MECHANICAL DESIGN IN THE HUMAN BODY

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In the real world a design logically implies a designer. The human body abounds with both simple and complex parts with intricate designs. The pulley is one of man's most work-saving machines. Thirteen examples of pulleys in the human body, grouped into five classes, are discussed. It is logical to conclude that these complex, mechanical examples did not evolve by consecutive random accidents of unthinking molecules but are the results of the planned thinking and workmanship of a Divine Designer.

When one of my anatomy students who has just comprehended one of the intricate designs in the human body asks me "how did this happen to evolve, my usual reply is "all intricate designs in the human body cannot be explained by gradual mutations over vast periods of time. God must have gotten into the act." Since in the real world, the existence of a watch demands the mind and effort of a watchmaker, likewise the existence of an intricate design in the human body demands the existence of the mind and effort of a brilliant Designer. Complex designs do not come about by random raw material accidentally meeting a random energy system over an everlasting period of time. To put it in collegiate slang "how can nobody make everything?" There must be a Grand Designer behind every grand design.

I like to refer this argument to the field of automotive production. Some autos are better than others because of better designs and quality workmanship. There has to be a "thinking force" behind every designed part. Automobiles are not made by unthinking randomness. Holroyd has stated it succintly "When changes are made in good designs by accidents, it is practically certain that the designs will be damaged or destroyed."[1]

At one time as an immature student of science, I had great admiration for man-controlled secular science. But after over 20 years of scientific experience, I now realize how weak and limited man-devised science is. As far as I am concerned it is very easy to distinguish between man-made and God-made designs. The more you magnify man-made designs, the cruder they appear, but the more you magnify God-made designs the more complex and precise they appear. One of the giants of science has said it so clearly: "it is not to be conceived that mere mechanical causes could give birth to so many regular motions . . . this most beautiful system of the sun, planets and comets, could only proceed from the counsel and dominion of an intelligent and powerful being."[2]

In a previous article[3] I cited some examples of mechanical designs in the human body. In this article I would like to cite some further examples of well-designed pulley systems in the human body that obviously infer the "planned thinking and workmanship" of a Divine Designer. A pulley can be defined as "a wheel, sometimes turning in a block, with a grooved rim in which a rope or chain runs that can raise or lower a weight attached at one end by pulling on the other end." It is one of the simple machines of mechanics, a subdiscipline of physics. Other simple machines are the lever, the inclined plane, the wheel and axle, the gear, the wedge and the screw. From these simple machines most more complex machines can be devised and built. In general these simple machines either give a resistance force a higher velocity at the expense of an effort force or gain magnitude of effort force at the sacrifice of magnitude of velocity.

There are two basic types of pulley systems. First, the "block and tackle" system which has both fixed and moveable pulleys. In this system, greater magnitude of force is gained at the expense of applying a lesser magnitude of force over a greater distance. Second, pulleys which are used to change the direction of an applied force. Figures 1 and 2 depict two basic types of pulleys devised by "intelligent" man. There are a number of bone-joint structures in the human body which simulate the pulley action of changing the direction of an applied force. In most cases a rounded bony part acts as the pulley wheel, the tendon acts as the cord, the muscular contraction supplies the effort force and the weight of the bone (limb) located at its center of gravity acts as the resistance force.

An anatomical pulley has two mechanical purposes. Some pulleys will completely change the action of a joint. Other pulleys will alter the angle of muscular insertion giving the muscle a mechanical advantage. Figures 3 and 4 demonstrate the difference between a muscle with a small angle of insertion and a muscle with a large angle of insertion.

Classification of Pulleys

Coleman[4] has recently grouped pulleys into five classes. These classifications with examples in the human body are clear signs of simple mechanical devices that had to be designed by a Divine Designer.

Class I

In this class an improved joint action results from the muscle tendon passing over an external structure which serves as the pulley wheel.

