# NEWS – Identification of Splenic Reservoir Monocytes and Their Deployment to Inflammatory Sites

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Finally, the Spleen Gets Some Respect

By NATALIE ANGIER

As a confirmed crab apple who has often been compared to the splenetic Lucy Van Pelt character from Peanuts, I am gratified to learn that should my real spleen ever decide to vent in earnest, the outburst may just help save my life.

Scientists have discovered that the spleen, long consigned to the B-list of abdominal organs and known as much for its metaphoric as its physiological value, plays a more important role in the body’s defense system than anyone suspected.

Reporting in the current issue of the journal Science, researchers from Massachusetts General Hospital and Harvard Medical School describe studies showing that the spleen is a reservoir for huge numbers of immune cells called monocytes, and that in the event of a serious trauma to the body like a heart attack, gashing wound or microbial invasion, the spleen will disgorge those monocyte multitudes into the bloodstream to tackle the crisis.

“The parallel in military terms is a standing army,” said Matthias Nahrendorf, an author of the report. “You don’t want to have to recruit an entire fighting force from the ground up every time you need it.”

That researchers are only now discovering a major feature of a rather large organ they have been studying for at least 2,000 years demonstrates yet again that there is nothing so foreign as the place we call home.

“Often, if you come across something in the body that seems like a big deal, you think, ‘Why didn’t anybody check this before?’ ” Dr. Nahrendorf said. “But the more you learn, the more you realize that we’re just scratching on the surface of life. We don’t know the whole story about anything.”

Dr. Nahrendorf, with Filip K. Swirski, Mikael J. Pittet and a dozen other colleagues, performed the initial studies using mice, but the scientists suspect the results will apply to humans as well.

Ulrich H. von Andrian, an immunologist at Harvard Medical School who was not involved with the research, agreed that the findings were a surprise. “If one had to guess the source of these cells, one would have thought it likely that they were mobilized from the bone marrow rather than from the spleen,” he said. “The discovery adds another layer of complexity not previously
The latest work also sounds a cautionary note against underestimating a body part or dismissing it as vestigial, expendable or past its prime. In an accompanying essay, Ting Jia and Eric G. Pamer of Memorial Sloan-Kettering Cancer Center admit that “the spleen lacks the gravitas of neighboring organs” like the liver or the stomach “because we can survive without it.”

Spleens can rupture during contact sports, say, or in a motorcycle accident, at which point surgeons have no choice.

“It’s such a vascularized organ, and the risk of big-time hemorrhaging is so great, that if the spleen ruptures, it’s a surgical emergency,” said James N. George, a hematologist with the University of Oklahoma Health Sciences Center. “You have to remove it.”

The new findings in no way counter the necessity of excising a ruptured spleen, the researchers said, but they do suggest that the loss of the organ is more than a mere “inconvenience,” as it has often been depicted, and could help explain previous reports showing an enhanced risk of early death among people who have undergone splenectomies.

In one study that appeared in The Lancet in 1977, for example, researchers compared a group of 740 American veterans of World War II who had had their spleens removed as a result of battle injuries with a similar size sample of veterans who had suffered other war injuries but had kept their spleens. The splenectomized men, the researchers found, were twice as likely to die of cardiovascular disease as were the veterans in the control group. All of which means that despleening should be diligently guarded against, particularly among our little sports warriors, perhaps through the wearing of appropriate protective gear.

Researchers cite other cases in which organs were presumed to be so dispensable that they could be removed “prophylactically” — often with unfortunate outcomes. In recent years, for example, many older women undergoing hysterectomies have been advised to have their healthy ovaries removed at the same time, the rationale being: if you are past your childbearing years, why hang on to reproductive organs that might turn cancerous and kill you? Yet follow-up surveys have shown that women who underwent elective ovariectomy had a heightened risk of dying during a given study period, were more susceptible to heart disease and lung cancer and were twice as likely to develop Parkinson’s disease compared with women who had kept their ovaries. “Evolution has an edge on us,” Dr. Nahrendorf said. “I would be very careful about saying, ‘You don’t need this organ, get rid of it.’ ”

Another reason to esteem the spleen — a purplish, fist-size, five-ounce organ in the upper left quadrant of the abdominal cavity, just behind the stomach and under the diaphragm — is its illustrious medical and poetic history. Galen considered the spleen to be a source of one of the four bodily humors, specifically the black bile associated with irritable, melancholic cranks. In his poem, “Spleen,” Charles Baudelaire describes a young narrator so weary and despondent,
unresponsive even to beautiful women and jesting men, that it is as if the “green waters of Lethe” fills his veins.

