The Inherently Vulnerable Areas of the Body: Reasons why the knee joint is inherently vulnerable

1. This is a major weight-bearing joint where the femur and tibia meet. It can flex and extend and in a healthy knee joint there may be a little rotation and gliding possible.

2. Significantly there is no direct support from surrounding muscles meaning it relies on ligaments and tendons for support:

    - The **anterior cruciate ligaments** prevent excessive flexion of the tibia and the **posterior cruciate ligament** excessive extension of the tibia; the **collateral ligaments (medial & lateral)** prevent excessive rotation or sideways movements
    - The biceps femoris tendon (extension of the quads) & patellar tendon create extension at the front of the leg; hamstring tendons at the rear of the leg help to flex the knee.

3. **When straight (fully extended) the knee is generally less vulnerable however we must be sure:**
    - **the knee follows the line of the foot** or there will be asymmetrical pressure placed upon the internal structure of the knee and pressure upon the collateral ligaments which overtime can cause long term issues. This is relevant is poses such as trikonasana (triangle) where we can turn the front foot in a few degrees so the knee & foot remain aligned, and/or can allow the top of the rear hip to fall inwards a little so there is less hip rotation needed. Students need to check for this alignment, notice their inner experience of the knee and make adjustments as needed.
    - **hyperextension of the knee is avoided** when leg is extended. (See additional handout)

4. **When the knee joint is flexed (bent):**
    - **if the knee travels inwardly due to tight hips or adductors then the lateral collateral ligament is placed under strain.** This is very relevant for asana such as virabhadrasana II (warrior 2) & parsvakonasana (lateral side stretch) where we must either turn the lead foot in a few degrees, can allow the rear hip to fall inwards a little and/or reduce the length of the stride. Students need to check their alignment and check their inner experience at the knee.

