activity and not elite sport. This threat can be dealt with via education, promotion and professional example. IPC swimming needs to take advantage of the potential to deliver information of general interest by stimulating the long term systematic collection of data on the training and competition patterns of its swimmers as well as on how they move and learn to move in the water and how this is related to ADL. Few persons with a disability take part in such an intense level of physical activity for such long periods. Participation at scientific meeting on sport and swimming science, rehabilitation as well as the inclusion of a disability swimming module in all swimming coach education programs is essential to progress in general and to classification in particular. Such a standpoint could be included in the mission of an independent IPC swimming.

### ***Introduction***

At some time in the future, IPC swimming might become independent. In view of what my perception is of the present management strategy of the IPC itself this seems like a good idea. The IPC appears to be taking on a profile similar to that of IOC. That is to run the games but not the sports. Presently sport promotion (media attention and education of the public) dominates interest while two other themes are high on the priority list: classification and (anti)-doping. Classification is claimed to be the main distinguishing factor of Paralympic sport and the present strategy is for centralization of control and a common classification concept over all sports. This might be to the advantage of less well-organized sports. *I am not a supporter of substance use but it does appear to me that anti-doping campaigns have monopolized the fund raising and granting horizon and that other activities (coaches' education and scientific service) have had less chance to succeed but things are changing.*

IPC swimming might be well equipped to become independent. Rules and regulations are generally established, the sport has a worldwide base with at least one major participant country on each continent. The programs of a large number of IPC swimming countries are based in the national swimming federations. More and more events are being run during major able-bodied competition and professionally run programs are more widely available. There does continue to be a gap in the public as well as the sport professional perception of what Paralympic sport is (elite sport).

The purpose of this short note is to discuss the position of sport science within an (independent) IPC swimming structure. Sport science is not only the domain of researchers and should not be seen in isolation. Sport science might also in fact be related to sponsoring, education of the public, coaches' education, sport management and sport development and (scientific) service. Paralympic sport science is and should not be only about classification.

### ***Swimming has an intrinsic value of its own***

Physical activity in water has decided advantages for persons with physical disabilities. Takeshima et al.,(2002) state that water is an equalizing medium; its gravity-minimizing nature reduces compressive joint forces, providing a better exercise environment for patients with arthritis, back pain, osteoporosis, or other medical conditions that may restrict training on land. Activity in water is said to aid in: relieving pain and muscle spasm, maintaining or increasing range of motion, strengthening weak muscles, re-educating paralyzed muscles, improving circulation, lung function, and speech, and maintaining and improving balance, co-ordination and posture. Water activities have been used in rehabilitation and exercise in athletes, persons with low back pain, ischemic heart disease, multiple sclerosis, spinal cord injury, cerebral palsy and rheumatism. Nevertheless, in a review of rehabilitation intervention literature from 1979 to 1999 related to the use of aquatic (water) therapy for children and adolescents with

neuromuscular and musculoskeletal diagnoses, Dumas & Francesconi (2001) state that most of the available articles are case reports and other descriptions of clinical practice.

Aquatic facilities exist at or are used by numerous rehabilitation centers, several major books have been published on rehabilitation in water and a variety of courses are offered on “philosophies” of aquatic rehabilitation such as Halliwick, Bad Ragaz Ring Method and Watsu. Water is, furthermore, a medium in which competitive, recreational as well as therapeutic activities are equally at home and in which all age levels can take part.

Swimming competition for persons with disabilities has been organized in classes. Those with a loco-motor disability use a functional system in which swimmers with various impairments compete against one another in one of nine or ten classes. From a biomechanical point of view, there is much to be learned about propulsive force, swimming speed and swimming efficiency from well-trained athletes who e.g. are missing an important propulsive surface such as a hand. In fact, the relationship between body structure and performance has long been of general interest to all swimming researchers and this line of study needs to be promoted among all those who study swimming. In addition to these classes swimmers with a visual impairment compete in three classes ranging from persons with no sight at all to those legally blind and the intellectually disabled swim in a single class. From a motor control and learning standpoint there is also something to be gained by studying how persons with visual impairment solve the problems of swimming straight and turning. Paralympic swimmers have only recently become the subject of more biomechanical and physiological study. Although systematic athletes screening has become a regular feature of some national swimming programs, any general recommendations evolving from these results have not become part of the public domain. IPC swimming can and should play a role here.

Since 1988 video recording have been made during the swimming events at the Olympic Games. Using these recordings, in addition to the usual end results and lap times, information was obtained on race segment speed and stroking variables (Starting and Turning time and Stroke Frequency and Length) at several points in the race. Together with researchers at the Olympic Games in both Atlanta (1996) and Sydney (2000) the same recordings were made during the Paralympic competition immediately following. *This was the only project of its kind carried out in an identical fashion at both Olympic and Paralympic Games.*

At the Sydney Paralympic Games, individual results were distributed to all finalists for both their preliminary heat and final swims (~2300 individual reports). This is not only a direct scientific service to the athletes but a significant educational tool for the coaches as well.