More recently, researchers determined that the spleen is like an elaborate wetlands, a Mississippi bayou for filtering and freshening the blood. In other organs, blood flows through an interconnected mesh of increasingly narrow arteries, veins and capillaries. The spleen, by contrast, has a so-called noncapillary circulatory system: as the blood flows in, it is dumped into puddle-like sinusoids, and to get back out it must squeeze between cells. That dumping and squeezing help filter out blood-borne parasites, aging blood cells too brittle for compression and the little oxidized pellets, the BB’s, with which red blood cells are often pocked. The spleen has often been called a graveyard for red blood cells, but it is more of a recycling center, for the iron and other components are plucked out of the cells and used to stock new hemoglobin cages.

Filtration, cannibalization, and now — serious monocyte cultivation. In the new study, the researchers began by looking at monocytes, the largest of the body’s white blood cells. “It was recognized that these cells are the major repair workers after a heart attack,” Dr. Nahrendorf said. “They remove dead muscle cells, they start rebuilding stable scar tissue, they stimulate the generation of new blood vessels.”

The cells make haste to cut and paste. “Within 24 hours after a myocardial infarction,” Dr. Nahrendorf said, “there are millions of monocytes” congregating around the broken heart. All of which would seem sensible, desirable, an excellent display of emergency preparedness, except that Dr. Nahrendorf and his principal colleagues were puzzled by one big unknown: Where did the rapid response team come from? The numbers circulating in the blood were simply too low. The researchers searched one organ after another, until they checked the spleen and found the monocytic mother lode. “The numbers there were huge, 10 times higher than what was in the bloodstream,” Dr. Nahrendorf said.

By the researchers’ reckoning, monocytes, like all blood cells, are born in the bone marrow and at some point migrate to the spleen, lured by cues yet to be identified. They sit and wait, a sessile bunch, but when aroused by such chemical signatures of damage as angiotensin, the cells surge forth without hesitation, a reaction the researchers hope someday to understand well enough to recapitulate at will. Hail to the chief, hail to the queen and hail to the monocytes residing in my spleen.
Spleen Gives Heart a Leg Up

A study in the journal Science shows that the spleen has a previously unrecognized function, as a large reservoir of infection-fighting monocytes that come into play in heart damage. Cynthia Graber reports

They've shown that the spleen is what they call a critical reservoir of monocytes. Those are cells that scientists had previously thought were only found in bone marrow and blood that help fight infection. Scientists discovered these spleen-based monocytes by accident. They were investigating heart damage and found more monocytes at the site of the damage than should have been in the entire circulatory system. Upon investigation, they found the reservoir in the spleen.

After a heart attack, those monocytes surge out of the spleen. When they reach the heart, they fight infection and are critically important in helping mend the heart tissue. The researchers now want to find out if there are other conditions where spleen-based monocytes are critical. Finally, the Rodney Dangerfield of organs gets some respect.

—Cynthia Graber

60-Second Science is a daily Podcast. Subscribe to this Podcast: RSS | iTunes
Appendix, tonsils, various redundant veins—they're all vestigial body parts once considered expendable, if not downright useless.

But as technology has advanced, researchers have found that, more often than not, some of these "junk parts" are actually hard at work.

Case in point: the spleen, which a new study shows may be critical in healing damaged hearts (interactive heart guide).

Sure, the spleen—kidney shaped and tucked into the upper left of your abdomen—helps spot infections and filters out red blood cells that are damaged or old. But overall the organ has been seen as nonessential. Cut it out, and people still live.

But the new study, to be published tomorrow in the journal Science, has uncovered another, more critical role.

How Do You Mend a Broken Heart?

Researchers studying mice discovered that the spleen stores monocytes, white blood cells essential for immune defense and tissue repair.

Previously, scientists had thought monocytes were made only in bone marrow, like other types of white blood cells, and were "stored" in the bloodstream.

But the new study found that the spleen contains ten times as many monocytes as blood—making it a far more important storehouse.

