

"DRAGON SCIENCE -- SPECIAL FROM CHINA"  
SHOW 602

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TEASER

ALAN ALDA (NARRATION) We'll meet the man who worked in secret to feed China's millions... We'll explore ancient mysteries -- mummies from the desert, and medical cures from the forest... We'll head straight for a brick wall

ALAN ALDA We're going kind of fast, right?

ALAN ALDA (NARRATION) -- not the wall the tourists visit...

ALAN ALDA (NARRATION) And we'll cruise the troubled waters of the Yangtze river.

ALAN ALDA I'm Alan Alda. Join me now for our special China edition of Scientific American Frontiers.

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EPISODE OPEN

ALAN ALDA Behind me is the entrance to the Forbidden City, where China's emperors ruled until a hundred years ago. Just down the street is the compound where today's rulers live. And in front of me is Tiananmen Square, with Mao Zedong's tomb and the Great Hall of the People. We're at the focus of China, ancient and modern. We're also at the center of what is the largest nation on earth. One in four human beings is Chinese. China is also the world's largest developing country, which means that many Chinese scientists are concerned with getting basic things done, like producing more food or generating electricity. And then other Chinese scientists are worried that with rapid development things

get lost, like wildlife or traditional medical knowledge. We'll have stories on all these subjects, but first back to basics.

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## DAMS AND DOLPHINS

ALAN ALDA (NARRATION) This shrine marks the entrance to the Three Gorges on the Yangtze River. Chinese and foreign tourists come here by the bus and boatload. It must be thousands of years since the first sightseer marveled at the Three Gorges with their plunging cliffs and secret canyons. The hundred-mile-long Three Gorges form the most spectacular part of the Yangtze, as it flows three and a half thousand miles from the Tibet border to Shanghai. And right now in the Three Gorges, the Chinese are hard at work. They're building the world's largest dam. But they're also caught up in maybe the world's most intense controversy. Begun in 1992, the dam is going to take seventeen years and about forty billion dollars to complete. Electric power generation and flood control are the objectives. The man-made lake behind the Three Gorges dam will eventually run upstream from here for three hundred miles. From the Three Gorges down to Shanghai, the Yangtze Valley is the heart of China, and the grimy, industrial city of Wuhan is at its center. Everybody wants their share of the river -- for fishing, waste disposal, shipping. The Three Gorges dam is going to have an enormous impact on a piece of nature that the Chinese have loved and feared for thousands of years. Is the dam worth the cost? Will it control floods? Is the fishing going to get better or worse? And what about the original Yangtze inhabitants, the ones who've been around a few million years longer than the Chinese?

ALAN ALDA Chi Chi is the only dolphin, river dolphin in captivity anywhere in the world?

WANG DING Chi Chi is the only baiji in the world.

ALAN ALDA The only baiji, I see. O.K.

WANG DING Yes, that's true.

ALAN ALDA O.K., wait a minute. Wait a minute, don't go away. Wait, I got it here, here, here.

ALAN ALDA (NARRATION) Chi Chi is a Yangtze River dolphin, one of the world's three freshwater dolphin species.

ALAN ALDA Hello Chi Chi. Nihao. I forgot I have to talk Chinese to him. He doesn't know English, right?

ALAN ALDA (NARRATION) A few years ago they tried to match up Chi Chi with a young female.

WANG DING Chi Chi was just kind of afraid of that female.

ALAN ALDA Really?

WANG DING He didn't let the female to get close to him.

ALAN ALDA Well, maybe it was a personality problem, maybe they just had a little personality clash there, you know.

ALAN ALDA (NARRATION) The Hydrobiology Institute, in Wuhan, was set up by the Chinese government to try and save the baiji, the river dolphin. Biologist

WANG DING and his colleagues are about to give Chi Chi his monthly check up. But first they have to drain the pool and then catch him. [CHINESE]

ALAN ALDA (NARRATION) Chi Chi is used to this kind of treatment. He's been here for 15 years, since a fisherman accidentally snagged him on a hook. But in that time, the total number of baiji in the river has fallen from about five hundred to less than one hundred. So now he's precious -- rarer than the panda.

