

SEAL HEART STUDIES

What can seals tell us about heart disease?

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Your heart is a remarkable organ.

Did you know that: at an average of about 70 beats each minute, your heart beats 4,200 times per hour and ...

**100,800 times per day
705,600 times per week
2,822,400 times per month
33,868,800 times per year and
more than 2.5 billion times in a lifetime of 75 years!**

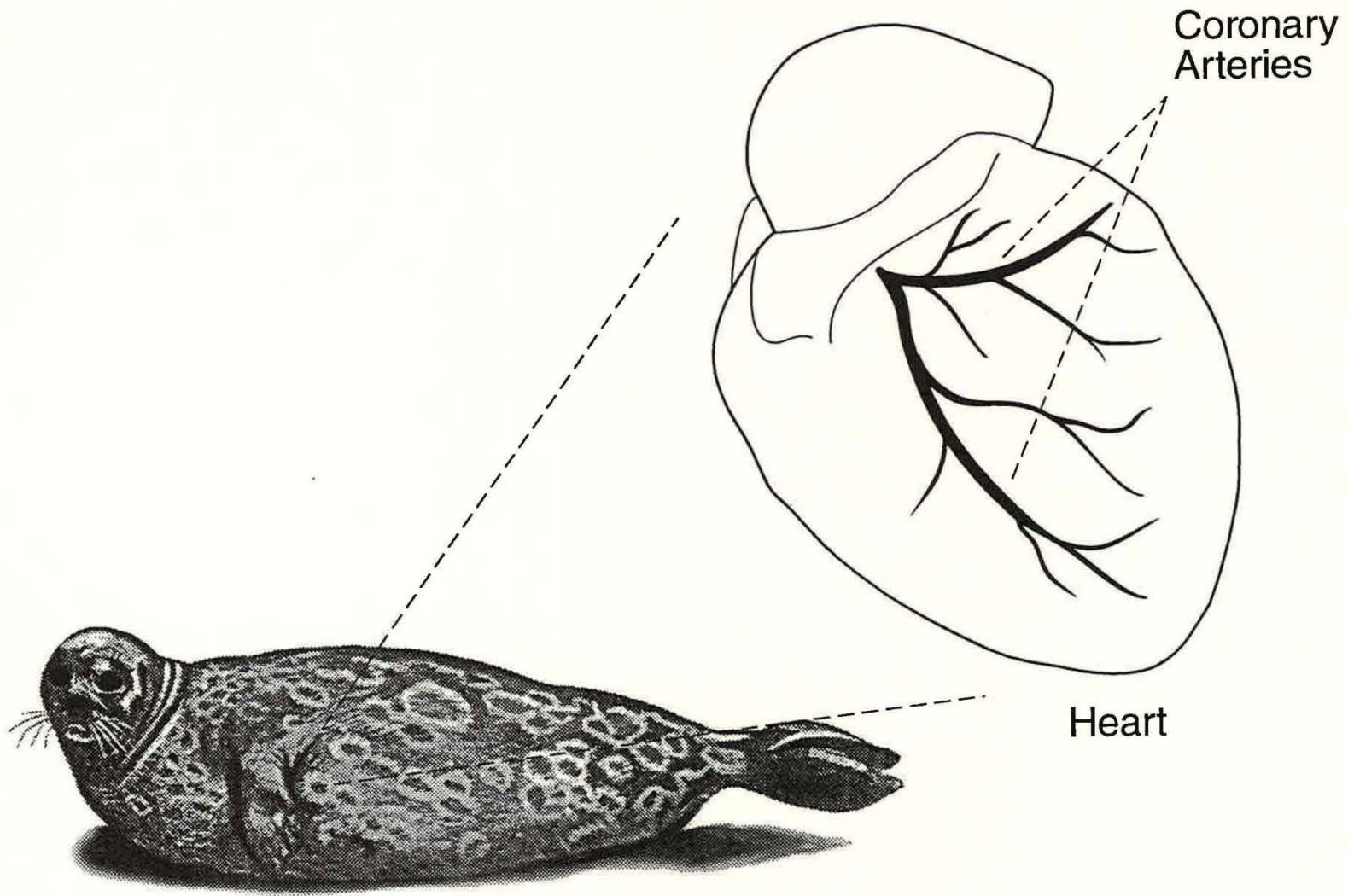
The heart is a pump. It pumps the blood carrying oxygen and nutrition to all the cells of the body. The output of the pump is about 1 1/4 gallons each minute. That amounts to...

75	gallons per hour	(about 1.5 fuel barrels)
1,800	gallons per day	(about 36 barrels)
12,600	gallons per week	(about 250 barrels)
50,400	gallons per month	(about 1,000 barrels)
604, 800	gallons per year	(about 12,100 barrels)

and ...

45,360,000 gallons in a lifetime of 75 years

(FOUR times the Exxon Valdez oil spill!)



The coronary arteries are the supply lifeline for the heart pump muscle.

The heart is a strong and complex muscle, and its contraction performs the pumping action. In order for this extraordinary pump to work regularly and flawlessly, its muscle needs a steady and sure supply of blood. The heart muscle depends upon the nutrients and oxygen in blood delivered by the coronary arteries. Failure in this blood flow, even briefly, leads to distress of the heart. This condition is indicated by chest pain and eventually failure of the heart pump - what we know as a "heart attack" - a major cause of human disease and death.

WHAT DO SEALS HAVE TO DO WITH HEART DISEASE?

Their hearts must work under extreme conditions, sometimes including lack of oxygen. Their adaptations for underwater dives show how they can tolerate long periods without breathing. In fact, they are the champions of all

mammals at breath-holding for their long dives. The common circumpolar ringed seals (NATCHIQ) can stay underwater for 15 to 20 minutes. Some other species can dive for one hour or longer.

When a seal dives, its only source of oxygen is the storage it can carry in its body, mostly in blood and muscle. The heart beats at a slower rate. Eventually, in a long dive, the available oxygen supply runs out, but the seal's heart can continue to function for a while longer. Not only that, seals appear to benefit by frequently reducing blood flow to the heart muscle for brief periods, resembling what happens in human heart attacks. That means that what is life-threatening for humans is a beneficial adaptation for seals!

The purpose of this research project is to learn how the seal's heart can work without blood flow and oxygen. To do this we need to understand how its coronary blood flow is regulated and what is different in the structure and chemistry of its heart muscle cells. Steady progress is being made, but there is still much to learn.

Many people contribute to this research. The support of the North Slope Borough Department of Wildlife Management has made the project possible. Staff of the Department are very helpful. Scientists from other universities in the US, Australia, Norway and Sweden have cooperated with special skills. The work has been supported by the American Heart Association and the Alaska Sea Grant College Program.



Microscopic view of small branch coronary arteries of ringed seal heart. Magnification 150 X.

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