What's more, the spleen is the source of 40 to 50 percent of the monocytes involved in nursing lab mice back to health after a heart attack, said study co-author Filip Swirski of Massachusetts General Hospital's Center for Systems Biology in Boston.

"If you're going to survive a heart attack, your heart has to heal the proper way, and that depends on monocytes," Swirski said.

"It was thought that the monocytes that accumulated immediately after a heart attack were ones that had been circulating in the blood. But we did calculations and found that the number that accumulated in the heart far exceeded the number in circulation," he said.

"And in studies where we removed the spleen and then induced a heart attack, we saw a vastly fewer number of monocytes accumulate."

Simply put, mice without spleens weren't able to recover as well.

Neither, it seems, can humans without spleens.

A 1977 study, published in the medical journal The Lancet, followed the health of World War II veterans over 20 years—some with spleens and some who'd lost theirs to war injuries.

The spleen-less men were twice as likely to die from heart disease and pneumonia.
"They knew the spleen played an important role, but they didn't know how," Swirski said.

(Also see "Gene Doctors Milk Mice; Yield Human Breast Milk Protein.")

Dangerous Logic

None of this is surprising to Jeffrey Laitman, director of anatomy and functional morphology at New York City's Mount Sinai School of Medicine and president-elect of the American Association of Anatomists.

History is littered with body parts that were called "useless" simply because medical science had yet to understand them, Laitman said.

"People say, You can remove it and still live. But you have to be careful with that logic," he said. "You could remove your left leg and still live. But whenever a body part is moved or changed, there's a price to pay."

Appendix Rescued From Biology's Junk Heap

In some cases, life in the developed world—rather than insufficient medical technology—has obscured important functions of vestigial organs.

The appendix, a narrow tube that hangs off one end of the colon, is probably the most famous "junk" organ. But it's turned out to be important even today—in certain circumstances.

"It's hard to figure out what the appendix does when you're studying superclean animals and people," said Bill Parker, assistant professor of surgery at Duke University Medical Center and one of the researchers who exposed the appendix's secrets in a 2007 Journal of Theoretical Biology study.

Far from useless, the organ is actually a storehouse of beneficial bacteria that help us digest food (interactive digestive-system guide).

The appendix evolved for a much dirtier, parasite-plagued lifestyle than the one most people live in the developed world today, Parker said. But where diarrheal disease is common, for example, the appendix is apparently vital for repopulating intestines with helpful bacteria after an illness.

Another example of anatomy lagging behind lifestyle, according to Mount Sinai's Laitman, is collateral circulation. Certain systems of veins and arteries ensure blood flow when the main paths are blocked or damaged.

The systems appear to be truly vestigial, at least for now.

Elbows, knees, and shoulders, for example, all have collateral circulation, Laitman said, but the heart and much of the brain don't.

"Why would we adapt enormous redundancy in an elbow but not where it really matters?" Laitman said. "The answer is unsettling. When do we have strokes and heart attacks? Our 50s, 60s.

"When the blueprints for our species were being drawn up, nobody lived that long."

The fact that our bodies evolved while humans lived short lives hunting and gathering is one key to understanding many "useless" body parts, Laitman said.

From an evolutionary viewpoint, we've been living in the modern manner for a relatively short time, he pointed out. "Our circumstances have changed a lot, but our bodies haven't."
Hail the Spleen: An Underappreciated Organ Gets the Credit It Deserves

Gone are the days when scientists considered the spleen a waste of space. Previously, doctors knew that the organ—which is located behind your stomach—performs a variety of functions, from making antibodies to storing red blood cells, but they categorized it as nonessential. A new study published in *Science*, however, found that while it’s true that people can survive without a spleen, the organ is far from worthless [Science News]. Researchers found that the spleen is actually a crucial storage place for large numbers of monocytes, a type of immune cell.

Monocytes form in bone marrow and rally to fight an infection or repair the body after a trauma such as a heart attack, and scientists previously believed they were stored in the blood stream. In the study, scientists analyzed the monocytes found near the hearts of mice that had experienced a heart attack, and traced nearly half of the cells to the spleen. Later they found that the spleen contains ten times as many monocytes as blood—making it a far more important storehouse [National Geographic].

