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Autore	DI BENEDETTO, Arnaldo
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Autore	Phil Salmon
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Sommario/riassunto	<p>A large literature exists on trabecular and cortical bone morphology. The engineering performance of bone, implied from its 3d architecture, is often the endpoint of bone biology experiments, being clinically relevant to bone fracture. How and why does bone travel along its complex spatio-temporal trajectory to acquire its architecture? The question "why" can have two meanings. The first, "teleological - why is an architecture advantageous?" - is the domain of substantial biomechanical research to date. The second, "etiological - how did an architecture come about?" - has received far less attention. This Frontiers Bone Research Topic invited contributions addressing this "etiological why" - what mechanisms can coordinate the activity of bone forming and resorbing cells to produce the observed complex and efficient bone architectures? One mechanism is proposed - chaotic nonlinear pattern formation (NPF) which underlies - in a unifying way - natural structures as disparate as trabecular bone, swarms of birds flying or shoaling fish, island formation, fluid turbulence and others. At the heart of NPF is the fact that simple rules operating between interacting elements multiplied and repeated many times, lead to complex and structured patterns. This paradigm of growth and form leads to a profound link between bone regulation and its architecture: in bone "the architecture is the regulation". The former is the emergent consequence of the latter. Whatever mechanism does determine bone's developing architecture has to operate at the level of individual sites of</p>

formation and resorption and coupling between the two. This has implications as to how we understand the effect on bone of agents such as gene products or drugs. It may be for instance that the "tuning" of coupling between formation and resorption might be as important as the achievement of enhanced bone volume. The ten articles that were contributed to this Topic were just what we hoped for - a snapshot of leading edge bone biology research which addresses the question of how bone gets its shape. We hope that you find these papers thought-provoking, and that they might stimulate new ideas in the research into bone architecture, growth and adaptation, and how to preserve healthy bone from gestation and childhood until old age.
