How to make an old immune system young again (BAŞLIK 1)

Antibodies that target blood stem cells can rejuvenate immune responses in mice. Old mice developed more youthful immune systems after scientists reduced aberrant stem cells in the aged animals1. The technique strengthened the old rodents’ responses to viral infection and lowered signs of inflammation. Antibodies that target blood stem cells can rejuvenate immune responses in mice. Old mice developed more youthful immune systems after scientists reduced aberrant stem cells in the aged animals1. The technique strengthened the old rodents’ responses to viral infection and lowered signs of inflammation.

The approach, published on 27 March in Nature, treats older mice with antibodies to diminish a population of stem cells that give rise to a variety of other cell types, including those that contribute to inflammation. Excess inflammation can wreak havoc in the body, and these pro-inflammatory stem cells become dominant as mice and humans age. The approach, published on 27 March in Nature, treats older mice with antibodies to diminish a population of stem cells that give rise to a variety of other cell types, including those that contribute to inflammation. Excess inflammation can wreak havoc in the body, and these pro-inflammatory stem cells become dominant as mice and humans age.

RESİM 1: Genişlik 10cm, yükseklik 6cm olmalı, resim sola dayalı ve yazılar çevresinde sıkı formatında olmalı.

RESİM YAZISI: Blood stem cells (example pictured; artificially coloured) generate red blood cells and immune cells.

It will be years before the approach can be tested in people, but many aspects of the stem-cell biology that underlies immune-cell production are similar between mice and humans. “It’s a really important first step,” says Robert Signer, a stem-cell biologist at the University of California, San Diego, who was not involved in the research. “I’m excited to see where they take this work next.” It will be years before the approach can be tested in people, but many aspects of the stem-cell biology that underlies immune-cell production are similar between mice and humans. “It’s a really important first step,” says Robert Signer, a stem-cell biologist at the University of California, San Diego, who was not involved in the research. “I’m excited to see where they take this work next.”It will be years before the approach can be tested in people, but many aspects of the stem-cell biology that underlies immune-cell production are similar between mice and humans. “It’s a really important first step,” says Robert Signer, a stem-cell biologist at the University of California, San Diego, who was not involved in the research. “I’m excited to see where they take this work next.”It will be years before the approach can be tested in people, but many aspects of the stem-cell biology that underlies immune-cell production are similar between mice and humans. “It’s a really important first step,” says Robert Signer, a stem-cell biologist at the University of California, San Diego, who was not involved in the research. “I’m excited to see where they take this work next.”

Skewed immune system (BAŞLIK 2)

For decades, researchers in Irv Weissman’s group at Stanford University in California have painstakingly tracked the fate of blood stem cells. These replenish the body’s stores of red blood cells (which carry oxygen from the lungs to all parts of the body) and white blood cells (which are key components of the immune system). In 2005, Weissman and his colleagues found that populations of blood stem cells shift as mice age2. In young mice, there is a balance between two types of blood stem cell, each of which feeds into a different arm of the immune system. The ‘adaptive’ arm produces antibodies and T cells targeted to specific pathogens; the ‘innate’ arm produces broadbrush responses, such as inflammation, to infection. For decades, researchers in Irv Weissman’s group at Stanford University in California have painstakingly tracked the fate of blood stem cells. These replenish the body’s stores of red blood cells (which carry oxygen from the lungs to all parts of the body) and white blood cells (which are key components of the immune system). In 2005, Weissman and his colleagues found that populations of blood stem cells shift as mice age2. In young mice, there is a balance between two types of blood stem cell, each of which feeds into a different arm of the immune system. The ‘adaptive’ arm produces antibodies and T cells targeted to specific pathogens; the ‘innate’ arm produces broadbrush responses, such as inflammation, to infection. In older mice, however, this balance becomes skewed towards the pro-inflammatory innate immune cells. Similar changes have been reported in the blood stem cells of older humans, and researchers speculate that this could lead to a diminished ability to mount new antibody and T-cell responses. That might explain why older people are more prone to serious infections from pathogens such as influenza viruses and SARS-CoV-2, and why they have weaker responses to vaccination than younger people do.

