SCIENCE NEWS

Dogs give Friends Food

Compared to the rest of the animal kingdom, the human capacity for cooperation is something quite special. Cooperating with one another requires a certain amount of prosocial behavior. This means helping others without any direct personal benefit. Now a new study has found prosocial behaviour in dogs toward humans.

Prosociality has already been demonstrated in animals that are very closely related with humans, i.e. primates. In other animals, the phenomenon has so far only been studied experimentally in rats and jackdaws. One study found prosocial behaviour in dogs toward humans. According to Friederike Range of the Messerli Research Institute, however, it remains questionable whether the dogs were merely reacting to the communication from the humans and were being 'obedient' or if they were truly exhibiting prosocial behaviour.

"Dogs and their nearest relatives, the wolves, exhibit social and cooperative behaviour, so there are grounds to assume that these animals also behave prosocially toward conspecifics. Additionally, over thousands of years of domestication, dogs were selected for special social skills," explains study director Range. For this reason, Range and her colleagues Mylene Quervel-Chaumette, Rachel Dale and Sarah Marshall-Pescini studied 16 dogs to test their readiness to benefit familiar versus unfamiliar partners.

The researchers studied the prosocial behaviour of the animals using a bar-pulling task in which the dogs had to pull trays and decide whether a second dog would receive a treat or not. In the test, the donor dogs used their mouths to pull a string to bring a tray toward a second dog. They could choose either an empty tray or a tray containing a treat on the partner's side.

Dogs donate to familiar partners more often than to unfamiliar ones

Whether the donor dogs knew the recipient made a difference. Donor dogs pulled the giving tray more often for familiar dogs than for unfamiliar ones. "Dogs truly behave

prosocially toward other dogs. That had never been experimentally demonstrated before. What we also found was that the degree of familiarity among the dogs further influenced this behaviour. Prosocial behaviour was exhibited less frequently toward unfamiliar dogs than toward familiar ones.

Prosocial behaviour put to the test

In the bar-pulling task, the donor dogs decided whether another dog would receive a treat or not. The donor dog itself did not get the treat. The only purpose of the task was to benefit the other dog. By conducting several control tests, the researchers excluded the possibility that the dogs were simply pulling the trays for the fun of it. Donor dogs were reserved in pulling the tray when an unfamiliar dog was in the next enclosure.

At the end of each test run, the researchers conducted another test to show that the donor dogs knew what pulling the tray meant. They allowed the donor dogs to pull on a tray to give themselves a treat, and all dogs did just that. "This control excludes the possibility that the dogs did not pull on the tray out of fear of the unfamiliar dogs. Given the same situation, the dogs gladly gave themselves a treat," says Range.

"We were also able to disprove the argument that the dogs pulled the string less frequently because they were distracted by the unfamiliar partner during the test. Only rarely did a donor dog interact with the unfamiliar dog," Range explains.

Ten Cool Things the Kitchen of the Future Will Do

When the next generation of home cooks go to their kitchens, they'll be entering a world of interconnected smart appliances, 3-D printers, and touchscreen controls that will simplify food preparation, create customized meal solutions, and produce far less waste.

In the December issue of *Food Technology* magazine published by the Institute of Food Technologists (IFT), associate editor Melanie Zanoza Bartelme writes about some cool features that the kitchen of the future will offer.

1. Appliances will be wired to actively monitor their contents and reorder when it senses supplies are running low. Products that are near their expiration dates would be moved closer to the front.
2. Each family member can print the dinner they want when they want using a countertop 3-D printer that takes account likes and dislikes, food allergies and nutritional needs.
3. Induction cooktops using magnetic energy and compatible pans will heat up only the pan placed on it; the rest of the surface can be safely used for other tasks.
4. At the touch of a button, counters, sinks and cooking surfaces can move up or down appealing to the height of people sharing a kitchen as well those with disabilities. Stoves can be moved up so children don't hurt themselves, while the sink can be lowered so they can easily wash their hands.
5. Integration facial recognition technology will make it so that the kitchen can automatically set itself to a combination of desired settings — from counter height to ambient lighting to

background music — as soon as the user is home.

