SUGGESTED REFERENCES

- Dimon, Jr. Theodore & Megan Day
  Anatomy of The Moving Body
  North Atlantic Books, 2001

- Nadis, Steve.
  Synthetic Muscularity
  Popular Science, October 1999

WEBSITES

- *Muscles In Motion*
  http://schod.discovery.com/lessonplans/programs/seehowtheyrun

- *An Electronic Textbook on The Human Skeleton*
  http://www.ecsu.ctstateu.edu/depts/edu/textbooks/skeleton.html

- *Nasa Jet Propulsion Laboratory*
  http://eis.jpl.nasa.gov

NATIONAL SCIENCE EDUCATION STANDARDS

Science Content Standards:

K - 4	Characteristics of Organisms
5 - 8	Structure and Function of Living Systems

CREDITS

The producers thank Channel 4 Television Corporation/4 Learning for materials used in this program.

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SCIENCE SCREEN REPORT® FOR KIDS

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MOVEMENT OF THE HUMAN BODY

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SYNOPSIS

The intricate relationship between our skeletal and muscular systems allows the body to stand and move. This relationship is continually being studied to add to our knowledge about structural integrity and flexibility.

This edition of SCIENCE SCREEN REPORT FOR KIDS looks at the human body in motion. It explains the composition of our muscles and bones, and it illustrates how they interact to create movement. The program also demonstrates how researchers use this knowledge to improve athletic performance, and to develop new and improved technologies by adapting elements of the body's mechanics.

CURRICULUM UNITS	RUNNING TIME
■ ANATOMY	13:41
■ BIOLOGY	
■ ENGINEERING	
■ HEALTH	
■ PHYSIOLOGY	

BACKGROUND

The skeleton not only provides the frame that holds our body in shape, it also works with the body's six hundred and fifty muscles to allow movement to occur.

This report looks at the skeleton and the bones themselves, exploring how they are composed and how they work in the body. We see experiments that measure the amount of pressure a bone can take before breaking, and the results of calcium loss when a bone is immersed in acid.

The program also demonstrates how muscles are attached to bones, how muscles are made to contract, and how they make us move. Illustrations show muscle fibers close up. Animations also portray how antagonistic muscle pairs work together as a gymnast performs, and how the bicep muscle contracts while the tricep relaxes.

Early in life, we all go through training to learn basic movements like walking and eating. However, performing beyond the norm requires dedication, practice and skill. Divers, for example, train hard to get themselves into prime condition, but even that is not always enough. Recognizing that performance takes more than just muscle and bone, researchers study how athletes move and what they need to do to improve their performance. They also work with computer animations and other techniques to demonstrate how improvements can be achieved.

Engineers study the body's skeletal and muscular systems in order to discover principles of design that work best. The superior strength built into the hollow physical structure of bones is demonstrated by a comparison of the pressures required to bend hollow metal tubes versus solid metal rods. This structure has been imitated in engineering materials such as bicycle frames, girders, and roll bars that provide the greatest strength with the least mass.

Simple animations used to improve athletic performance have been utilized to develop highly complex and lifelike computer games. Engineers are using artificial muscles to move robots, and scientists have already developed some artificial limbs that will enable incapacitated people to regain day-to-day functioning. But, this is just the beginning of what might be achieved by studying the skeletal and muscular systems and how they work together to create movement.

CAREER POSSIBILITIES

- BIOLOGIST
- CHIROPRACTOR
- MATERIALS ENGINEER
- MEDICAL DOCTOR
- ORTHOPEDIST
- PHYSIOLOGIST
- PHYSICAL THERAPIST
- ROBOTIC ENGINEER
- SPORT SCIENTIST

VOCABULARY

Analyze: . . . . . to examine by separating into parts and studying relationships
Animation: . . . the creation of artificial moving images
Antagonistic: . . a muscle that counteracts the action of another muscle
Artificial: . . . . made to imitate nature
Athlete: . . . . . someone with natural or trained ability for physical exercises or sports
Capture: . . . . . to gain possession of; to attract and hold
Compact: . . . . solid; dense
Constantly: . . . seemingly uninterrupted
Dedication: . . . devotion; commitment
Flexible: . . . . . capable of being bent or stretched
Force: . . . . . a push or pull that causes physical change
Honeycombed: . . full of cavities like a bee's honeycomb
Imitate: . . . . . to copy; to try to be like
Mineral: . . . . . a naturally occurring substance usually obtained from the ground
Porous: . . . . . full of pores or small openings
Reaction: . . . . . a response to a stimulus or a chemical change
Rigid: . . . . . stiff; firm; unbending
Structure: . . . . . arrangement of parts organized in a definite pattern
Tissues: . . . . . a mass of cells forming elements of a plant or animal body

CRITICAL THINKING EXERCISES

1. After showing the video, ask your students the following:
   a| Why do we need to have a skeleton?
   b| How do muscles work?
   c| How can we show that bones are strong?
   d| What is it about bones that makes them so strong?
   e| What are antagonistic muscle pairs and how do they work?

2. Discuss how scientists study athletic performance.
3. Discuss how muscles and bones work together to produce motion.
4. Discuss calcium and why it's necessary for healthy bones.
5. Discuss what it takes for an athlete to perform at his or her best, and compare to performance in other fields.
6. Arrange a tour of a gym and see how athletes train their muscles.