Example 1: the knee joint is the most obvious example of this (Figure 5). In reality, the patella is not necessary for the quadriceps muscle group to extend the tibia bone. But the patella is necessary to change the angle of insertion of the patellar ligament (which is an extension of the quadriceps tendon) into the tuberosity on the tibia. This hemispheric bone increases the angle of insertion of the patellar ligament which increases the

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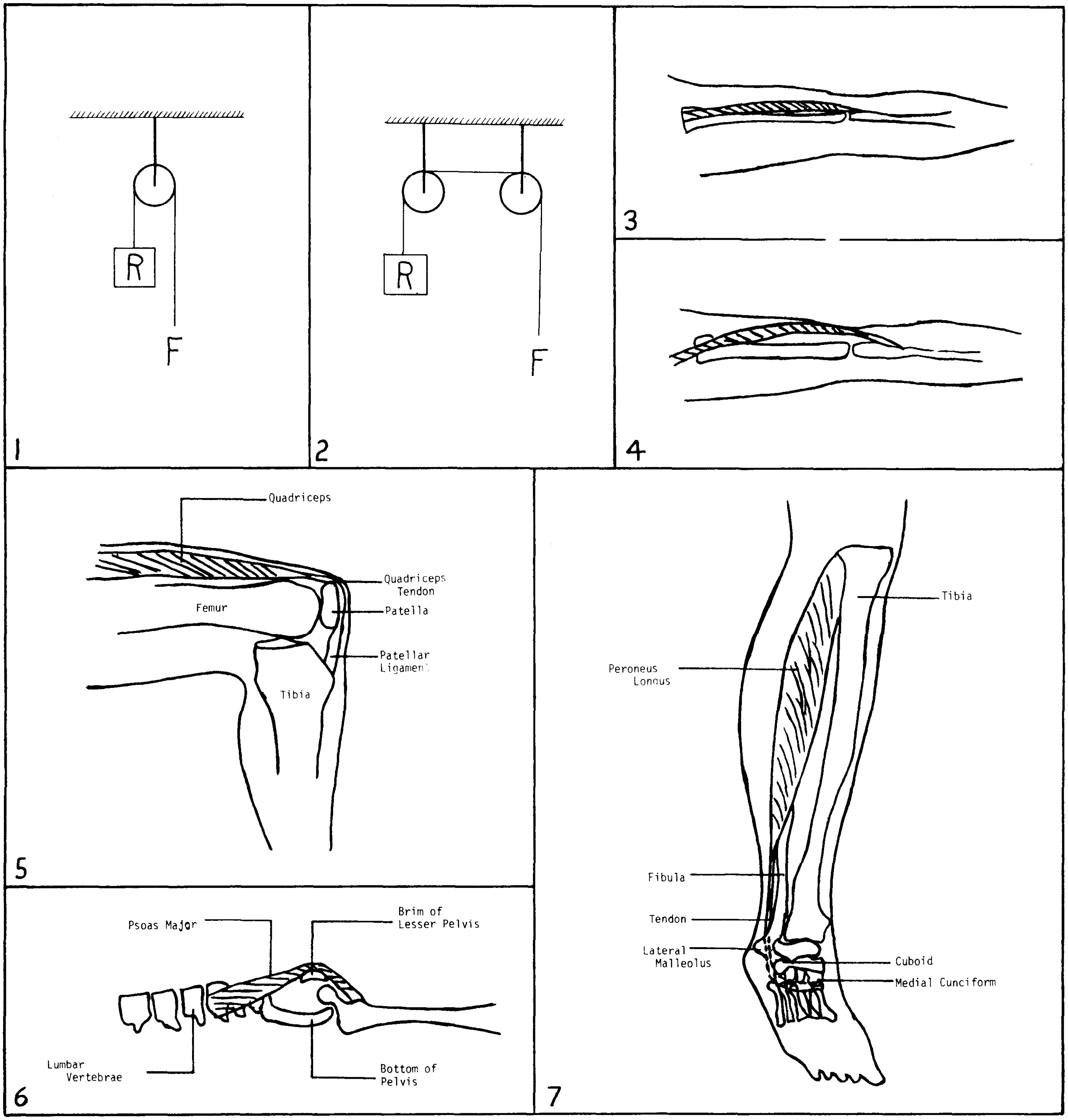
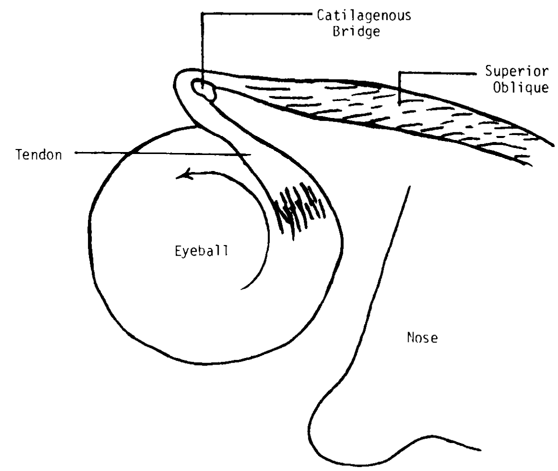