ALAN ALDA These are the big marks from when he was caught by the fisherman's hook?

WANG DING By the fisherman's hook. Yes, that's right.

ALAN ALDA (NARRATION) Studying Chi Chi has taught the Chinese biologists how to look after these rare animals.

WANG DING The heart, it's a little too fast, heart rate is a little too fast. That's normal because it's... it's you know, it's not in water.

ALAN ALDA (NARRATION) As the biologists expected, there are many lighter skin patches. They're skin infections and they'll be treated with an antibiotic. It's one of the biggest problems the Chinese have encountered in keeping freshwater dolphins.

ALAN ALDA What's that brown greasy stuff that goes on top of him?

ZHANG XIANFENG It's kind of oil. It's a kind of Chinese traditional medicine.

ALAN ALDA That's traditional medicine.

ZHANG XIANFENG Yeah.

ALAN ALDA So first you put the western medicine on, and then on top of that you use some traditional medicine?

ZHANG XIANFENG Yeah. Yeah.

ALAN ALDA What is...

ZHANG XIANFENG And also the oil keep the western medicine for long... a little bit longer time.

ALAN ALDA I see. So sort of like a bandage?

ZHANG XIANFENG Yeah. Yeah.

ALAN ALDA (NARRATION) The check-up is quickly completed and the pool refilled, so that Chi Chi's temperature stays as even as possible. You could almost feel his relief as he made it back into his own element.

ALAN ALDA He looks happy now.

ZHANG XIANFENG He is happy.

ALAN ALDA (NARRATION) Chi Chi would be happier with a mate, but the female they had here died of pneumonia before maturity. That was before they had worked out all the routine precautions that need to be taken. This is Chi Chi's food. It's locked up, not only to keep out poachers, but also to prevent accidental contamination. Strict hygiene is essential with fresh water dolphins. A chlorinating system for Chi Chi's tank would help -- in fact it might have saved his young female companion, but that's something the program cannot afford. Using a combination of medication in the food and monthly check-ups, they've managed so far to keep Chi Chi healthy. The Chinese are now trying to catch all the remaining dolphins, either for captive breeding, or to confine them in an isolated natural area away from the busy river.

ALAN ALDA Was it difficult in the beginning to get interest and funding in saving the dolphin? Did people understand the problem right away?

ZHANG XIANFENG At the very beginning, it's very, very... it was very difficult to get support. If we started the work for saving the dolphin ten year earlier, the situation would be much better than today.

ALAN ALDA Do you think you'll be able to save them? Do you think it will be possible to save the dolphins?

ZHANG XIANFENG It's hard to say for myself. Ah, but I think we... we still should do... still... should try our best to save the dolphin. We have chance, but probably the last chance.

ALAN ALDA (NARRATION) The mile long dam taking shape on the Yangtze nearly didn't get built. It sparked an unprecedented debate, which some people say fueled the student democracy movement of 1989.

ALAN ALDA This is a pretty big model.

YANG GUOWEI Yeah.

ALAN ALDA How does it compare to the dam itself? What's the scale?

YANG GUOWEI Oh, it's the model scale is one to one hundred fifty.

ALAN ALDA (NARRATION) Across town from the dolphin institute, I visited engineers who are working out how to keep the dam running. The critics claim that the slow-moving reservoir, behind the dam, will in time just fill up with sediment. And the Yangtze carries tons of sediment.

YANG GUOWEI The water carries so much sediment every year...

ALAN ALDA Oh, the water carries five hundred million tons of sediment a year. Now, but if you don't let it carry it through the dam, that will get deposited or some of that will get deposited.

YANG GUOWEI Yes.