Although this is the first time the spleen’s role as a monocyte storehouse has been proven, scientists previously suspected the spleen might play an important role in the body. In fact, a 1977 study revealed that servicemen who had their spleen removed during World War II were more likely to die, especially from pneumonia and heart disease, in the 28 years after the war, than those whose spleens remained intact. But aside from showing exactly why the spleen is so important, the new findings may also shed light on the downside of monocytes. Too many monocytes ... can rev up inflammation too much. Since inflammation plays a deleterious role in cancer and many autoimmune diseases, a better understanding of monocytes’ migration from the spleen might offer ways to combat these diseases [Science News].

The spleen is far from the only organ whose importance was long neglected; for example, the appendix was once considered a vestigial trait. Then scientists found that the organ is highly important when people are commonly exposed to an unusually germ-ridden environment. [T]he organ is actually a storehouse of beneficial bacteria that help us digest food... The appendix evolved for a much dirtier, parasite-plagued lifestyle than the one most people live in the developed world today, [said surgeon Bill] Parker. But where diarrheal disease is common, for example, the appendix is apparently vital for repopulating intestines with helpful bacteria after an illness [National Geographic].
THE NOT-SO-DISPENSABLE SPLEEN

Overlooked organ harbors immune cells, serving a greater purpose than thought, new study finds

By Nathan Seppa

Web edition: Thursday, July 30th, 2009

It’s high time somebody said something nice about the lowly spleen. The much-maligned organ serves as a holding tank for ready-to-go immune agents called monocytes, a new study finds. These simple cells are first responders to trouble sites in the body, and the spleen is their main dispatcher, researchers report in the July 31 Science.

While it’s true that people can survive without a spleen, the organ is far from worthless. It recycles iron from old red blood cells, houses fresh blood cells, synthesizes antibodies and acts as a chamber in which pathogens are killed.

Monocytes are formed in the bone marrow and circulate in the blood stream. When the immune system detects an infection or trauma, immune proteins usher monocytes to trouble sites. There, a first wave of inflammatory monocytes engulfs pathogens, takes apart dead cells and cleans up debris from the battle. After a few days, a second wave, this time of anti-inflammatory monocytes, arrives to foster the rebuilding process.

Pittet teamed with Harvard colleagues Filip Swirski, Matthias Nahrendorf and others to ascertain these monocytes’ origins.

In a series of experiments in which they induced heart attacks in mice, the researchers showed that many monocytes arriving at traumatized heart tissue could be traced back to the spleen.

Further tests showed that the compound angiotensin-II, which is released into the blood during cardiac trauma, is needed to draw monocytes out of the spleen. Mice engineered to lack an angiotensin-II receptor failed to recruit monocytes from the organ, hindering healing in the heart. Other messenger proteins may also recruit monocytes, Pittet says.

The new findings may also shed light on the downside of monocytes. Too many monocytes from the first wave can rev up inflammation too much. Since inflammation plays a deleterious role in cancer and many autoimmune diseases, a better understanding of monocytes’ migration from the spleen might offer ways to combat these diseases, Pittet says.

The additional duties of the spleen may raise further doubts about whether its
removal is a good idea. In 1977, scientists reported that servicemen who had undergone spleen removal during World War II had higher rates of death due to diseases in general — and from heart disease and pneumonia specifically — during the 28 years following the war, compared with similar men who kept their spleens.

Spleen removal can indeed cause diminished response to some vaccines and increased susceptibility to infections, note Ting Jia and Eric Pamer of Memorial Sloan Kettering Institute in New York City, writing in the same issue of Science. With the new finding, they argue, “the organ gains some new respect.”
Mass. General researchers discovered an unexpected reservoir of the immune cells called monocytes in the spleen and showed that these cells are essential to recovery of cardiac tissue in an animal heart attack model.

Unexpected reservoir of monocytes discovered in the spleen

Mouse study indicates immune cells from spleen may be essential in healing heart attack damage

30 Jul 2009

It takes a spleen to mend a broken heart - that's the conclusion of a surprising new report from researchers at the Massachusetts General Hospital (MGH) Center for Systems Biology, directed by Ralph Weissleder, MD, PhD. In the July 31 issue of Science the team reports how, in following up an intriguing observation, they discovered an unexpected reservoir of the immune cells called monocytes in the spleen and went on to show that these cells are essential to recovery of cardiac tissue in an animal heart attack model.

"Monocytes are known to serve as a central defense system against injury, and we found that monocytes released from the spleen go directly to the injured heart and participate in wound healing," says Matthias Nahrendorf, MD, PhD, a co-lead author of the study.