6. Virtual chefs will be projected directly into consumers' kitchens to guide their cooking.
7. Integrated systems will read data from fitness-monitoring devices and suggest meals appropriate to certain situations, such as muscle recovery after a strenuous workout.
8. Sinks would come equipped with a finger sensor that could read users' hydration levels, dispensing water when it is needed.
9. Video monitoring will help consumers see exactly what they have and systems that are linked to ovens and stoves will create recipes that use the meal preparation ingredients that are expiring.
10. A fridge will use ultraviolet light to sterilize food within it, keeping it safe from spoilage. A blast chiller instantly takes leftovers out of the danger zone where bacteria thrive.

New Test for Ancient DNA Authenticity Throws Doubt on Stone Age Wheat Trade

Wheat DNA thought to provide evidence of trade between English hunter gatherers and more advanced Neolithic European farmers 8,000 years ago is younger than a few hundreds of years old.

A new method reliably tests whether DNA shows ancient or modern patterns of biochemical change. This has recently cast doubt on the authenticity of what was thought to be evidence of a Stone Age wheat trade.

A DNA sample thought to show prehistoric trade in cereals is most likely from modern wheat, according to new research led by the Max Planck Institute for Developmental Biology.

The scientists developed a new test to verify the authenticity of ancient DNA. They applied the test to a sample from submerged sediment off the Isle of Wight, thought to provide evidence of trade between English hunter gatherers and more advanced Neolithic European farmers 8000 years ago. The new test, described in the journal *eLife*, shows the sample to be younger than a few hundreds of years old.

"Modern DNA can easily contaminate precious samples so it is crucial to build in assurances that historic DNA is authentic," says first author Clemens Weiß.

"Only then can these molecular treasures tell tales unravelling history," he says.

The researchers developed a method focused on biochemical changes that accumulate with age and that are specific to ancient DNA. These changes cause one specific building block, cytosine (C), to be misread as thymine (T).

The new method reliably tests whether DNA shows ancient or modern patterns of such C-to-T changes. Testing the British wheat sequences with this approach showed that their DNA damage pattern does not fit with what would be expected for ancient DNA.

"As more and more scientists enter the field of environmental and metagenomics ancient DNA research, it becomes increasingly

important to set certain standards for evaluation and interpretation of the data," says lead author Hernán Burbano.

Handling and interpreting ancient DNA data is challenging. DNA, the storage place for genetic information, can survive the death of the organism from which it originates for centuries or even millennia. However, it still ages and decomposes. Old or ancient DNA is often fragmented and present in only tiny quantities. These remaining traces of DNA are easily lost when the sample is contaminated with modern DNA from the surroundings or from researchers handling samples.

Both the high risk of contamination and the low amounts of available data make it even more important to present positive evidence that the retrieved DNA is of ancient origin. The new computational method could be used to authenticate ancient DNA even when only minute amounts of DNA can be extracted. Scientists will still be able to check whether the damage pattern matches that expected for ancient DNA.

"Ancient DNA can allow us a glimpse into the evolution and ecology of both plant and animal species, sometimes also revealing details of human history," says Burbano.

"We hope our new method is one step towards sound and successful extraction and interpretation of these windows into the past."

Ancient Trade Routes between Bronze Age Iran and Mesopotamia Uncovered

Archaeologists have found evidence of raw materials trade between Bronze Age Iran and Mesopotamia.

Tübingen researchers and Iranian archaeologists have discovered evidence of raw materials trade between Bronze Age Iran and Mesopotamia.

Many of us have seen the impressive statues of ancient Mesopotamian rulers in the Louvre and the British Museum. They bear witness to the wealth of Bronze Age Akkadian and Sumerian city-states more than four thousand years ago. But they are made of black diorite and gabbro stone not found in the region of today's Iraq and northeastern Syria. Where did it come from? The blocks of stone must have been transported along ancient roads from distant trading partners to the Bronze Age cities of Mesopotamia.

A team of researchers from the University of Tübingen's ResourceCultures collaborative research centre has investigated the origins of the stone and the methods used to move such heavy loads over great distances. The team from Tübingen collaborates with the Iranian Center of Archaeological Research (ICAR) to find the answers and is jointly headed by Professor Peter Pfälzner and Nader Soleimani.