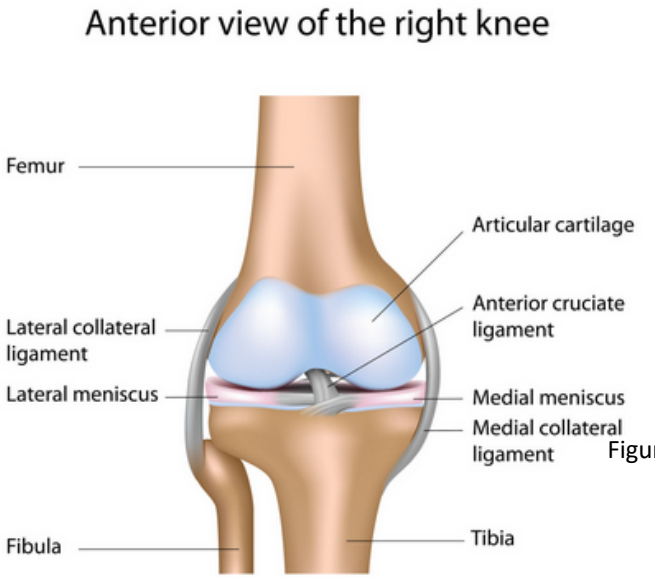

Figure 1

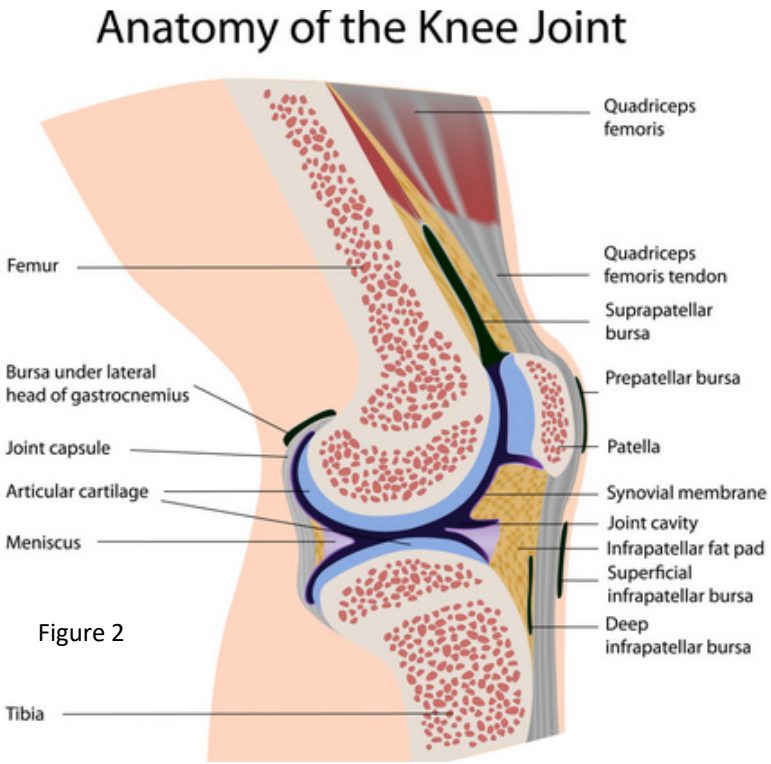

Figure 2

- **and free standing then it must always be aligned well with knee over ankle** to avoid adverse compression within the knee cap, surrounding connective tissues and posterior nerves.

5. **Limited external hip rotation can cause the twist to occur at the knee** causing strain within the lateral collateral ligaments & potentially also compression within the medial collateral ligaments and the inner kneecap itself in poses such as sukhasana (easy pose) or kapotasana (pigeon). We can try altering the seated position by sitting on blocks, take the legs a little further forward or in some asana such as kapotasana dorsiflexing the foot is helpful to redirect the rotation back to the hip joint. Students need to check their inner experience at the knee.

6. There are 13 **bursae, fluid filled sacs providing lubrication and protection for the knee,** & with age, injury or repetitive movements these can become **dry and irritated,** making kneeling uncomfortable or painful. Here some padding beneath the knee, or placing a roll or block between the calf and thigh can help, or we can have an alternative where we stand, sit in dandasana etc. if necessary.

7. **Flexion & extension of the knee** can also be inhibited in several ways:
   - When flexing & extending the patella must slide along a groove helped by fluid filled bursae (sacs) lying in the soft tissues beneath the patella; with age or injury the **fluids can become dry and bone spurs may inhibit smooth movement of flexion & extension.**
   - The menisci (small crescent shaped discs) at the end of the femur and tibia cushion them preventing the two bones meeting and damaging one another. With age lubrication can be reduced and excessive pressure exerted upon the knee joint can cause the **menisci to become misshapen and reduce the capacity for flexion.**

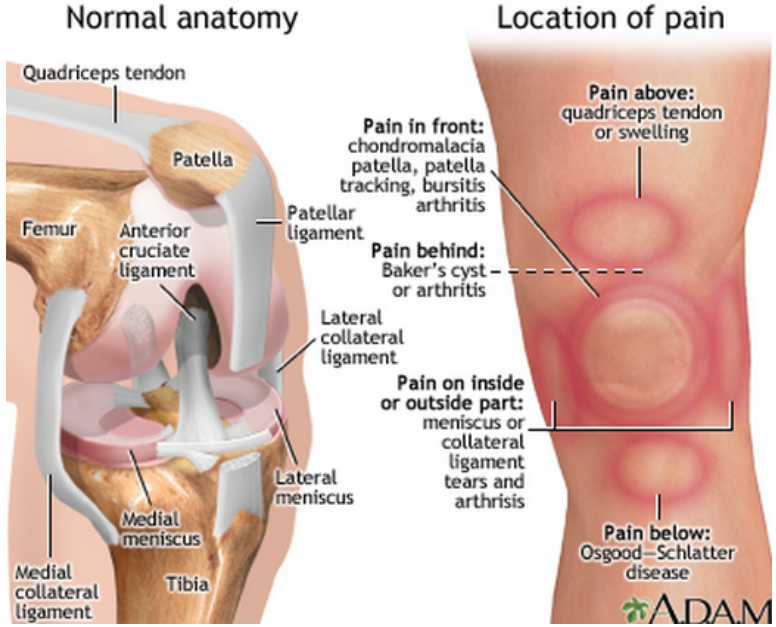

Figure 3

   - It is possible with age or injury that the **knee joint becomes unstable and prone to giving way,** and this is usually due to problems with the menisci, the collateral ligaments and the patella tracking.

   - In each case we must practice with caution reducing the depth of the flexion & extension asking students to gauge their inner experience.

Bibliography:

Figures 1 & 2:http://www.interactive-biology.com/3992/functional-anatomy-of-the-knee-movement-and-stability/ accessed 12.01.18
Figure 3: http://www.nlm.nih.gov/medlineplus/ency/imagepages/19506.htm accessed 12.01.18