

A stylized, grayscale map of Japan is the background for the text. Overlaid on the map is a circular graphic consisting of a white circle in the center, surrounded by four dark, curved segments that resemble petals or a stylized flower.

Program of
**THE FIFTH
JAPAN-USA-SINGAPORE-CHINA
CONFERENCE
ON
BIOMECHANICS**

**August 9-13, 1998
Miyagi-Zao Royal Hotel
Sendai, Miyagi, Japan**

EVIDENCE OF BIOGENETIC LAW OF HAECKEL BY MEANS OF TRILATERAL RESEARCH METHODS

L. Jiang, K. Nishihara, University of Tokyo, Tokyo, Japan

Correlation between ontogeny and phylogeny is major problem of early development and embryology. Haeckel proposed “biogenetic law”, i.e., recapitulation theory, which means that in embryo of vertebrates phylogenetical change of morphology is reproduced at a part of the viscerocranium.

Present study aims to prove biogenetic law by means of newly developed trilateral research methods. The biogenetic law had a profound impact in the discipline of evolutionary morphology. Haeckel’s biogenetic law revolved around the principle of recapitulation, better known by its dictum “ontogeny recapitulates phylogeny”. Pere Alberch proposed to explain mechanism of recapitulation theory a concept of heterochrony, which meant regulation of timing of gene expression in morphogenesis of organisms. The authors take notice of development in bone marrow hemopoiesis as a phenotype of biogenetic law in hematopoietic function. The author carries out experimental evolutionary studies combining trilateral categories of morphology, molecular biology, and molecular genetic in remodeling by means of biomechanics, to elucidate the cause of recapitulation in hemopoietic function, i.e., emigration of hemopoietic sites. As a result the gravitation in terrestrialization from $1/6G$ by buoyancy to $1G$ is known the cause of recapitulation in hemopoietic function. Through changes in gravitation genetic expression of hemopoiesis conjugated with ossification in cartilage cell, i.e., mesenchymal cells is triggered in second revolution of vertebrates as well as development into fetus from the embryo which lives in sufficient amniotic fluid.

EVIDENCE OF USE AND DISUSE THEORY OF LAMARCK BY MEANS OF EXPERIMENTS

K. Nishihara, University of Tokyo, Tokyo, Japan

The mechanism of the evolution is major issue to solve in life science of the vertebrates. The present research aims to prove use and disuse theory by means of newly developed experiments. Lamarck proposed the empirical law of use and disuse theory as results of precise observation of the vertebrates. However, this theory has not been explained by means of molecular biology and molecular genetics. For this reason this theory has been disregarded in evolutionary science.

In vertebrates we have trilateral riddles to be read, i.e., mechanisms of the evolution, immune system, and development of hematopoiesis in bone marrow in phylogeny as well as in ontogeny.

Definition of the vertebrates is a cordate having bony backbone, with the various degree of ossification. Therefore, if we can synthesize cartilage or bone artificially, we can read the trilateral riddles by means of model experiments using these skeletal substitutes.

Trilateral research methods are developed by the author integrating morphology, molecular biology (physiology and biochemistry), and molecular genetics of remodeling by means of biomechanics. Through this research method the author develops artificial bone marrow chamber using bioceramics.

Conventionally, evolutionary change is thought phenomena of changes of genetic cord. However, the author discovers through studies on evolution of hemopoiesis that the morphology of an organism can be changed by vicissitudes of inner or outer stimuli of biomechanics, i.e., environmental factors, which act to the organism, and if these vicissitudes of biomechanical stimuli are transmitted to the next generation morphological changes can be transmitted. Through this discovery the use and disuse theory of Lamarck can be explained biomechanically in molecular genetics.

Experimental evolutionary studies are carried out as follows: developing artificial bone marrow biochamber, the author has implanted them into archetype vertebrates as well as mammals, compared them each other, and analyzed them. Development of hemopoiesis in bone marrow chambers in phylogeny are evident as the action of the gravity in terrestrialization, which is converted into heightening of blood pressure in chondrichthyes.

As conclusion use and disuse theory is evidenced in second revolution of vertebrates for the gravity to trigger genetic expression in mesenchymal cells producing hemopoiesis conjugated with ossification of the cartilage.

HLA AND DEVELOPMENT OF BONE MARROW HEMOPOIESIS

Katsunari NISHIHARA

Department of Oral Surgery, Faculty of Medicine, University of Tokyo.

7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8655, Japan.

Telephone: +81-3-5800-8946

Fax: +81-3-5800-6832

E-mail: katsunari-n@amy.hi-ho.ne.jp

Self and not-self immunology is in vogue in these days. However, this concept is defined only in tissue immunity. Present research aims to prove for development of tissue immunity through genetic expression by the gravitation during terrestrialization. In ontogeny, embryo has no tissue immunity, which is called immune-tolerance. However, mechanisms of immuno-tolerance is not known.

During research of phylogeny in bone marrow hemopoiesis the author discovers that the function of human leukocyte antigen (HLA) is induced through the second evolution of the vertebrates, i.e., in terrestrialization.

The author proposes hypothesis in development of tissue immunity by change of the gravity of 1G during landing or delivery from 1/6G in sea water or amniotic fluid in phylogeny as well as in ontogeny.

Xenotransplantation of various tissues between archetype vertebrates of chondrichthyes (sharks), cyclostomata (hogfish), and mammals (rats and dogs) are carried out.

As results xenotransplantation of tissues can be successful. In sharks the major histocompatibility complex (MHC) of class I as well as class II are well known to exist. Therefore, in archetype vertebrates MHC is masked in genetic expression just as immuno-tolerance in embryos of higher animals.

As conclusion genetic expression of MHC is triggered by the gravity, which triggers development of bone marrow hemopoiesis in phylogeny as well as ontogeny. Without genetic expression of MHC xenotransplantation can be successfully carried out. Therefore MHC exists not to distinguish self or not-self in organism but to function for cellular level digestion.