The archaeologists found diorite and gabbro in the Iranian province of Kerman, not far from the Persian Gulf, which matches that used in the Mesopotamian statues. In the same area, the archaeologists also found deposits of chlorite, which was used to make stone vessels traded as far away as Mesopotamia and the Levant. Close to these deposits, the researchers found petroglyphs and Early Bronze Age settlements, indicating that the stone was quarried during the Jiroft Culture of southeastern Iran (approx. 3000-2000 B.C.), and that it was traded across the Near East.

One of the recently-discovered settlements may have been a production and distribution centre for the valuable stone. "This shows that the civilizations of Mesopotamia and southeastern Iran were in direct contact in the Early Bronze Age," says Pfälzner of the Institute for Ancient Near Eastern Studies. "The Persian Gulf most likely served as a trade route." Pfälzner said this illustrated the great significance of this waterway in the international ties between important regions — from the Bronze Age to the present day.

Pfälzner and his Iranian colleague Nader Soleimani are jointly heading research into an area of 110 by 120 kilometres in Iran's Kerman Province — both on the ground and from the air using unmanned aircraft. Until now, there has been little archaeological research conducted in the hot, dry region south of the city of Jiroft. Using aerial photography, the team creates 3D models of ancient settlements (tells) from the Jiroft Culture era and other historical periods up to the coming of Islam. Along the potential trade routes running between high mountain chains to the coast of the Persian Gulf, the team is looking out for Early Bronze Age way-stations and any other trade activity. The German-Iranian team has so far mapped and investigated 42 settlements.

Now that the initial investigations have yielded results, work is set to resume in Iran in February 2016. The researchers are hoping to find out more about where the Bronze Age trade routes ran between the Jiroft Culture and the city-states of Mesopotamia, as well as what sort of effects this early long-distance trade had on Iranian civilizations more than four thousand years ago.

New Anti-inflammatory Molecule Could Halt MS Progression

A new drug-like molecule that can halt inflammation has shown promise in preventing the progression of multiple sclerosis. Researchers developed a molecule that inhibits a key signal that triggers inflammation.

Walter and Eliza Hall Institute scientists have developed a new drug-like molecule that can halt inflammation and has shown promise in preventing the progression of multiple sclerosis (MS).

Dr Ueli Nachbur, Associate Professor John Silke, Associate Professor Guillaume Lessene, Professor Andrew Lew and colleagues developed the molecule that inhibits a key signal that triggers inflammation.

Multiple sclerosis is an inflammatory disease that damages the central nervous system including the brain, spinal cord and optic nerves. There is no cure and there is a desperate need for new and better treatments.

Inflammatory diseases such as MS were triggered by an over-active immune system, Dr Nachbur said. "Inflammation results when our immune cells release hormones called cytokines, which is a normal response to disease," he said. "However when too many cytokines are produced, inflammation can get out-of-control and damage our own body, all of which are hallmarks of immune or inflammatory diseases."

To apply the brakes on this runaway immune response, institute researchers developed a small drug-like molecule called WEHI-345 that binds to and inhibits a key immune signalling protein called RIPK2. This prevents the release of inflammatory cytokines.

Professor Lew said they examined WEHI-345's potential to treat immune diseases in experimental models of MS.

"We treated preclinical models with WEHI-345 after symptoms of MS first appeared, and found it could prevent further progression of the disease in 50 per cent of cases," he said. "These results are extremely important, as there are currently no good preventive treatments for MS."

Associate Professor Lessene, who developed the molecule with colleagues in the institute's ACRF Chemical Biology division, said WEHI-345 had potential as an anti-inflammatory agent. "This molecule will be a great starting point for a drug-discovery program that may one day lead to new treatments for MS and other inflammatory diseases," Associate Professor Lessene said.

Dr Nachbur said institute scientists would use WEHI-345 to further investigate the signalling pathway that produced inflammatory cytokines and to develop a better, stronger inhibitor of RIPK2 for treating inflammatory disease. "This signalling pathway must be finely balanced, because WEHI-345 only delayed signalling rather than blocked it. Nevertheless, this delay is enough to completely shut off cytokine production," he said.