This type of scientific service affects thus a large group of coaches and swimmers and can lead to more fundamental research questions (Mason, 2001). Examining the variation in movement of persons with different disabilities but who achieve the same Race Result (swimming time) can teach us quite a bit about disability itself. We have compared the race speed patterns of swimmers with Cerebral Palsy to those with other disabilities and this over several distances. Persons with Cerebral Palsy supposedly have problems with adjusting their movement tempo and with mechanical efficiency. They should have more trouble than other impairment groups with sprinting at the end of a race and generally in longer distance (endurance) events. Paralympic participants, however, train considerably more and more intensely than the persons on which most literature findings are based. An essential question concerns the positive as well as negative effects of long-term physical activity on persons with specific disabilities. Little literature is available on e.g. the affects of 10 hours/week of physical activity over several years on persons with Cerebral Palsy. These results remain descriptive and may only serve to highlight problems but provide no explanations or solutions. In addition, such analysis produces a large amount of data requiring a large investment in both time and man power so that in fact only recently has any overview of these results become available.

Directly related to this swimming technical research are sport development questions e.g. on the fairness and credibility of the classification system. Any study of how Paralympic swimmers achieve speed involves comparisons of results among functional classes as well as among the various impairment groups. By examining these findings, together with the evolutions in swimming performances over time, the functional classification system can be monitored. This is essential to the future of the sport in which

the classification system must be strong enough to stand up in a court of law. This also leads to the development and application of statistical techniques not yet used in the study of sport performance. Methods have to be developed to compare relative performances of higher functional classes and those in lower. This is also the basis of the selection of athletes for participation in major championships in many countries.

The same results are also valuable in establishing realistic participation quotas, which in turn are crucial in determining if an event is actually put on the Paralympic program for a particular class. This quota system may be questioned by some. Lower functional classes and some women's events might be e.g. less populated. Constant tracking of disability swimming performances is essential in establishing credible and valid quotas. Although some results are available with the obvious exception of the relative medal count of various impairment groups little systematic long term information is available on IPC swimmers.

### ***IPC-Swimming, Swimming Science***

Sport science has an obvious role in sport development, coaches' education and in monitoring classification. This is all interrelated to sponsoring in my opinion. The IPC might take better advantage of their potential role in examining the actual effects of long-term physical activity on persons with a disability. The intrinsic potential of Paralympic sport as a provider of information of general interest on the health and functioning (or disfunctioning) of persons with a disability has not been sufficiently examined. While swimming can be sold only as sport, IPC swimming can also be sold as therapy. This should widen the potential sponsor base. A sponsoring project could e.g. attempt to solicit money to fund classifier training. A company name would be associated with a trainee. Specific promotional material should be further developed.

Swimming science can also be used to make links with able-bodied sport. It is of essential importance in the future that sport scientist include Paralympic athletes in the participant pool. A few years ago a series of papers were published on body balance, body role and buoyancy. A sophisticated 3 dimensional video system was used under and above water (Yanai, 2001, 2003, 2004). It would have been quite enlightening had a swimmer with CP and leg and arm amputees been able to take part in these studies. Unfortunately, the mathematical models used were not applicable to this population. Of course, the fitting of a correct prosthesis or the development of a robotic leg to assist stroke survivors to walk again will always be of greater interest to engineers and funders than why a person with one leg might not swim as fast as someone with two.

Another place where IPC swimming can be promoted is in coach education. In Belgium, a module on disability swimming is included at the two first levels of the national coaching scheme. The emphasis is on swimming and not on disability.

IPC swimming might pro actively support scientific activities.

#### Envisioned tasks included:

1. Stimulating, performing and documenting scientific research related to disability swimming.
  - A. Assemble an overview of researchers and current projects in the area of disability swimming. A centralized bibliography could grow out of this.
  - B. Help identify priority topics of research.
  - C. Encourage further participation in international scientific meetings related to aquatic activities and communicate with related groups.
2. Assisting in the development of educational material, both written and multi-media for disability swimming coaches and classifiers.

Some suggested research topics some related to but not exclusively to classification.

- Simple but valid methods of measuring buoyancy and the sinking force of legs.
- Measurement of passive drag force and associating this with buoyancy measurements and physical characteristics e.g. hip and ankle muscle utilization (active and passive flexibility)
- Influence of altitude training on swimmers with hindered blood flow to some limbs.

- Mechanical efficiency of disability swimmers (Energy cost, power, muscle use).
- Computer simulations allowing the calculation of the loss of efficiency when e.g. a hand (propulsive surface) was lost.
- Investigate the need (viability) for a specific class(es) for longer distance events in freestyle. This includes the 400 m free as well as Open Water events.
- Solicit information in other fields such as biology (fish swimming) which might help with the questions now proposed.
- Set up suggested guidelines to be used by national governing bodies in their athlete selection policy. Closely related to this are the meet standards and medal times.
- Investigate facility, seating and transport problems for championship venues
- All topics regarding race analysis as well as stroking parameters.
- Relationship of training background (Quantity and Quality) and age to performance.
- Topics related to motivation, team membership, retirement (life after sport) and the under representation of women in some classes.
- Medal and final place distribution within impairment groups.
- Athletes concerns for the future of the sport.

Specific medical topics related to doping etc might be dealt with more centrally.

### ***Conclusion***

Presently there is an immediate need to collect all information available of scientific or semi-scientific quality, which might be of use in directing the future of IPC swimming. We are sure that quite a bit is available and hope that the meeting in Berlin will provide a good opportunity to move further in this direction.

Dan Daly, Leuven, Belgium  
([daniel.daly@faber.kuleuven.be](mailto:daniel.daly@faber.kuleuven.be))  
May 18, 2009