ALAN ALDA (NARRATION) The answer, they say, is to open special gates, low down in the dam, during flood season -- when most of the sediment comes down river. The extra flow should flush most of the accumulated sediment out of the reservoir. Technicians constantly run water mixed with coal dust -- to represent sediment -- through the model. They measure the depth of sediment as it settles behind the dam. A day and a half on the model simulates a year in real life. Even though nobody has ever controlled sediment on this scale before, the engineers are convinced they know their stuff.

ALAN ALDA So people are working around the clock here?

YANG GUOWEI Yeah. Twenty four hours every day.

ALAN ALDA The poor women are pushing this thing back and forth. It's hard work.

YANG GUOWEI If we want to do some research work we have to do that.

ALAN ALDA This is what you mean a little bit by experience. I mean you start to get a sense of the river, and how your apparatus makes the river respond.

YANG GUOWEI Yes, and a very famous professor, American professor says that if you want to know your result is right or not, most important thing is, you should know the river itself.

ALAN ALDA Mark Twain said, you've got to know the river.

YANG GUOWEI Really? Oh, so I should learn from Mark Twain.

ALAN ALDA (NARRATION) For the engineers, knowing the river is a matter of life and death. Five times this century the Yangtze has flooded, with three hundred thousand deaths, and millions homeless. More and more people live in the Yangtze flood plain, protected right now by embankments, which are desperately strengthened in times of flood. It remains to be seen whether the engineers can keep the reservoir free of sediment, so that there will be room to store future floodwaters. The greatest outcry came on behalf of the people living behind the dam, in the reservoir area. In China every inch of usable land is occupied, so when water levels in the gorges rise a hundred and fifty feet, thousands of villages and towns clinging to the sides will disappear. This is the first of the so-called relocation villages, built for 10,000 people. Eventually a million will have to move, and for them to be absorbed the government is counting on an expanding economy stimulated by the output of the dam's electricity, equal to twenty-six power-stations. There will be new jobs -- on the spectacular road up to the dam site, for example. Much of it is being built by hand, wheelbarrow load by wheelbarrow load. The dam is a gigantic gamble on the future, and that's why so many people objected, and were even willing to go to jail over it. But that's a level of opposition my charming host shrugged off as normal.

ALAN ALDA If it is believed by most of the authorities that the dam is a good idea, are other scientists willing then to contradict that opinion?

YANG GUOWEI I think that most of them understand what the importance of the Three Gorges construction. But for any, I mean for any good idea, there are some people say no. This is very common sense. We cannot get one hundred percent to agree with the project construction. It's the same everywhere in the world.

ALAN ALDA (NARRATION) We won't know who's right about damming the Three Gorges for several decades to come.

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## FOOD FOR THOUGHT

ALAN ALDA (NARRATION) We're in a small village in central China. Most Chinese -- seven hundred million of them-- live in villages. Mrs. Zhao is threshing her crop of canola seed, used for cooking oil. Her two sons help run this typical farm, which is very small -- just under an acre. Yet the six-member family is self-sufficient in most things. They raise fish in their pond. There are chickens and ducks... And behind the house there's a comfortable pigsty. The Zhaos grow vegetables, potatoes, peanuts, and oranges. They produce all their own meat, oil, and eggs. There's only one concern... Rice. A third of their land is rice field. Twenty percent of the crop has to be sold to the government. What's left will feed half the family -- they'll have to buy the rest. Yet overall, China right now is feeding itself. In the late fifties, things were very different. It was the time of Mao Zedong's Great Leap Forward. Cooking pots and tools were melted down in backyard furnaces. Everybody had to pitch in to achieve rapid industrial development. The result was not just bad quality iron, but also widespread neglect of essential work in the fields. Agricultural production collapsed. It's said that the three-year famine took thirty million lives. Today, China's rice fields are full, not only because those disastrous policies have gone, but also thanks to one extraordinary man, Yuan Longping.

YUAN LONGPING They are flowering, you can see. Here, the anthers come out.