CAPTION FOR THE ILLUSTRATIONS

The various Figures are collected into these two Plates, as follows: 1: Simple Pulley; 2: Double Pulley (Sometimes, however, that term is reserved for arrangements in which one of the pulleys moves); 3: Muscle with Small Angle of Insertion; 4: Muscle with Large Angle of Insertion; 5: Patella Acting as Pulley at the Knee Joint; 6: Brim of Lesser Pelvis Acting as Pulley for Psoas Major; 7: Lateral Malleolus and Cuboid Acting as Double Pulleys for Peroneus Longus; 8: Cartilagenous Troehlea Acting as Pulley for Superior Oblique Muscle of Eye; 9: Ligamentous Sling acting as Pulley for Omohyoid; 10: Distal Interphalangeal Joint Acting as Pulley for Flexor Digitorum Profundus; 11: Epicondyle of Femur Acting as Pulley for Gracilis Tendon; 12: Metacarpophalangeal Joint Acting as Pulley for Palmar Interossei; 13: Shoulder Joint Acting as Pulley for Middle Deltoid; 14: Head of Radius Acting as Pulley for Supinator; 15: Increased Size of Brachialis and Brachium Acting as Pulley for Biceps Brachium.

trigonometric sine relationship which increases the magnitude of the applied force on the tibia.

Example 2: at the hip joint the psoas major muscle passes over the brim of the lesser pelvis (Figure 6). As a person lies on his back, both the origin on the lumbar vertebrae and the insertion on the lesser trochanter of the femur are posterior to the brim of the lesser pelvis. The elevated brim of the lesser pelvis increases both the



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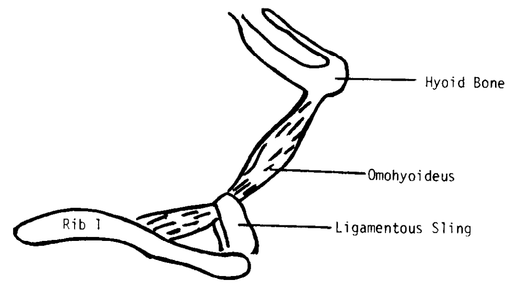

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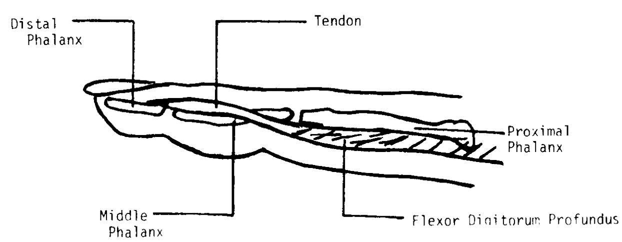

