Basic Mechanics of Hopping

***** The phases are for a right foot hop.**

Preparation Phase

- **Shift the center of gravity over the right foot.**
- **Load the right leg: ankle flexion (maintain friction forces with the ground), knee flexion, hip flexion. The flexion angles are at a degree that is conducive to the strength of the jumper. The jumper needs to be able to develop force for the entire distance of the takeoff.**
- **The knee lines up over the toes of the right foot. Observe from the front, to ensure the knee is not collapsing in or bowing out, well past the foot line.**
- **Look to make sure the hip is not swaying out to the right. This would create a curve in a force line that needs to be straight to get maximal height.**
- **Line up the back vertebrae (flat back) and keep the head up (observe from the side). The straight line of the vertebrae, will permit the take-off forces to follow a straight line.**
- **Hyper-extend the arms back with the elbow joint extended. Eventually, the arms movement forward will add inertia and force to the overall output of the jump.**
- **Maintain the nose over the toes and the 'butt' low (maximum 90 degree knee angle) and just off the back of the heels of the right foot. This will ensure the center of gravity is lined up over the base (the foot).**
- **The left thigh is hyper-extended. The height is determined by the amount of force needed for the hop. A higher height will provide more distance for force to build-up, which will contribute to the height/distance of the hop.**
- **The knee is flexed to 90 degrees. The shorter overall appendage will allow it to move faster and contribute to the height/distance of the hop.**

Force Producing Phase

- **All the body's movements add force and inertia to the height/distance of the hop.**
- **Each body movement directly builds onto the next creating a straight line of forces that contribute to the final outcome of the hop.**
- **The shoulder joints flex forward (degree will depend on the amount of force needed for the hop), the elbow joints flex to 90 degrees.**
- **The vertebrae must remain aligned. This will allow the force lines to follow a straight and efficient line.**

- **The weight shifts forward toward the 'toe box' (ball of the foot) while maintaining friction forces with the ground, and equilibrium.**
- **The hip and knee joints of the right appendage extend, adding inertia to the straight force lines of the body.**
- **The left appendage swings forward. The thigh forcefully flexes forward. The knee remains flexed at a 90 degree angle.**

Critical Instant

- **All the other built up forces that the body has accumulated will base off the surface of the ground. Therefore, maximal friction forces with the ground are desirable.**
- **The foot plantar flexes (vertical hop), and/or 'claws' back (horizontal hop) at the ground as the body extends into the air.**
- **A horizontal hop will require the glutes and hamstrings to contract and hyper-extend the thigh at the hip joint.**
- **Forcefully 'blocking' the left leg at 90 degrees at take-off will add to the height/distance of the hop.**
- **Forcefully 'blocking' the shoulder joint at 90 degrees at take-off will help attain height/distance at take-off.**

Follow Through / Recovery

- **Legs prepare to absorb the weight of the body as it returns to the ground. Decreasing impact forces on the body's joints (ankle, knee, and hip) will decrease injuries over the long run.**
- **The entire de-summation of forces occurs smoothly, in order, and very quickly.**
- **The balls of the feet hit first, followed by the heels, ankle flexion, knee flexion, hip flexion. The body will eccentrically contract the associated joint musculature to keep the movement smooth.**
- **Locking the hip joint and keeping the chin up and level will aid the state of equilibrium at the end point of the landing (complete de-summation).**
- **Arms are slightly abducted from the body with the elbows bent, which will aid the final balance point.**