Discuss with you (BAŞLIK 2)

In older mice, however, this balance becomes skewed towards the pro-inflammatory innate immune cells. Similar changes have been reported in the blood stem cells of older humans, and researchers speculate that this could lead to a diminished ability to mount new antibody and T-cell responses. That might explain why older people are more prone to serious infections from pathogens such as influenza viruses and SARS-CoV-2, and why they have weaker responses to vaccination than younger people do. In older mice, however, this balance becomes skewed towards the pro-inflammatory innate immune cells. Similar changes have been reported in the blood stem cells of older humans, and researchers speculate that this could lead to a diminished ability to mount new antibody and T-cell responses. That might explain why older people are more prone to serious infections from pathogens such as influenza viruses and SARS-CoV-2, and why they have weaker responses to vaccination than younger people do. In older mice, however, this balance becomes skewed towards the pro-inflammatory innate immune cells. Similar changes have been reported in the blood stem cells of older humans, and researchers speculate that this could lead to a diminished ability to mount new antibody and T-cell responses. That might explain why older people are more prone to serious infections from pathogens such as influenza viruses and SARS-CoV-2, and why they have weaker responses to vaccination than younger people do.

Restoring the balance (BAŞLIK 2)

If that were the case, then restoring balance to the populations of blood stem cells could also rejuvenate the immune system. The team tested this by generating antibodies that bind to the blood stem cells that predominantly generate innate immune cells. They then infused these antibodies into older mice, hoping that the immune system would destroy the stem cells bound by the antibodies.

The antibody treatment rejuvenated the immune systems of the treated mice. They had a stronger reaction to vaccination, and were better able to fend off viral infection, than older mice who had not received the treatment. The treated mice also produced lower levels of proteins associated with inflammation than did old, untreated mice. This is an important demonstration that the different populations of blood stem cells influence how the immune system ages, says Signer.

But it’s also possible that the antibody treatment did more than just affect the dominant blood stem cell population, says Enca Montecino-Rodriguez, who studies the development of white blood cells at the David Geffen School of Medicine at the University of California, Los Angeles. The treatment might also affect the environment in which the blood stem cells live. Or it could clear other aged cells from the body, or trigger immune responses that affect how the mice respond to vaccines and viruses, she says. The antibody treatment rejuvenated the immune systems of the treated mice. They had a stronger reaction to vaccination, and were better able to fend off viral infection, than older mice who had not received the treatment. The treated mice also produced lower levels of proteins associated with inflammation than did old, untreated mice. This is an important demonstration that the different populations of blood stem cells influence how the immune system ages, says Signer.

But it’s also possible that the antibody treatment did more than just affect the dominant blood stem cell population, says Enca Montecino-Rodriguez, who studies the development of white blood cells at the David Geffen School of Medicine at the University of California, Los Angeles. The treatment might also affect the environment in which the blood stem cells live. Or it could clear other aged cells from the body, or trigger immune responses that affect how the mice respond to vaccines and viruses, she says.

Weissman says that his team is working on a similar approach to rebalance aged human blood stem cells. But even assuming ample funding and no unexpected setbacks, it will be at least three to five years before they can begin testing it in people, he says.

In the meantime, his team will continue to study mice to learn more about other effects of the antibody therapy, such as whether it affects the rates of cancer or inflammatory diseases. “The old versus the young blood-forming system makes a big deal of difference,” says Weissman. “It’s not just a difference in the bone marrow. It’s a difference all over the body.”

Climate change has slowed Earth’s rotation — and could affect how we keep time (BAŞLIK 1)

The effect of melting polar ice could delay the need for a ‘leap second’ by three years. Climate change is starting to alter how humans keep time.

An analysis1 published in Nature on 27 March has predicted that melting ice caps are slowing Earth’s rotation to such an extent that the next leap second — the mechanism used since 1972 to reconcile official time from atomic clocks with that based on Earth’s unstable speed of rotation — will be delayed by three years. An analysis1 published in Nature on 27 March has predicted that melting ice caps are slowing Earth’s rotation to such an extent that the next leap second — the mechanism used since 1972 to reconcile official time from atomic clocks with that based on Earth’s unstable speed of rotation — will be delayed by three years. “Enough ice has melted to move sea level enough that we can actually see the rate of theEarth’s rotation has been affected,” says Duncan Agnew, a geophysicist at the Scripps Institution of Oceanography in La Jolla, California, and author of the study. According to his analysis, global warming will push back the need for another leap second from 2026 to 2029. Leap seconds cause so much havoc for computing that scientists have voted to get rid of them, but not until 2035. Researchers are especially dreading the next leap second, because, for the first time, it is likely to be a negative, skipped second, rather than an extra one added in.