"Not only is this a potential new treatment, it is a great tool we can use to unravel this signalling pathway and identify other important proteins that control inflammation that could be a drug target."

2015 Antarctic Maximum Sea Ice Extent Breaks Streak of Record Highs

The sea ice cover of the Southern Ocean reached its yearly maximum extent on 6 October, At 7.27 million square miles (18.83 million square kilometres), the new maximum extent falls roughly in the middle of the record of Antarctic maximum extents compiled during the 37 years of satellite measurements — this year's maximum extent is both the 22nd lowest and the 16th highest.

More remarkably, this year's maximum is quite a bit smaller than the previous three years, which correspond to the three highest maximum extents in the satellite era, and is also the lowest since 2008.

The growth of Antarctic sea ice was erratic this year: sea ice was at much higher than normal levels throughout much of the first half of 2015 until, in mid-July, it flattened out and even went below normal levels in mid-August. The sea ice cover recovered partially in September, but still this year's maximum extent is 513,000 square miles (1.33 million square kilometres) below the record maximum extent, which was set in 2014. Scientists believe this year's strong El Niño event, a natural phenomenon that warms the surface waters of the eastern equatorial Pacific Ocean, had an impact on the behaviour of the sea ice cover around Antarctica. El Niño causes higher sea level pressure, warmer air temperature and warmer sea surface temperature in the Amundsen, Bellingshausen and Weddell seas in west Antarctica that affect the sea ice distribution.

"After three record high extent years, this year marks a return toward normalcy for Antarctic sea ice," said Walt Meier, a sea ice scientist at NASA's Goddard Space Flight Center in Greenbelt, Maryland. "There may be more high years in the future because of the large year-to-year variation in Antarctic extent, but such extremes are not near as substantial as in the Arctic, where the declining trend towards a new normal is continuing."

This year's maximum extent occurred fairly late: the mean date of the Antarctic maximum is 23 September for 1981-2010.

Global Sea Ice Diminishing, Despite Antarctic Gains

Sea ice increases in Antarctica do not make up for the accelerated Arctic sea ice loss of the last decades, a new study finds. As a whole, the planet has been shedding sea ice at an average annual rate of 13,500 square miles (35,000 square kilometres) since 1979, the equivalent of losing an area of sea ice larger than the state of Maryland every year.

"Even though Antarctic sea ice reached a new record maximum this past September, global sea ice is still decreasing," said Claire Parkinson, author of the study and climate scientist at NASA's Goddard Space Flight Center in Greenbelt, Md. "That's because the decreases in Arctic sea ice far exceed the increases in Antarctic sea ice."

Parkinson used microwave data collected by NASA and Department of Defense Satellites for her study, which was published last December in the *Journal of Climate*. She added Arctic and Antarctic sea ice extents month by month from November 1978 to December 2013 to determine the global ice extent for each month. Her analysis shows that over the 35-year period, the trend in ice extents was downward in all months of the year, even those corresponding to the Arctic and Antarctic sea ice maximum extents.

Furthermore, the global ice decrease has accelerated: in the first half of the record (1979-96), the sea ice loss was about 8,300 square miles (21,500 square kilometres) per year. This rate more than doubled for the second half of the period (1996 to 2013), when there was an average loss of 19,500 square miles (50,500 square kilometres) per year — an average yearly loss larger than the states of Vermont and New Hampshire combined.

"This doesn't mean the sea ice loss will continue to accelerate," Parkinson said. "After all, there are limits. For instance, once all the Arctic ice is gone in the summer, the Arctic summertime ice loss can't accelerate any further."

Sea ice has diminished in almost all regions of the Arctic, whereas the sea ice increases in the Antarctic are less widespread geographically. Although the sea ice cover expanded in most of the Southern Ocean between 1979 and 2013, it decreased substantially in the Bellingshausen and Amundsen seas. These two seas are close to the Antarctic Peninsula, a region that has warmed significantly over the last decades.

