

## **Fascia, boundary, separatrix, and meridian - a model of acupuncture with confirmed predictions**

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**Abstract:** Fascia mostly exists at the boundaries between different structures or domains in the body. In growth control, the boundaries are the separatrices of morphogen gradient and bioelectric field. The growth control model of acupuncture suggests that acupuncture points originate from a network of organizers in embryogenesis and the meridians originate from intersecting growth control boundaries / separatrices which are associated with fascia and connective tissue. The following predictions and extrapolations of the growth control model have been independently confirmed or supported: 1. Acupuncture has extensive growth control effects. 2. Singular points and separatrices, which correspond to organizers and growth boundaries, have important roles in morphogenesis. 3. Organizers are macroscopic singular points of morphogen gradient field and bioelectric field with high electric conductance, high current density and high density of gap junctions. 4. A high density of gap junctions is distributed as separatrices or boundaries at body surface after early embryogenesis. 5. Many acupuncture points are located at transition points or boundaries between different body domains or muscles, coinciding with the fascia and connective tissue planes. 6. Some morphogens and organizers continue to function after embryogenesis. The growth control model has shed light on several phenomena of acupuncture such as the distribution of auricular acupuncture points, the long term effects of acupuncture and the effect of multimodal nonspecific stimulation at acupuncture points. The growth control model of acupuncture set the first example of a biological model in integrative medicine with significant prediction power across multiple disciplines.

The growth control model suggests that acupuncture points – organizers and separatrices – boundaries – meridians in growth control form an under-differentiated, interconnected cellular network that regulates growth and physiology both during and after embryogenesis. In consistence with the prediction of under-differentiation of the growth control system, it has been observed that the most apical part of folds of embryo remains undifferentiated in morphogenesis, including organizers. Stem cells, which are undifferentiated, are likely to localize at the organizers and boundaries with high density of gap junctions. There is preliminary evidence that gap junctions play important role in the maintenance of adult stem cells. Manipulating the singular points - organizers of the growth control system – meridian system may be a convenient way of activating intrinsic adult stem cells which is supported by studies on acupuncture. The correlation between the distribution of adult germ cells (a type of stem cell) and the chakra system suggests a unified biological basis of growth control system, meridian system and the chakra system. Future research may include further delineation of the structure, cell differentiation and signal transduction at acupuncture points and meridians, mapping of the bioelectromagnetic field with high resolution techniques, and developing diagnostic and therapeutic techniques directed at the early signal transduction stage of pathophysiology utilizing the singularities of the growth control system.