Monocytes are generated in the bone marrow, released into the blood and are known to accumulate at injured or infected tissues, where they differentiate into macrophages or dendritic cells. In investigating processes involved in the healing of ischemic heart tissue - the sort of injury produced in a heart attack - in mice, the research team was surprised to find more monocytes accumulating at the site of injury than would be found in the animals' entire circulatory system. When they searched many types of tissue for the presence of cells with monocyte-specific molecules, they only found significant numbers of such cells in the spleen.

Monocytes in the spleen were identical in appearance, composition and function to monocytes in the blood. To investigate the splenic monocyte reservoir's potential involvement in cardiac healing, the researchers used several new technologies. A newly developed microscopic technique allowed them to determine how and where monocytes are stored in the spleen - previously known to store red blood cells - and to study how monocytes are released in response to an experimentally-induced heart attack. A novel three-dimensional optical imaging technique (fluorescence molecular tomography, developed at the MGH Center for Molecular Imaging Research) allowed study of monocyte-mediated immune functions at the site of heart muscle injury.

In mice whose spleens were removed and replaced with a donor organ, an induced heart attack led to rapid increase of spleen-derived donor monocytes in the bloodstream and massive accumulation of donor cells at the site of injury. In animals from whom spleens were removed but not replaced, heart attack produced no significant monocyte increase in the bloodstream or in the heart. "With all these approaches together, we found that the monocytes that travel to the heart after a heart attack come directly from the spleen and that, without the splenic monocytes, the heart tissue does not heal well," says Filip Swirski, PhD, co-lead author of the Science report.

The investigators also found that the hormone angiotensin II, known to be released in response to a heart attack, is actively involved in the release of monocytes from the spleen. Identifying that pathway could lead to ways of manipulating the splenic monocyte reservoir to improve healing after a heart attack and potentially regulate other inflammatory situations. "We need to know whether this monocyte reservoir is important in other diseases - such as viral or bacterial infection, cancer or atherosclerosis - and understand how to precisely control storage and release of monocytes in a therapeutic setting, both of which we are currently investigating," says Mikael Pittet, PhD, senior author of the Science report.

Pittet and Nahrendorf are both assistant professors of Radiology at Harvard Medical School, and Swirski is an instructor in Radiology. Additional co-authors of the Science report are Martin Etzrodt, Montz Wildgruber, Virna Cortez-Retamozo, Peter Panizzi, PhD, Jose-Luiz Figueiredo, MD, Rainer Kohler, PhD, Aleksey Chudnovskiy, Peter Waterman, Elena Aikawa, MD, PhD, Thorsten Memperl, MD, PhD, and Ralph Weissleder, MD, PhD, MGH Center for Systems Biology; and Peter Libby, MD, Brigham and Women's Hospital. The study was supported by grants from the National Institutes of Health and the MGH Center for Systems Biology.
Spleen May Help Heart Recover From Disease
Low-profile organ plays a big role in immune response, study finds

By Randy Dotinga
HealthDay Reporter

THURSDAY, July 30 (HealthDay News) -- Though its reputation doesn't rank down there with the appendix, the spleen isn't exactly known as a vital organ. In fact, plenty of people do fine without it.

But new research suggests the spleen plays a bigger role in the immune system than previously thought.

In mice, scientists found, the spleen serves as a home for a type of white blood cell that scavenges dead tissue and helps produce inflammation, which contributes to healing. In particular, the researchers discovered that the spleen helps the heart recover from disease.

"While the spleen may not be essential for your survival, it plays a crucial role once you are sick," said study author Filip K. Swirski, an immunology instructor at Harvard Medical School and Massachusetts General Hospital, Boston.

The findings could lead to a better understanding of the immune system, including its response to cancer, Swirski said. And it definitely improves the profile of a little-understood organ.

It's much more obscure than, say, the liver or kidneys, but the spleen still takes up a lot of space. In humans, it's about the size of a large eggplant and shaped like a kidney, Swirski said.

Scientists have known that the spleen recycles red blood cells and scans the blood for germs. "It serves as a filtering system," Swirski said. "It captures viruses or bacteria, and can elicit an inflammatory response."

Inflammation -- think of the redness around a wound -- indicates that the immune system is rushing in to defend the body.