In her study, Parkinson also shows that the annual cycle of global ice extents is more similar to the annual cycle of the Antarctic ice than the Arctic ice. The global minimum ice extent occurs in February of each year, as does the Antarctic minimum extent, and the global maximum sea ice extent occurs in either October or November, one or two months after the Antarctic maximum. This

contrasts with the Arctic minimum occurring in September and the Arctic maximum occurring in March. Averaged over the 35 years of the satellite record, the planet's monthly ice extents range from a minimum of 7.03 million square miles (18.2 million square kilometres) in February to a maximum of 10.27 million square miles (26.6 million square kilometres) in November.

"One of the reasons people care about sea ice decreases is that sea ice is highly reflective whereas the liquid ocean is very absorptive," Parkinson said. "So when the area of sea ice coverage is reduced, there is a smaller sea ice area reflecting the sun's radiation back to space. This means more retention of the sun's radiation within the Earth system and further heating."

Parkinson doesn't find it likely that the Antarctic sea ice expansion will accelerate and overturn the global sea ice negative trend in the future.

"I think that the expectation is that, if anything, in the long-term the Antarctic sea ice growth is more likely to slow down or even reverse," she said.

Parkinson calculated and published the global results after witnessing the public's confusion about whether Antarctic sea ice gain might be cancelling out Arctic sea ice loss.

"When I give public lectures or talk with random people interested in the topic, often somebody will say something in the order of 'well, the ice is decreasing in the Arctic but it's increasing in the Antarctic, so don't they cancel out?'" Parkinson said. "The answer is no, they don't cancel out."

How Fatty Acids can Fight Prostate Cancer

Washington State University researchers have found a mechanism by which omega-3 fatty acids inhibit the growth and spread of prostate cancer cells. The findings, which are at odds with a 2013 study asserting that omega-3s increase the risk of prostate cancer, point the way to more effective anti-cancer drugs.

Scientists have long known that omega 3s reduce inflammation and have anti-diabetic effects, and some recently discovered how this happens.

"But we're the first to show that they work this way in cancer," said Kathryn Meier, a professor of pharmacy at WSU Spokane. "The attention has mostly been on inflammation and diabetes but there has always been an interest in cancer, and we were the first to show this mechanism in any cancer cell at all. And we're using prostate cancer, which is the most controversial subject in omega 3s."

A 2013 study in the journal of the National Cancer Institute found that men with higher levels of omega-3 fatty acids in their blood had a greater risk of developing prostate cancer. It was not clear if the fatty acids came from food—certain fish, seeds and nuts are high in omega 3s—or supplements like fish oil.

Working with prostate cell cultures, Meier and two students, Ze Liu and Mandi Hopkins, found the fatty acids bind to a receptor called FFA4 (free fatty acid receptor 4). Rather than stimulating cancer cells, the receptor acts as

a signal to inhibit growth factors, suppressing proliferation of the cancer cells.

"This kind of knowledge could lead us to better treat or prevent cancer because now we know how it works," Meier said. The study also found that a drug mimicking the action of omega 3s can work as well or better than fatty acids in suppressing the cancer cells.

Meier said it is still unclear if the effect can be obtained by taking dietary supplements like fish oil. Some people don't tolerate fish oil very well, she said. Moreover, the effect of fish oil could fade as it is digested, while data from this study suggest that an omega-3 drug needs to be in a cancer cell all the time to have an effect.

"It's very difficult in dietary studies to tell how much to take or what form to take," Meier said. "Should you be eating fish? Should you be taking pills? But now we have a potential drug. Once you have a drug you can test very precisely whether it works or not in a certain disease and you would know exactly how much to give people."

The study appears in the Journal of Pharmacology and Experimental Therapeutics.

Estimating the Cost of Flooding for Communities around Estuaries

Scientists have developed a new visualization tool to predict the maximum cost of coastal flooding to communities around estuaries.

The National Oceanography Centre (NOC) and the University of Liverpool have developed a new visualisation tool to predict the maximum cost of coastal flooding to communities around estuaries.

This method, published in *PLOS One*, works by combining high impact flooding scenarios with land use maps. Researchers used this method to find that the economic damage of coastal flooding increased much more than expected with the size of the flood.

Combining a model for flood inundation with one that simulates the effect of waves means that it is possible to estimate how likely it is that sea defences will be 'over-topped' in a changing climate. This threshold is based on a plausible amount of sea-level rise by 2100. The highest recorded river level was also added to this model to give an overall 'worst-case scenario' of flooding for communities around estuaries.

