

Dance Science

(Source: Rist, R. (1991) 'Dance Science', *The Dancing Times*, Dec. 1991, p. 243.)

How have things changed since we were trained? – Part I

Do you remember being told any of these things?

- It has to hurt to do any good.
- Push your turn out, if you keep pushing, you will get more turn out.
- Bounce forwards over the legs to warm up.
- 'Pull up'!
- You must not drink liquid straight after class.
- I had to do it, so you have to do it!

In the years since we were trained as dancers and dance teachers, there have been many advances and developments especially in the area of sports medicine. Our athletes are supported by the latest technologies and understanding of biomechanics. A well funded dance company may also have access to high level medical back up and training methods, but the people who are most responsible for training young dancers have little access to help and advice and in many cases, superficial understanding of muscle action and joint structure. Anatomy is now an integral part of teacher training, but there must be generations of dance teachers who did not have an opportunity to learn about the body, and who continue to take responsibility for growing dancers. Dance is an expressive art, and with our current understanding of physics, physiology and anatomy it can also be looked at from a scientific view. This may mean some changes.

The idea that the theories of our predecessors are sacred and must never be questioned prevents our development as teachers and trainers of the growing young bodies and minds in our care. It takes courage to question the heritage of many years of the development of dance technique, but in order to fully understand how a body best responds to training, it is necessary to continually re-evaluate training methods.

It has to hurt to do any good.

It doesn't have to hurt to do any good. Dancers should be encouraged to know the difference between the ache of muscles unused to work (what we term Good Pain) and the other sort of injury pain (what we term Bad Pain). In my experience, this distinction has proved to be useful and easy to understand for all levels of training. Adolescents should be encouraged to learn about the natural restrictions of their bodies and RESPECT them. Often a dancer may be too 'frightened' of the teacher, or of looking weak in the eyes of fellow students, to admit to having pain. Pain is the only way the body has of communicating that something is wrong. The source of pain should be found and the student reassured.

Push your turn out

No one ever thinks they have enough turn out. I remember sitting in “frogs” for hours to try to gain more. I hear of horror stories of people who sit on each other’s thighs to get more turn out. Turn out depends on many factors, mostly predetermined ones:

- 1 The depth of the socket in the pelvis.
- 2 The length of the neck of the femur.
- 3 The angle at which the femur is placed in the socket.
- 4 The elasticity of the Y shaped ligament at the front of the hip joint.
- 5 The age at which dance training is begun (ie. how early this Y shaped ligament is encouraged to stretch).

These are mostly congenital factors over which a dancer has no control, rather like having blue eyes, or brown hair. The one thing that the dancer can do is strengthen the muscles of turn out, and this should be encouraged. Damage caused by forcing turn out is severe and long lasting and can affect the spine, hips, knees and feet. I have seen huge bunions on young children, combined with dropped arches and sore knees; all too often the result of over enthusiastic turning out from the feet.

A bunion, or Hallux Valgus, is caused by the laying down of bone over the joints of the first toe in response to the stress of body weight incorrectly placed over the front of the foot (ie. not maintaining turn out from the hips). This is permanent bone growth and cannot be removed (except by surgery) so a young dancer whose alignment is not corrected may take a legacy of misshapen feet into adulthood, possibly long after having given up dance training.

Bounce forwards to warm up

Bouncing forward over the legs to warm up, or in an attempt to stretch the muscles, has little effect, and in some cases can cause damage. In order to understand why, it is necessary to understand the *stretch reflex* of skeletal muscles. Muscles have an in-built safety mechanism to prevent sudden over-stretching. In simple terms, this works on the same principle as the reaction to placing your hand on a very hot surface when your hand is automatically taken off the surface before you consciously realise that it is too hot. The muscles have a similar mechanism called the stretch reflex. When a sudden stretch and tension is put on a muscle, it contracts to prevent damage. Thus all those hours spent bouncing forwards over legs to gain more stretch have probably had a minimal effect because the body is making very sure that you do *not* stretch the muscles!

In order to overcome the stretch reflex, a different approach is necessary. By placing a gentle and steady stretch on a muscle and maintaining that for a minimum of five seconds, the stretch reflex is overcome and the muscle may be stretched a “comfortable” amount. However, an even more effective mechanism than passive stretching is called “Proprioceptive Neuromuscular Facilitation”. This has been found to be three times more effective than passive stretching and five times more effective than ballistic bouncing. It is safe, and can be used as a warm up for the large muscles, or at the end of range of movement to gain more stretch. The student works the muscle group “isometrically” against pressure applied very gradually (by another person) maintaining the muscle at the same length for a minimum of five seconds. As the muscle relaxes after the contraction, it lengthens into a slightly improved end of range ... The hamstrings seem to respond very well to this type of muscle work, and this method can be used with the leg forwards, sideways or backwards ... The stretch can then be repeated in the new lengthened position. This has proved to be very popular with all who have used this method as there is a visible change in the muscle length with minimal subsequent stiffness. The stretch gained seems to stay

with the dancer longer than with other methods. The other benefit is the strength gained at the end of range of movement. Flexibility without stability is dangerous.

Note: Rachel Anne Rist, author of *The Injured Dancer*, teaches and lectures on dance and anatomy.