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# Joint Structure and Function

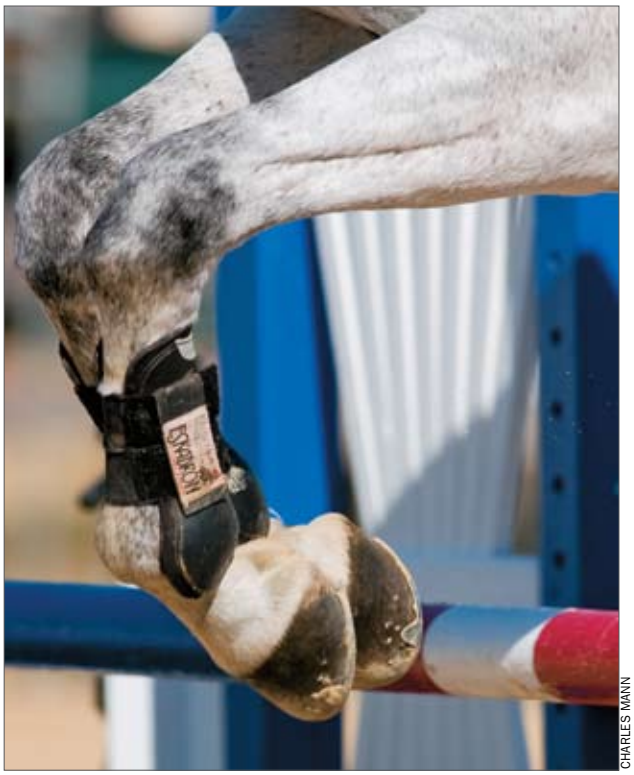
*There are three types of equine joints: synovial, fibrous, and cartilaginous*

## Overview

The equine skeletal system is comprised of more than 200 bones that interconnect with the assistance of connective tissues such as tendons, ligaments, and cartilage.[1-3] Where two or more bones meet is considered a joint.

Of the three different types of joints, the synovial joint is the most common type in the horse's body. Synovial joints are freely movable synovial fluid-filled anatomic structures that have a joint capsule surrounding the joint.[1,3]

In contrast, a fibrous joint is an immovable joint that exists between two bones (such as the bones of the skull), and a cartilaginous joint holds bones together via fibrocartilaginous discs and ligaments that permit only a limited amount of movement. Examples of fibrous joints include the joints between individual vertebrae and the pubic symphis (where the pubic bones join at the pelvic girdle).[1]



CHARLES MANN

The highly specialized tissues of the synovial joint (such as the knee) come together to perform two main functions: enable movement and transfer load from one bone to another.

The equine skeletal system is comprised of a number of different types of synovial joints. These include: ball and socket joints in which the rounded end of one bone fits into the hollow curve of the opposing bone, such as the hip and shoulder; hinge joints in which the bones and ligaments are arranged to permit motion in one direction only, such as the elbow; and gliding joints, such as the carpus (knee) and tarsus (hock), in which the flat surfaces of opposing bones slide over one another permitting only a limited amount of movement.

## The Synovial (Diarthroidal) Joint

Regardless of the actual type or location of the synovial joint, the basic structure of all synovial joints is the same. All synovial joints have:[4]

- Two or more bones (ending with a plate of subchondral bone) covered with a thin layer of articular cartilage.
- A synovial-fluid filled cavity between the articulating bones.
- A synovial membrane lining the inner layer of the joint.
- A joint capsule that encapsulates the joint.

Depending on the joint, discs of cartilage (called menisci) might be present to cushion the articulating long bones inside the joint (such as the junction between the femur and tibia in the stifle). Also, the number and location of ligaments and tendons that help stabilize the joint varies from joint to joint. These include intra-articular ligaments (such as the cruciate ligaments in a horse's stifle) and ligaments and tendons located outside the joint (such as collateral ligaments).

## Joints are Organs

A joint is more than simply the union of two or more bones; the joint is an organ.[5] The highly specialized tissues of the synovial joint come together to perform two main functions: enable movement and transfer load from one bone to another. In a normally functioning joint, both of these tasks are achieved in an efficient and pain-free manner. The secret of how this frictionless, painless movement occurs relies on all the joint elements functioning in concert, but necessitates the involvement of healthy articular cartilage lining bones.

Articular cartilage is an extremely specialized connective tissue capable of withstanding very high loads during physical activity. It is composed largely of water (70-80% of articular cartilage is water), type II collagen fibrils, proteoglycan molecules such as aggrecan, chondrocytes (cartilage cells), and a variety of miscellaneous (yet important) molecules.

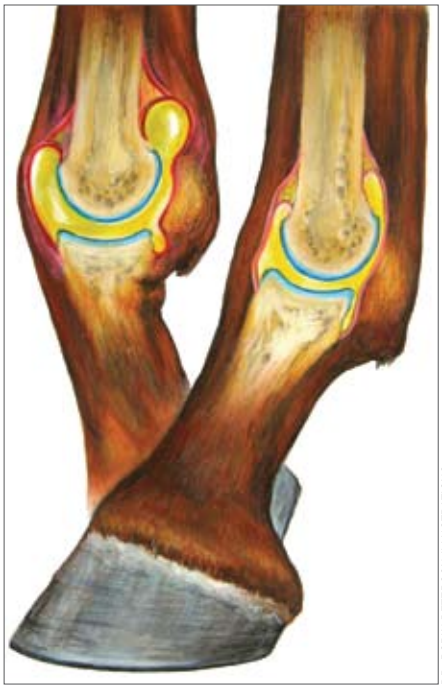
The chondrocytes are responsible for synthesizing, organizing, and regulating the extracellular matrix of the articular cartilage. The extracellular matrix is the tissue surrounding the chondrocytes where water, collagen, and proteoglycans are found. The type II collagen forms a fibrillar network within the extracellular matrix, which is responsible for maintaining the shape and strength of the tissue. Also found within the extracellular matrix are large, negatively charged macromolecules called proteoglycans. These are a mixture of proteins and long chains of

sugar that attract large amounts of water, but repel each other. The most common proteoglycan in articular cartilage is aggrecan—a very large proteoglycan that plays a pivotal role in the function of articular cartilage.

During weight bearing, the aggrecan molecules, which are already very tightly packed together, become even further compressed. During this compression water molecules (that were attracted to the negatively charged aggrecan molecules) are forced from the extracellular matrix of the cartilage, and all of the negatively charged branches of the aggrecan molecule repel each other like similar ends of a magnet. That is, the bones are protected by this layer of shock-absorbing articular cartilage and the load is transmitted from one bone to another.

## Problems of Joints

Musculoskeletal dysfunction is the leading cause of lameness and loss of function in athletic horses. Joints can become damaged in one of two main ways: abnormal forces acting on normal cartilage or normal forces acting on abnormal cartilage.[5]



DR. ROBIN PETERSON ILLUSTRATIONS

View of normal left fetlock joint and abnormal (inflamed) right fetlock joint.

Horses also can have infections in various structures of the joint and congenital abnormalities (problems foals are born with, such as angular limb deformities) that affect joints. In a diseased joint, such as one with synovitis or capsulitis (i.e., inflammation of the synovial membrane or fibrous joint capsule, both common in athletic horses)—even normal stresses can initiate, perpetuate, or exacerbate degeneration of articular cartilage.

The progressive destruction of articular cartilage in diarthroidal joints is known as osteoarthritis: the leading cause of joint disease in horses.

## REFERENCES

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