ALAN ALDA (NARRATION) We're in southern China for the crucial few days when the rice plants flower. Rice is normally a self-fertilizing plant, which means each flower makes its own pollen, carried on these thick yellow anthers. But there's a second, different kind of rice in this field, planted in alternate rows. It's a little shorter than the first. When you compare the two, just during flowering, you can see the secret of Yuan Longping's success.

YUAN LONGPING You can compare. Here, you can... the anther is much smaller than the other one. You can... the color is pale...

ALAN ALDA Very pale white color.

YUAN LONGPING And there's no pollen inside.

ALAN ALDA (NARRATION) The second flower, on the left, is male sterile -- it has no pollen of its own. This means it can receive pollen from the first plant-- and that's the big prize. Here's what they do. The workers wait for midday when the rice flowers open. Then they spring into action. Pollen, shaken loose from the normal flowers, settles on the male sterile ones, pollinating them. Now the rice that will form will be a hybrid--that's a cross of two different plants. When that hybrid is planted next year, it will grow extra large, as all hybrids do. Result -- more rice.

YUAN LONGPING Please follow me, follow my step.

ALAN ALDA O.K.

ALAN ALDA (NARRATION) While pollination went ahead, we decided to find someplace to get out of the sun.

ALAN ALDA Oh, oh, oh... oh God. I've got it, I'm fine. This rice is dangerous stuff.

YUAN LONGPING Dangerous.

ALAN ALDA Thank you. I've got some kind of cactus in my finger. What kind of cactus do you have here?

ALAN ALDA (NARRATION) Every grain of rice is still important in China. As usual, the ducks here are cleaning up in an already harvested field. But with hybrid seeds, the harvest has been transformed. Yields are over a third higher. Since 1976, when the first few seeds became available, it's as if China has had an entire extra year's crop. The crucial breakthrough in developing hybrid rice came in 1970, in a streambed on Hainan Island, off China's south coast. During the terrible famines a decade earlier, Yuan Longping had decided he would devote his life to developing better rice. A hybrid would be ideal, but at the time plant breeders couldn't figure out how to cross-breed two kinds of rice if each made its own pollen. Then on a routine collecting trip,

Yuan Longping's assistant found the answer -- wild rice with a natural male-sterile flower, containing no pollen. Yuan Longping instantly realized what he had. He could now breed hybrid rice, by adding pollen from another plant.

YUAN LONGPING Lucky. We were very lucky. There is a famous saying, that chance favors the prepared the mind only. Yeah, this is true.



ALAN ALDA (NARRATION) Yuan Longping's mind was very nearly not prepared. In the fifties, China followed Russia's lead, in culture, technology -- and science, including the faulty theories of Russian geneticist Lysenko, which were based more on ideology than nature.

YUAN LONGPING Lysenko, ah. Now, I hate him, because he wasted my... my useful time. When I was young and strong, I believed his theory.

ALAN ALDA (NARRATION) During the Russian period, only Lysenkoism was permitted. But Yuan Longping had a rare courage.

ALAN ALDA How did you free yourself from those ideas?

YUAN LONGPING Oh, at the time, I just secretly read some western magazine. But in secret.

ALAN ALDA In secret.

YUAN LONGPING We cannot... in the public.

ALAN ALDA So during the day you would go to school and work with Lysenko's ideas, and at night, at night you would read the other stuff.

YUAN LONGPING Yes. Yes. I bring Lysenko's book, outside... but inside...

ALAN ALDA (NARRATION) Back on Hainan Island, where that original wild rice was found, development has now arrived. On the pristine beaches, resorts are sprouting up for China's new middle class.

YUAN LONGPING's prepared mind got here just in time, because the road to the new airport has almost wiped out the lucky streambed.

YUAN LONGPING Twenty-five years ago, many, many wild rice over here. Now only a few places, and a few plants here.

ALAN ALDA (NARRATION) Mrs. Zhao is preparing the evening meal, while her mother-in-law stokes the fire. The bacon is their own... So are the vegetables, the oil and the peppers. But the rice they bought, with some of the family's four-thousand dollar-a-year cash income -- money that comes mainly from the sons' jobs at the new metal pipe factory nearby. All over China now, people are leaving the land. They will be needing to buy rice, and at least for now they can get it -- thanks in part to

YUAN LONGPING.