But people often do just fine without their spleens. Traumatic injuries, such as those sustained in traffic accidents, often result in surgery to remove the spleen. And surgeons remove spleens from people with some medical conditions, including non-Hodgkin lymphoma.

In their study, the researchers examined mice to see if having a spleen helped the mice recover from induced heart disease. A 1977 study of veterans who'd had their spleens removed suggested they had twice the risk of dying of heart disease, Swirski said.

They found that the spleen did indeed appear to help the heart, through white-blood cells known as monocytes. The spleen served as a home for many of the cells, Swirski said.

A report on the study appears in the July 31 issue of Science.

"This just adds another function to the spleen," Swirski said. "It's not only a place where blood cells come to die and where the immune system screens for infection. It's relevant to how the immune system is mobilized."

Future research could explore how to boost the spleen's role in the immune system's response or keep it from being hijacked by germs, he added.

In a commentary accompanying the study, two doctors from Memorial Sloan-Kettering Cancer Center in New York City suggest the spleen is still as "dispensable," despite the new findings. But, they wrote, the spleen does seem "a bit more purposeful and deserving of recognition."

More information
The Journal of the American Medical Association has more about the spleen.
‘Junk’ organs are not really useless

Published on: Friday 31 Jul 2009 11:05 - by, ANI

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Washington, July 31 - ANI: Vestigial organs like appendix, spleen, tonsils and various redundant veins, which have long been considered useless, are not really expendable as previously believed, according to researchers.

The researchers have found that, more often than not, some of these "junk parts" are actually hard at work.

Jeffrey Laitman, director of anatomy and functional morphology at New York City's Mount Sinai School of Medicine, says that history is littered with body parts that were called "useless" simply because medical science had yet to understand them.

In a new study, the researchers have found that spleen might have a critical role to play in healing damaged hearts.

Spleen—the kidney shaped organ tucked into the upper left of a person's abdomen—helps spot infections and filters out red blood cells that are damaged or old. However, it is considered as nonessential, and one can live even without it.

But the new study in mice discovered that the spleen stores monocytes, white blood cells essential for immune defence and tissue repair.

Previously, scientists had thought monocytes were made only in bone marrow, like other types of white blood cells, and were "stored" in the bloodstream.

In fact, the spleen is the source of 40 to 50 percent of the monocytes involved in nursing lab mice back to health after a heart attack, said study co-author Filip Swirski of Massachusetts General Hospital's Center for Systems Biology in Boston.

"If you're going to survive a heart attack, your heart has to heal the proper way, and that depends on monocytes. It was thought that the monocytes that accumulated immediately after a heart attack were ones that had been circulating in the blood. But we did calculations and found that the number that accumulated in the heart far exceeded the number in circulation," National Geographic News quoted Swirski as saying.

He added: "And in studies where we removed the spleen and then induced a heart attack, we saw a vastly fewer number of monocytes accumulate."

One of the most famous "junk" organs is the appendix, a narrow tube that hangs off one end of the colon. But it's turned out to be important even today—in certain circumstances.
"It's hard to figure out what the appendix does when you're studying superclean animals and people," said Bill Parker, assistant professor of surgery at Duke University Medical Center and one of the researchers who exposed the appendix's secrets in a 2007 study.

Far from useless, the organ is actually a storehouse of beneficial bacteria that help us digest food (interactive digestive-system guide).

Parker said that the appendix evolved for a much dirtier, parasite-plagued lifestyle than the one most people live in the developed world today, but where diarrhoeal disease is common, for example, this organ is apparently vital for repopulating intestines with helpful bacteria after an illness.

Laitman said that another example of anatomy lagging behind lifestyle is **collateral circulation**.

Certain systems of veins and arteries ensure blood flow when the main paths are blocked or damaged. The systems appear to be truly vestigial, at least for now.

He said that elbows, knees, and shoulders, for example, all have collateral circulation, but the heart and much of the brain don't.

"Why would we adapt enormous redundancy in an elbow but not where it really matters' The answer is unsettling. When do we have strokes and heart attacks' Our 50s, 60s. When the blueprints for our species were being drawn up, nobody lived that long," said Laitman.