“Enough ice has melted to move sea level enough that we can actually see the rate of theEarth’s rotation has been affected,” says Duncan Agnew, a geophysicist at the Scripps Institution of Oceanography in La Jolla, California, and author of the study. According to his analysis, global warming will push back the need for another leap second from 2026 to 2029. Leap seconds cause so much havoc for computing that scientists have voted to get rid of them, but not until 2035. Researchers are especially dreading the next leap second, because, for the first time, it is likely to be a negative, skipped second, rather than an extra one added in.

RESİM 2 Genişlik 12cm, yükseklik 8cm olmalı, resim sola dayalı ve yazılar çevresinde sıkı formatında olmalı.

RESİM YAZISI: As polar ice has melted and moved mass towards the Equator, it has slowed Earth’s rotation.

“We do not know how to cope with one second missing. This is why time metrologists are worried,” says Felicitas Arias, former director of the Time Department at the International Bureau of Weights and Measures in Sèvres, France.

In metrology terms, the three-year delay “is good news”, she says, because even if a negative leap second is still needed, it will happen later, and the world might see fewer of them before 2035 than would otherwise have been anticipated.

But this should not be seen as a point in favour of global warming, Agnew says. “It’s completely outweighed by all the negative aspects.”

Synchronizing clocks (BAŞLIK 2)

For millennia, people measured time using Earth’s rotation, and the second became defined as a fraction of the time it takes for the planet to turn once on its axis. But since 1967, atomic clocks — which tick using the frequency of light emitted by atoms — have served as more precise timekeepers. Today, a suite of around 450 atomic clocks defines official time on Earth, known as Coordinated Universal Time (UTC), and leap seconds are used every few years to keep UTC in line with the planet’s natural day. For millennia, people measured time using Earth’s rotation, and the second became defined as a fraction of the time it takes for the planet to turn once on its axis. But since 1967, atomic clocks — which tick using the frequency of light emitted by atoms — have served as more precise timekeepers. Today, a suite of around 450 atomic clocks defines official time on Earth, known as Coordinated Universal Time (UTC), and leap seconds are used every few years to keep UTC in line with the planet’s natural day. For millennia, people measured time using Earth’s rotation, and the second became defined as a fraction of the time it takes for the planet to turn once on its axis. But since 1967, atomic clocks — which tick using the frequency of light emitted by atoms — have served as more precise timekeepers. Today, a suite of around 450 atomic clocks defines official time on Earth, known as Coordinated Universal Time (UTC), and leap seconds are used every few years to keep UTC in line with the planet’s natural day.

Atomic clocks are better timekeepers than Earth, because they are stable over millions of years, whereas the planet’s rotation rate varies. In his analysis, Agnew used mathematical models to tease apart the contributions of known geophysical phenomena to Earth’s rotation and to predict their effects on future leap seconds. For millennia, people measured time using Earth’s rotation, and the second became defined as a fraction of the time it takes for the planet to turn once on its axis. But since 1967, atomic clocks — which tick using the frequency of light emitted by atoms — have served as more precise timekeepers. Today, a suite of around 450 atomic clocks defines official time on Earth, known as Coordinated Universal Time (UTC), and leap seconds are used every few years to keep UTC in line with the planet’s natural day.

Many metrologists anticipated that leap seconds would only ever be added, because on the scale of millions of years, Earth’s spin is slowing down, meaning that, occasionally, a minute in UTC needs to be 61 seconds long, to allow Earth to catch up. This reduction in the planet’s rotation rate is caused by the Moon’s pull on the oceans, which creates friction. It also explains, for example, why eclipses 2,000 years ago were recorded at different times in the day from what we would expect on the basis of today’s rotation rate, and why analyses of ancient sediments suggest that 1.4 billion years ago a day was only around 19 hours long.

But on shorter timescales, geophysical phenomena make the rotation rate fluctuate, says Agnew. Right now, the rate at which Earth spins is being affected by currents in the liquid core of the planet, which since the 1970s have caused the rotation speed of the outer crust to increase. This has meant that added leap seconds are needed less frequently, and if the trend continues, a leap second will need to be removed from UTC.