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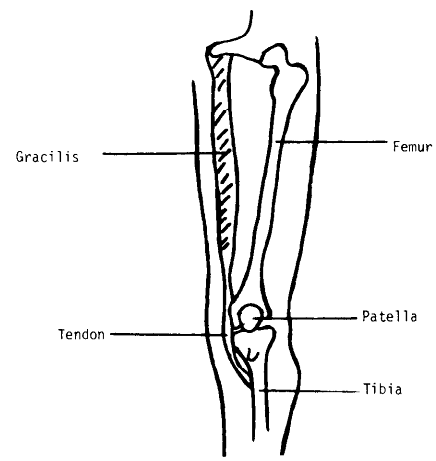

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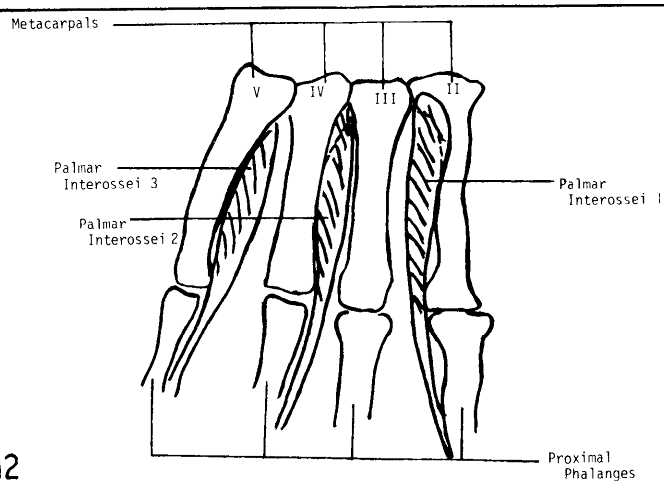

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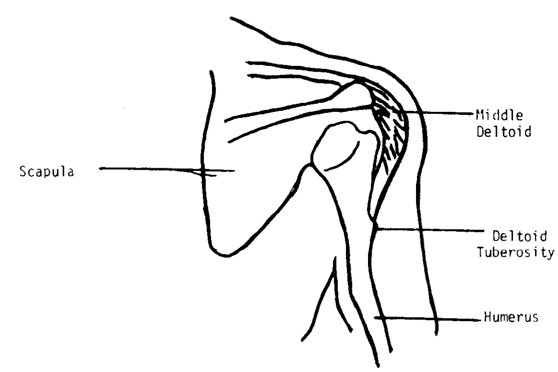

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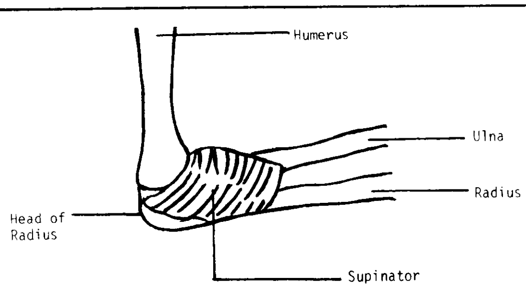

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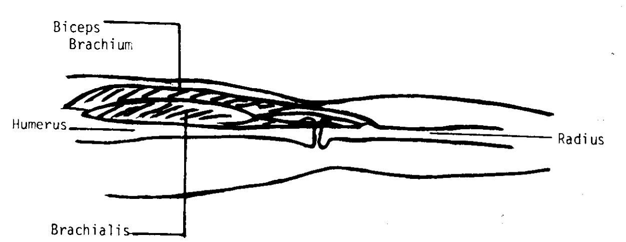

15

angle of origin and angle of insertion of the psoas major. If the trunk is flexed on the femur or the femur flexed on the trunk, both movements have a greater magnitude of applied force because of this increase in angular pull. This pulley device at the hip joint causes two major kinesiological results. First, if the brim of the lesser pelvis did not improve the angle of pull of the psoas major, this muscle could not be a major hip flexor. Second, the psoas major would not be the main muscular culprit in promoting the prevelant postural disorder, lordosis (hollow back).

Class II Pulleys

In this class the action of the muscle at the joint is altered because of the pulley.

