Structure, Function, Integration.

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All About Hands and Arms

Hands and arms are among our primary tools, whether we are bodyworkers, desk workers, factory workers, or gamers. In this issue we share how Rolfing® Structural Integration has evolved understanding and methodology to help hands and arms find ease with the demands placed upon them.

Also in this issue

The Complexity of Three-Dimensional Hands and Fingers

Deep learning from injury and healing.

Body Readings by Touch

Meet a blind Rolfer.

Getting a Grip

Practical stretches and movement work for hand and arm self-care.

Letter from the Embryo

A 'Footnote'

By Konrad Obermeier, Basic Rolfing® Instructor

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ABSTRACT *Structure is a dynamic, developmental movement. An embryological perspective can contribute to our understanding of structure and can provide us with insights into the practical work of structural integration. Development and differentiation follow lawful principals and what is described in the brief article below in respect to the organization of the foot is relevant to arm or hand development as well.*

Editor's Note: The complete original paper will reappear in its English translation as a contribution to a new edition of selected writings by the anatomist and embryologist Erich Blechschmidt, published by Kiener Verlag (www.kiener-verlag.de), Munich, Winter 2019.

The embryological formation of anatomical structures can be described as developmental movements in time and space — a seamlessly flowing sequence of expansive stages. In the course of growth and differentiation, some elements of the body expand more rapidly than others.

The elements relatively slower in growth-expansion will predictably manifest a highly specific local resistance to growth-movements on neighboring structures. Uneven growth rates inevitably create, manifest, and maintain formative frictional forces between the elements involved. From an ontogenetic point of view, any frictional developmental forces manifest as connective tissues. The relative position of these elements to each other will be of critical importance for the developmental unfolding. This is true not only for local, microscopic, cellular structures but, consequently, also for the formation of macroscopic structures (tissues) and the complete shape of the body.

When an embryo sprouts a limb bud (an arm, a leg, a finger, or whatever structure is to arise) the pioneering cells of skin and soft tissues protrude first into *outer space*. The supporting neurovascular bundles and the cells differentiating to form cartilage and bone will always appear later. This cannot be the other way around and consequently can be understood as an inevitable and lawful differentiation.

One of the many questions that may arise is: how are these elements spaciously relating to each other? For example: how is an artery or the neurovascular bundle positioned relative to a forming bone? This is of importance because the neurovascular bundle always is slower in longitudinal expansion than the proliferation of cells manifesting bone. It is specifically the arteries (supplying molecules for bone growth) that are

Figure 1: The immanent torsion of the calcaneus is orienting towards the path of artery and nerve tibialis posterior, extending posterior to the medial malleolus into the plantar region.

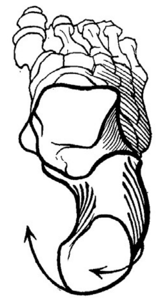

Figure 2: The foot expresses a general torsion that originates in its developmental growth. The torsion as a whole is oriented towards the position of the major neurovascular bundle, supplying molecular support and simultaneously orienting and restraining the formation of the foot from a posterior-medial fulcrum.

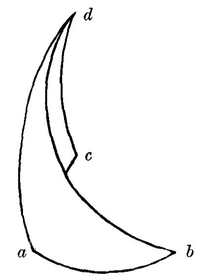

Figure 3: Abstraction – (a) small toe; (b) big toe; (c) calcaneus; (d) talus. The edges ac and bd are spirally wound around each other. The surface abcd is a spiral band arched in length and width. This spiral band wraps around the dominant neurovascular bundle (i.e. the *artery* and *nerve tibialis posterior*).

exerting a secondary, restraining force to the progressive bone growth.

Arteries and neurovascular bundles are creating and maintaining (!) a force of *retention* towards the primarily expansive bone growth. Simply put: the developmental growth of bone and cartilage is expansively pushing, while arteries and nerves (like muscle and connective tissues) are resisting the push. Therefore, the latter are tensile and serve to orient expansive growth through providing local resistance like a dynamic fulcrum in a specific direction.

So the growing bone (or the limb as a whole) is predictably and always orienting specifically towards the artery. In this way we can understand the artery (and neurovascular bundle as a whole) as a relatively orienting, slow-moving fulcrum to all surrounding structures. Ultimately this is the formative reason why the primary neurovascular bundle is located always on the flexion side of all joints. It is relative resistance to expansive growth that initiates and creates any joint development and defines flexion.

This principle will be illustrated below by way of a consideration of the leg and foot. The same principle, however, can be observed in many other anatomical structures. The arm and hand, for instance, offer a readily available analogue to the situation described below. It is to be hoped that the description to follow will prepare readers to explore further manifestation of this principle.

When we apply this line of thought to the formation of the foot, we have to consider the *artery tibialis posterior* (extending together with the *nerve tibialis, ramus posterior*) as the primary support structure for normal developmental growth. This means, for example, that the intrinsically torsional shape of the calcaneus (see Figure 1) originates from its developmental growth in relation to the nerve and artery *tibialis posterior.*

We can generalize this and come to understand the immanent structural torsion of the foot – including the formation of the arches – in relationship to the orienting force of relative arterial and neurovascular retention during developmental growth (see Figure 2). The general developmental torsion of the foot (see Figure 3, abstraction) not only manifests the curvatures and torsion of the calcaneus and the appearance of the arches, it can also be perceived in the asymmetric positioning of the lateral and medial malleoli.

The neurovascular bundle creates a spiraling organized tensional force that torques into the connective tissue structures of the sub-cutis as well. The internal organization of the *padding-of-the-heel* (inferior to the calcaneus) shows a turbine like arrangement of connective tissue lamina that reflects the force of retention arising from the *spiral band* around the neurovascular bundle in the *tibialis posterior* compartment (see Figure 4).

Figure 4: Schematic representation of the connective tissue lamina organizing the padding of the heel inferior to the calcaneus. Illustration from Prof. Dr. Erich Blechschmidt (1982).

Considering the clinical problem of a so-called *flat foot* or *collapsed arch* we invite you to re-evaluate your assumptions from an ontogenetic point of view. The medial arch of the foot does not *collapse* in the implicate sense of the word and is not simply falling down. There is no such thing as a collapsed foot. When we see a *flat foot* or a *collapsed arch,* we actually see a foot in which a number of elements have partly or fully disengaged from their natural torsion by way of de-rotating out of order. Any attempt to reorganize a dysfunctional foot might profit from considering the general and local developmental torsion as the necessary and normal arrangement (see Figure 4). The ontogenetic developmental movement initiated, constructed, and maintains the organization of the foot in this way. The embryo intended the foot to be torsional, like a propeller.

Konrad Obermeier holds a degree in communications from the University of Munich and has been a Rolfer since 1991. Currently, he serves as chair of the Anatomy faculty for the European Rolfing® Association. His is the editor of a series of books on the biodynamic embryology of Erich Blechschmidt.

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