

DEVELOPMENT OF THE MUSCULOSKELETAL SYSTEM

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The upper limb bud forms on the lateral wall of the 4-week embryo, followed promptly by the lower limb bud. By 2 months, differentiation of the limb elements is complete. Most congenital limb anomalies arise during this period. Three coordinated signalling centres control limb development. The apical ectodermal ridge (AER) guides Carl Hueter, 1838–1882, Professor of Surgery, University of Greifswald, Germany. Richard von Volkmann, 1830–1889, Professor of Surgery, Halle, Germany. Julius Wolff, 1836–1902, Professor of Orthopaedic Surgery, Berlin, Germany. mesodermal differentiation in a proximal-to-distal direction, controlling digit formation via the production of fibroblast growth factors (FGFs). The mesodermal zone of polarising activity (ZPA) directs anteroposterior development via the sonic hedgehog protein, which is itself sustained by FGFs. The ectodermal driven wingless-type (Wnt) signalling centre develops dorsoventral axis configuration and limb alignment. Certain limb anomalies are directly related to alterations in these centres. Experimentally, removal of the AER leads to a truncated limb, similar to a congenital amputation, and prevents interdigital necrosis resulting in syndactyly. An additional ZPA results in a mirror duplication of the distal limb. Factors causing fetal limb anomalies may also influence other organ formation, resulting in potentially life-threatening disorders. Summary box 44.1 Development of the musculoskeletal system

Presentation and management of other childhood hip conditions Management of club foot • Problems associated with musculoskeletal infection in childhood Occurs 4–8 weeks after fertilisation AER controls proximal-to-distal differentiation and interdigital necrosis ZPA directs posterior-to-anterior differentiation Wnt influences dorsal-to-ventral differentiation

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