講演会のお知らせ

日時：2015 年 9 月 24 日 16：30～

場所：慶應義塾大学矢上キャパス 14 棟 7 階フォーラム

Avian bipedal locomotion: Can we learn from birds?

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and

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Birds and their ancestors used bipedal locomotion long before primates. This prolonged optimization period should foster adaptations with respect to functional morphology and control. Despite of some general similarities differences between birds and humans seem to be obvious. We hypothesize that they may have intrinsic mechanical reasons.

At the level of center of mass dynamics the gaits used seem to be similar. Both groups walk and run. The gaits follow the idea of a rather stiff spring loaded inverted pendulum with low energy during walking and a higher energy allowing flight phases during running. A closer look reveals that especially small birds prefer to use across a wide range of speeds “grounded running”: a gait without aerial phases but with a running dynamics. Human subjects seem to avoid this intermediate gait. A striking difference is the respective posture of the trunk. In simulations assuming a virtual pivot point (VPP) control the upright human posture seems to represent a small, delicate island of stability whereas there is a wide range of pronate postures in which stability can be achieved. The pronate posture in turn is related to the leg function. Whereas the human leg is able to work almost conservative, in birds the caudal displacement of the hip requires asymmetric leg operation with axial absorption and tangential propulsion. Bird legs geometry also differs from ours. The almost horizontal femur shifts the “knee” close to the center of mass. This minimizes work and allows the distal segments to store and/or absorb energy. At least birds of small and intermediate size are able cope with

strongly uneven ground. It has to be shown whether this advantage represents a desired outcome of the prone posture.

Altered physical conditions, or boundary conditions enforced by environment and anatomy might alter the way we use our legs. A pronate posture may make grounded running a preferred gait. First experiments while walking with enforced bent postures result in force patterns typical for grounded running. Posture seems to effectively modulate leg properties.

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