Bones come in a variety of shapes, each serving different functions in the body. Here are some of the main bone shapes:

Long bones:

Found in the limbs (e.g., femur, tibia, humerus, radius, ulna) Cylindrical in shape with a shaft (diaphysis) and two expanded ends (epiphyses) Responsible for most of the body's height and facilitate movement

Short bones:

Cube-shaped (e.g., carpal bones in the wrist, tarsal bones in the ankle) Provide stability and support

Flat bones:

Thin and relatively flat (e.g., skull bones, scapula, sternum) Protect internal organs and provide attachment points for muscles

Irregular bones:

Vary in shape and do not fit into the other categories (e.g., vertebrae, some facial bones) Serve specialized functions like protecting the spinal cord or facilitating facial expression

Sesamoid bones:

Small, round bones embedded within tendons (e.g., patella) Improve the mechanical advantage of muscles and tendons

The specific shapes of bones are adapted to their functions within the skeletal system, allowing for efficient movement, protection of vital organs, and attachment of muscles and ligaments. The diversity of bone shapes is an important aspect of the human skeletal structure.

Available normative references of cranial bone development and suture fusion are incomplete or based on simplified assumptions due to the lack of large datasets. Liu et al. presented a fully data-driven normative model that represents the age- and sex-specific variability of bone shape, bone thickness, and bone density between birth and 10 years of age at every location of the calvaria.

The model was built using a cross-sectional and multi-institutional pediatric computed tomography image dataset with 2068 subjects without cranial pathology (age 0-10 years). They combined principal component analysis and temporal regression to build a statistical model of cranial bone development at every location of the calvaria. They studied the influences of sex on cranial bone growth, and the bone density model allowed quantifying for the first time suture fusion as a continuous temporal process. They evaluated the predictive accuracy of our model using an independent longitudinal image dataset of 51 subjects.

The model achieved temporal predictive errors of 2.98 ± 0.69 mm, 0.27 ± 0.29 mm, and 76.72 ± 91.50 HU in cranial bone shape, thickness, and mineral density changes, respectively. Significant sex differences were found in intracranial volume and bone surface areas ($P < 0.01$). No significant differences were found in the cephalic index, bone thickness, mineral density, or suture fusion.

Liu et al. presented the first pediatric age- and sex-specific statistical reference for local cranial bone shape, thickness, and mineral density changes. They showed its predictive accuracy using an independent longitudinal dataset, they studied developmental differences associated with sex, and quantified suture fusion as a continuous process [1].

[1]

Liu J, Elkhill C, LeBeau S, French B, Lepore N, Linguraru MG, Porras AR. Data-driven Normative Reference of Pediatric Cranial Bone Development. Plast Reconstr Surg Glob Open. 2022 Aug 10;10(8):e4457. doi: 10.1097/GOX.0000000000004457. PMID: 35983543; PMCID: PMC9377678.