A new tool then relates the model output in terms of how many brick layers the flood water will reach, this can then be easily related to possible mitigation options for the different water levels.

The lead author of this study, Thomas Prime, from the University of Liverpool, said "By showing how high the flood water could rise in terms of brick courses, and providing a corresponding estimate of economic damage, these new maps can help residents see the impact of low probability flooding scenarios."

An estimate of the economic damage of the flood is obtained by relating the water depth predicted by this method with the land use maps. This information is then fed into 'depth-damage curves', which are used to give a value for the economic damage of flooding for a given water depth and land use type. For example, arable land under five metres of water or residential property under three metres.

Dr Jenny Brown, co-author of this study from the NOC, said "This research is an example of the NOC's commitment to developing transferable science that benefits coastal communities through the provision of evidence in support of flood risk management. This new visual representation of flood hazard identifies areas at risk, allowing improved adaptive management — increasing community resilience to climate change and rising sea levels. This work leverages the expertise in marine hazards from across NOC, and our external collaborators, to assess flood risk to a coastal community from extreme waves, water levels and projected rises in sea level."

Experts Test New Ebola Vaccine on Frontline Medical Personnel and at Risk Groups after Promising Results

The World Health Organisation declared the Ebola virus outbreak a public health emergency in August 2014; since then the development of vaccines against Ebola virus has been fast tracked.

A live vaccine based on the "Vesicular Stomatitis Virus" (VSV) has yielded highly promising results for the rapid development of an effective vaccine against the Ebola virus. This vaccine would only need to be injected once for long-lasting immunoprotection.

Experts at St. George's, University of London, are working in collaboration with other international researchers on one of these vaccines; rVSV-ZEBOV-GP. Researchers are now vaccinating a larger population to examine the efficacy of this vaccine.

The initial study, which tested the safety, tolerability and immunogenicity of the vaccine, has been successfully completed; with the first volunteer vaccinated in November 2014. Volunteers in Kenya, Gabon, Switzerland and Germany participated in this harmonised Phase I clinical trial.

The rVSV-ZEBOV-GP vaccine, which is named after its components, carries only one protein (GP) from the Zaire strain of the Ebola virus (ZEBOV) on the surface of a different virus (VSV) that infects cows, horses, pigs and insects. The Ebola virus protein by itself is not able to cause any disease, and VSV only causes minimal illness in humans.

Currently, it is the only vaccine against Ebola virus disease in clinical trials that is made from a replicating virus. The advantage of this type of vaccine is that the immune system may develop an effective protective response to Ebola virus, and it allows the use of a lower dose of vaccine. Furthermore, only one shot of vaccine may be required, minimising the number of visits to healthcare workers needed to develop protection.

Experts at St. George's, University of London, are part of an international consortium (VEBCON) that provided results essential to begin a clinical trial to test the vaccine in Guinea. They say early results are good and responses to the vaccine are promising.

Professor Sanjeev Krishna, of the university's Institute for Infection and Immunity, said: "We have not had such urgency to deliver a viable vaccine or treatment since the coming together of medical experts in the early 1980s tackling HIV. The progress of these clinical trials is very promising and this vaccine adds

significantly to the options available for testing against Ebola virus."

"Although cases of Ebola virus disease are now decreasing, the outbreak has left an appalling legacy. If a vaccine had been available, the health workers tackling this scourge could have been protected. We still urgently need a safe and effective vaccine to protect people in the future. This research works towards meeting that need."

The consortium examining the Ebola virus vaccine is led by our colleagues in Lambaréné at CERMEL, Gabon, coordinated by Dr Selidji Agnandji, and by Professor Peter Kremsner in their partner institute at University of Tübingen in Germany.

Professor Krishna acts as a scientific advisor to the consortium, and was among a consortium of experts convened by the WHO, in September 2014 in Geneva, to discuss solutions and strategies for combatting the current Ebola virus crisis. The candidate vaccine is called rVSV-ZEBOV-GP and was developed by the Canadian Public Health Agency and produced by the US firm NewLink Genetics. A new paper on the Phase I trial has been published in the *New England Journal of Medicine*.

Source: Science Daily Online