Example 1: Figure 7 depicts the tendon of the peroneus longus muscle proceeding down the lateral calf behind the first pulley, the lateral malleolus of the fibula, curving forward and under the foot, passing along the groove in the second pulley, the cuboid bone, and finally inserting on the lateral side of the medial (first) cuneiform bone. The first pulley causes the applied force to plantar flex the ankle (extending the foot as in pointing the toes), and the second pulley causes the applied force to evert the ankle (as moving the lateral border of the foot away from the midline of the body in a frontal plane). Without these pulleys this muscle would insert in front of the ankle and on top of the foot, and its action would be limited to only dorsiflexion at the ankle joint (moving the instep toward the tibia in a sagittal plane).

Example 2: Figure 8 depicts the action of the superior oblique muscle of the eye. The tendon of this muscle passes over a small cartilagenous bridge called the trochlea (Latin for pulley). This change in angle of pull causes this muscle to rotate the eyeball obliquely.

Example 3: Figure 9 depicts the omohyoid muscle pulling on the hyoid bone, a horseshoe shaped bone in the anterior neck. The pulley is a ligamentous sling which directs the applied force downward rather than backward.

Class III Pulleys

In this class the joint framework serves as the pulley.

Example 1: Figure 10 depicts the flexor digitorum profundus passing over the knuckles of the distal interphalangeal joint. Similarly, the tendon of the gracilis muscle on the medial thigh gains a favorable angle because of the size of the medial epicondyles of the femur (Figure 11).

Example 2: Figure 12 depicts the tendons of the palmar interossei muscles as they pass over the metacarpophalangel joints. The heads of the metacarpals alter the angle of pull of these muscles causing the applied force to adduct the fingers (pull fingers II, IV and V toward finger III in the frontal plane).

Example 3: Figure 13 depicts the belly of the middle deltoid muscle as it passes over the shoulder joint. The head of the humerus causes an improved angle of insertion on the deltoid tuberosity of the humerus resulting in abduction of the shoulder joint (lifting the upperarm away from the midline of the body in a frontal plane).

Class IV Pulleys

In this class the muscle wraps around the pulley causing the pulley to rotate. Figure 14 depicts the supinator muscle wrapping around the head of the radius. In this example the pulley action is not to gain a more favorable mechanical advantage, but to cause the pulley to rotate. Mechanical advantage can only be increased here by having a bone with a larger cross sectional area (radius).

Class V Pulleys

In this case the muscle acts as its own pulley. Figure 15 depicts the biceps brachium muscle with the elbow extended. As this muscle increases in size, it not only becomes stronger but the angle of insertion increases slightly. Added to this is the probability that when the brachialis, which is a bulky muscle underneath the biceps brachium, is increased in size and strength, this also will elevate the biceps brachium a little.

Summary

Five classes of pulleys which increase the mechanical actions at certain joints have been discussed. Is it not reasonable to conclude that these advanced, complex devices did not come about by random accidents by unthinking molecules, but are the result of the planned thinking and workmanship of a Divine Designer?

References

[1]Holroyd, H.B., 1975. Arguments against symmetry and design from chance events. *Creation Research Society Quarterly*, 12 (2); 95-98.

[2]Newton, Sir Isaac, Mathematical principles of natural philosophy: Optics. (in) *Great Books of the Western World*, vol. 34, William Benton, Chicago, 1952. P. 369.

[3]Kaufmann, D.A., 1974. Design in the human body. *Creation Research Society Quarterly*, 11 (2): 91-94.

[4]Coleman, J., 1978. The function of anatomical pulleys *Proceedings Kinesiology: A National Conference on Teaching*. ed. by C. Dillman and R. Sears. University of Illinois, Urbana. Pp. 63-73.

QUOTABLE QUOTE

"Just as in the law courts no man can pass judgement who does not listen to the arguments from both parties, so must the person whose task is to study philosophy place himself in a better position to reach a judgement by listening to all the arguments, as if they came from undecided litigants."

St. Thomas Aquinas, in his Exposition of Aristotle's *Metaphysics*.