ALAN ALDA How does it feel to know that your work is actually feeding hundreds of millions of people?

YUAN LONGPING Yes. You... you mean my feeling?

ALAN ALDA You. How do you feel?

YUAN LONGPING My feeling. I feel very happy to do that. If people, they live very comfortable... this is my goal, my goal of my life, to make more people happy.

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## DRIVEN TO THE WALL

ALAN ALDA (NARRATION) A lot of things are different about China, but not the traffic. There's only one car per four hundred people -- America has one for two -- but that's changing rapidly, with the number of cars doubling every five years. So China's roads are going to get more crowded and more dangerous. I'm at North China University of Technology in Beijing. My guide is Wei Xu, a computer expert. We're here to see a high-tech anti-collision device. But first -- Mr. Tuo is from the Foreign Affairs Office. Every organization has one, to keep an eye on foreigners. Then I'm introduced to the professor who developed the device. Then there's a meeting. There are always large meetings. It's partly politeness but also, possibly, to share responsibility -- individualism is often frowned on in China.

ALAN ALDA So this... this is the sensor?

ALAN ALDA (NARRATION) The device uses a laser range-finder. The car is made in China, by the way.

ALAN ALDA Is the idea that this will stop you sooner than you would be able to on your own?

ALAN ALDA (NARRATION) With Wei Xu translating, the professor explained that the system automatically applies the right braking for different conditions. Gentle for slow or distant obstacles, or rapid in an emergency.

ALAN ALDA So what are we doing, basically? We're going to go out and look for walls we can smash into or what?

WEI XU Yes, we want to try... there's an object like a wall in front of us, we want to try to -

ALAN ALDA See if we stop?

WEI XU Yes. Going to see if car can make stop or not.

ALAN ALDA Does this car have an airbag?

WEI XU No, they have a safety belt.

ALAN ALDA I think I'll use that. O.K. Zouba. Does he have like a favorite wall he heads for, or are we just going to look... Is this the wall here? We're going kind of fast, right? What the... Excuse me, that was pretty fast. Yeah. Did you put the brakes on at all? Or was that all the system?

WEI XU All the system.

ALAN ALDA How fast were we going? How fast was that?

WEI XU Like 40 kilometers or 40 kilometers an hour. Like 30 miles...

ALAN ALDA 30 miles an hour.

WEI XU Yeah.

ALAN ALDA Do you ever worry that that's not going to work when you do this?

WEI XU Yes, at the beginning, he's pretty worried.

ALAN ALDA Yeah, well I... Well, you know how before I said it would be nice if I could drive and do this?

WEI XU Yeah.

ALAN ALDA I don't want to.

WEI XU I do.

ALAN ALDA You do? You do, you want to do it?

WEI XU You want to try it?

ALAN ALDA You're a daredevil from Beijing. What do you -- all right. No, wait a minute. No, I don't want to do it with you. You don't know how to do it. You never did it before. This guy's been doing it over and over. He was afraid the first time he did it. Yeah, good job. Hun hao, hun hao.

MAN Yi... er... san... Cheese.

ALAN ALDA Say qiezi.

MAN Qiezi.

ALAN ALDA (NARRATION) End of visit pictures are common too -- maybe because meeting foreigners is still quite rare.

MAN Yi... er... san...

GROUP Qiezi!

GROUP (SUBTITLE TRANSLATION) Eggplant!

ALAN ALDA (NARRATION) Next stop in our search for Chinese high-tech was this experimental train. China has thousands of miles of railroad track, all strung with overhead electric wires. Right now, workers have to check the alignment of the wires by walking the track once a week. But here the idea is to check automatically from the moving train. The system has to pick out the right wire from a complicated TV picture.

ALAN ALDA This shows you where the wire is horizontally...