He added that the fact that our bodies evolved while humans lived short lives hunting and gathering is one key to understanding many "useless" body parts. - ANI
**VisEn Molecular Imaging Technology Enables Key Insights Into Newly Discovered Biologic Pathway Published in SCIENCE**

BEDFORD, Mass., July 30 /PRNewswire/ -- VisEn Medical Inc., a leader in fluorescence *in vivo* imaging from research through medicine, announced today that scientists reporting in the July 31 issue of SCIENCE have discovered a key disease-related biologic pathway using an integrated and innovative array of *in vitro* readouts and advanced *in vivo* imaging technologies. The newly reported biologic pathway relates to monocyte deployment from the spleen to inflammatory sites, including myocardial infarction. The findings are expected to open up new areas of research and potentially advance therapeutic approaches to key disease areas including inflammation and myocardial injury.

In the *SCIENCE* report, entitled "Identification of Splenic Reservoir Monocytes and Their Deployment to Inflammatory Sites," researchers at the Massachusetts General Hospital's Center for Systems Biology found that monocytes were held in concentration in the spleen and released to injured tissue sites in the body to participate in wound healing. As presented in the findings, the reporting scientists discovered and detailed the biologic pathway through the use of a series of advanced and integrated *in vitro* assays, microscopic readouts, and *in vivo* imaging methodologies, including Magnetic Resonance (MR) imaging combined with quantitative Fluorescence Molecular Tomographic (FMT) imaging. Used together in a series of novel scientific models, the researchers developed correlated data sets to both identify this previously unidentified splenic reservoir of monocytes, and demonstrate the monocyte deployment to inflammatory sites *in vivo*. In the *in vivo* data analysis, non-invasive, quantitative FMT imaging using novel fluorescent molecular imaging agents, combined with MR imaging, clearly demonstrated not only the location, but also the biological activity of the recruited splenic monocytes at the disease site, thus helping to confirm "unambiguously the fate of monocytes from the spleen to the heart."

"We see the integration of *in vitro* and *in vivo* readouts becoming increasingly important in research today, and we are extremely pleased that our FMT quantitative in vivo imaging technology and activatable *in vivo* imaging agents were able to help the research team answer some of the key questions about this important biologic pathway *in vivo,*" said Dr. Jeffrey Peterson, VP, Applied Biology at VisEn Medical. "When cardiac molecular imaging data from the FMT was combined with MRI imaging, the researchers were able to create a fused molecular and anatomical imaging map of the heart to identify and quantify biomarkers of monocyte activity *in vivo*. These results enabled an important data correlation that further enhanced the integrated array of *in vitro* assays and microscopy-based readouts of this important pathway."

**About VisEn Medical Inc.**

VisEn's *in vivo* fluorescence imaging technologies, including its Fluorescence Agent Portfolio and its Fluorescence Molecular Tomography (FMT(TM)) Imaging Systems, provide robust fluorescence molecular imaging performance in identifying, characterizing and quantifying ranges of disease biomarkers and therapeutic efficacy *in vivo*. VisEn's FMT systems and agents are used by leading research institutions and pharmaceutical companies worldwide in applications including cancer research, inflammation, cardiovascular, skeletal and pulmonary disease. The Company also works with large pharmaceutical and clinical partners to design ranges of tailored molecular imaging agents and applications designed for their specific pre-clinical and clinical research areas.

Additional information can be found at [www.visenmedical.com](http://www.visenmedical.com).

**SOURCE VisEn Medical**

**Related Links:**

- [http://www.visenmedical.com](http://www.visenmedical.com)
Hilfe nach Herzinfarkt

**Neue Rolle für die Milz**

Die Milz ist ein bedeutendes Reservoir für Immunzellen, die bei der Reparatur des geschädigten Herzens helfen. Das berichtet eine Gruppe um Filip Swirski von der Harvard Medical School in Boston im Journal “Science”.

**Quell für Monozyten**


"Verzichtbar, aber nicht irrelevant"


*Quelle: dpa*

*Adresse:*
http://www.n-tv.de/wissen/gesundheit/Neue-Rolle-fuer-die-Milz-article445838.html
Auch die Milz bildet ein großes Reservoir an wichtigen Zellen des Immunsystems, den Monozyten, berichten Forscher um Filip Swirski von der Harvard University. Die hier entstehenden Abwehrzellen könnten zudem ohne größere Umwege in attackierte Geweben einwandern: In Versuchsmäusen bewegten sie sich zum Beispiel in durch Unterversorgung geschwächte Herzmuskeln und stellten dort den Löwenanteil dieser Immunzellen.