Agnew’s analysis finds that this could happen later than was previously thought, because of climate change. Data from satellites mapping Earth’s gravity show that since the early 1990s the planet has become less spherical and more flattened, as ice from Greenland and Antarctica has melted and moved mass away from the poles towards the Equator. Just as a spinning ice skater slows down by extending their arms away from their body (and speeds up by pulling them in), this flow of water away from Earth's axis of rotation slows the planet’s spin.

The net result of core currents and of climate change is still an accelerating Earth. But Agnew found that without the effect of melting ice, a negative leap second would be needed three years earlier than is now predicted. “Human activities have a profound impact on climate change. The postponing of a leap second is just one more example,” says Jianli Chen, a geophysicist at the Hong Kong Polytechnic University. For millennia, people measured time using Earth’s rotation, and the second became defined as a fraction of the time it takes for the planet to turn once on its axis. But since 1967, atomic clocks — which tick using the frequency of light emitted by atoms — have served as more precise timekeepers. Today, a suite of around 450 atomic clocks defines official time on Earth, known as Coordinated Universal Time (UTC), and leap seconds are used every few years to keep UTC in line with the planet’s natural day.

Precision problems (BAŞLIK 2)

A delayed leap second would be welcomed by metrologists. Leap seconds are a “big problem” already, because in a society that is increasingly based on precise timing, they lead to major failures in computing systems, says Elizabeth Donley, who heads the time and frequency division at the National Institute of Standards and Technology in Boulder, Colorado.

An unprecedented negative leap second could be even worse. “There’s no accounting for it in all the existing computer codes,” she says. A delayed leap second would be welcomed by metrologists. Leap seconds are a “big problem” already, because in a society that is increasingly based on precise timing, they lead to major failures in computing systems, says Elizabeth Donley, who heads the time and frequency division at the National Institute of Standards and Technology in Boulder, Colorado.

An unprecedented negative leap second could be even worse. “There’s no accounting for it in all the existing computer codes,” she says. Agnew’s paper is useful in making predictions, but Donley says that there is still high uncertainty about when a negative leap second will be needed. The calculations rely on Earth’s acceleration continuing at its present rate, but activity in the inner core is almost impossible to predict, cautions Christian Bizouard, an astrogeophysicist at the International Earth Rotation and Reference Systems Service in Paris, which is responsible for deciding when to introduce a leap second. “We do not know when that mean acceleration will stop and reverse itself,” he says.

Agnew hopes that seeing the influence of climate change on timekeeping will jolt some people into action. “I’ve been around climate change for a long time, and I can worry about it plenty well without this, but it’s yet another way of impressing upon people just how big a deal this is,” he says.

Agnew’s paper is useful in making predictions, but Donley says that there is still high uncertainty about when a negative leap second will be needed. The calculations rely on Earth’s acceleration continuing at its present rate, but activity in the inner core is almost impossible to predict, cautions Christian Bizouard, an astrogeophysicist at the International Earth Rotation and Reference Systems Service in Paris, which is responsible for deciding when to introduce a leap second. “We do not know when that mean acceleration will stop and reverse itself,” he says. Agnew hopes that seeing the influence of climate change on timekeeping will jolt some people into action. “I’ve been around climate change for a long time, and I can worry about it plenty well without this, but it’s yet another way of impressing upon people just how big a deal this is,” he says. It will be years before the approach can be tested in people, but many aspects of the stem-cell biology that underlies immune-cell production are similar between mice and humans. “It’s a really important first step,” says Robert Signer, a stem-cell biologist at the University of California, San Diego, who was not involved in the research. “I’m excited to see where they take this work next.”

New results for aging (BAŞLIK 2)

It will be years before the approach can be tested in people, but many aspects of the stem-cell biology that underlies immune-cell production are similar between mice and humans. “It’s a really important first step,” says Robert Signer, a stem-cell biologist at the University of California, San Diego, who was not involved in the research. “I’m excited to see where they take this work next.”It will be years before the approach can be tested in people, but many aspects of the stem-cell biology that underlies immune-cell production are similar between mice and humans. “It’s a really important first step,” says Robert Signer, a stem-cell biologist at the University of California, San Diego, who was not involved in the research. “I’m excited to see where they take this work next.”It will be years before the approach can be tested in people, but many aspects of the stem-cell biology that underlies immune-cell production are similar between mice and humans. “It’s a really important first step,” says Robert Signer, a stem-cell biologist at the University of California, San Diego, who was not involved in the research. “I’m excited to see where they take this work next.”