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У человека нет рудиментов: все органы полезны

Ученые поняли, для чего служат селезенка и аппендикс

Светлана КУЗИНА — 03.08.2009

Органы, которые долго время считались ненужными по причине их бездействия, оказались жизненно необходимы для выживания человека в экстремальных условиях.

Селезенка починит сердце

До сих пор в школе учителя на уроках биологии показывают на цветных плакатах человеческие органы, которые пренебрежительно называют рудиментами. К ним относят аппендикс, селезенку, мицдалины и различные «лишние» вены. Эти запчасти тела человека не вызывают удовольствия у ученых, потому что уже давно считаются бесполезными. Они якобы утратили свое основное значение в процессе эволюционного развития. Закладываются во время зародышевого развития, но полностью не развиваются. И потому служат ненужными довесками к организму.

Однако последние исследования убедительно показали, что мы недооценивали значение рудиментов. На самом деле, они могут играть очень важную роль для выживания человека или в экстремальных ситуациях, или в новых непривычных условиях обитания, или во время серьезной болезни.
АТАВИЗМЫ У ЧЕЛОВЕКА
Атавизм (от nat. atavus — предок), появление у отдельных организмов данного вида признаков, которые существовали у отдалённых предков, но были утрачены в процессе эволюции.

Развитие дополнительных пар млечных желез
Густой волосяной покров на лице и теле

Такие учебные пособия висят в школьных кабинетах.

- Так, например, в своем исследовании мы пришли к выводу, что селезенка играет важную роль в заживлении поврежденных болезнь сосудов сердца, - говорит Джеффи Лайтман, руководитель функциональной анатомии и морфологии Нью-Йоркской школы медицины. – Именно она помогает справиться с инфекциями, создавая фильтры для нездоровых кровяных клеток.

Кроме того, опыты на мышах показали, что селезенка — это целый завод по производству моноцитов, белых кровяных телец, необходимых для иммунной защиты и ремонта тканей, сообщает The Times of India. Ранее же ученые считали, что моноциты рождаются только в костном мозге, как и другие виды белых кровяных клеток, и "хранятся" в кровяном русле.

- Селезенка является источником от 40 до 50 процентов от всех моноцитов, которые участвуют при восстановлении здоровья после сердечного приступа, - убежден другой исследователь - Филип Свирски из Массачусетского Центра системной биологии в Бостоне.

Аппендикс против паразитов

Не так уж и бесполезен оказался и знаменитый рудимент — аппендикс, этот странный червеобразный отросток, придачок слепой кишки, который имеется лишь у кроликов, обезьян и человека.

- Этот орган фактически является складом полезных бактерий, которые помогают нам переваривать много разной пищи, в том числе некачественной или плохо обработанной, - считает Билл Паркер, доцент кафедры хирургии из Медицинского центра Университета Дьюка.

По словам Паркера, аппарат спасает нас от отправлений и паразитов, особенно в тех случаях, если мы окажемся в других условиях проживания. Например, если европеец переехал жить в Африку, то его желудочно-кишечный тракт не пострадает от перехода к новой еде благодаря этому отростку кишки, который тотчас начнет активно работать. И европеец не умрет от диареи. Более того, ученые полагают, что этот орган, по-видимому, имеет важнейшее значение для заселения кишечника полезной бактериальной флорой после желудочных заболеваний.

Обнаружилась полезность и некоторых систем вен и артерий, работа которых ранее была неизвестна. Как выяснилось, они тоже включаются в активную борьбу за здоровье человека, чтобы обеспечить кровоток, если основные «каналы» заблокированы или повреждены.
Теперь исследователи ломают голову, для чего природа одарила человека другими «бесполезными» приспособлениями: хвостовыми позвонками, волосяным покровом туловища и ушными мышцами?

Ученые ищут пользу других многочисленных рудиментов у человека.

Кстати, а вы знаете, что видеть во сне длинный лошадинный хвост – к получению денег, отрезать хвост у собаки – к ссоре с приятелем, держаться за собачий хвост – к мнимой надежде на друга, видеть лисий хвост – к обману? О том, что снится другим людям – читайте в нашем блоге «Толкователи сновидений». Пишите и вы свои ночные видения – мы их растолкуем!