WEI XU On the crossbar.

ALAN ALDA On the crossbar. Right now it's moving over to the side, right?

WEI XU Yes.

ALAN ALDA It's jumping over to the side. Staying there. Now... now it's moving back toward the center...

ALAN ALDA (NARRATION) The little white arrow shows that the system is successfully tracking the position of the overhead electric wire. The system also measures the height, or looseness of that essential power wire, and counts the poles, so it knows where any fault is located.

ALAN ALDA What's this? What's happening there?

WEI XU This is a message to tell you there's a problem. You see this here is too loose.

ALAN ALDA It's too loose down here?

WEI XU Yes.

ALAN ALDA And that's how loose it is? That's a number telling you how loose it is.

WEI XU Yes. Yes.

ALAN ALDA And this tells you what pole, where the problem was, at what pole.

WEI XU That's right.

ALAN ALDA So that... that information is sent...

WEI XU To the computer.

ALAN ALDA To the computer.

WEI XU Here's another problem.

ALAN ALDA Another problem. You got a lot of problems along this track...

WEI XU Yeah.

ALAN ALDA In Asia, did fuzzy logic...

ALAN ALDA (NARRATION) Both the car and train systems use a kind of computer programming, called fuzzy logic, that's rapidly caught on in China. Here at Beijing Normal University, there's a national lab devoted to it.

ALAN ALDA How does this work?

ALAN ALDA (NARRATION) With fuzzy logic, instead of working out mathematical equations, the computer uses a series of simple rules. So it can decide what are poles in this picture, if it's told that poles always move at a particular speed. Things that look slower, or faster, must be something else -- like buildings or tunnel structures.

ALAN ALDA Does this in some way mimic the way the human brain works?

WEI XU Yes, and fuzzy logic is mainly based on the human experience. You can... you also have this kind of experience. For example, the way you balance the stick in your palm. And for example, the basic rule is, if the stick fall on this side, what are you going to do? Your hand will move to this side. This is rule. This stick moves to this side, I move my hand on this side.

ALAN ALDA Let me get the feel of it here. O.K., so, yeah, yeah. O.K. I see, I'm automatically going -- I'm not only going in the direction it's going in, but I'm changing the speed. If it really starts to tilt and go fast I notice that I'm going much faster in that direction.

WEI XU Your experience is the rule.

ALAN ALDA That's the rule. That's the rule, I'm following.

ALAN ALDA (NARRATION) Chinese scientists are heavily involved these days in high tech and it does show where the country is headed. China is clearly going to be a technical giant in years to come. There'll be no stopping it.

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THE WISDOM OF LI SHIZHEN

REN JUN You see, he has very thick and greasy coating.

ALAN ALDA And that's related to the heart?

REN JUN Yes.

ALAN ALDA (NARRATION) Weng Weiliang is a professor of Chinese medicine. He's going through the traditional diagnosis -- tongue, then pulse. Not just one pulse, but six per wrist.

REN JUN In Chinese medicine when we feel the pulse, we call it xin, gan and shen. It's reference to different organs. So this one, this finger is the heart, and this is the liver, and this is the kidney.

ALAN ALDA And you feel different things in each finger?

REN JUN Yes.

ALAN ALDA (NARRATION) Dr. Weng now questions the patient.

DR. WENG (SUBTITLE TRANSLATION) What discomfort do you feel?

PATIENT (SUBTITLE TRANSLATION) A little bit of heartache...

ALAN ALDA (NARRATION) It seems that his yin and yang are badly out of balance, and his qi is seriously affected.

PATIENT (SUBTITLE TRANSLATION) Sometimes when I am anxious or angry the heartache comes more often.

REN JUN These emotional causes can cause the disorder of the movement of the qi inside the body.

ALAN ALDA The qi?

REN JUN Yeah, the qi. If they get angry, then the qi is blocked.

ALAN ALDA The qi is what? [CHINESE]

DR. WENG (SUBTITLE TRANSLATION) It's very abstract. It's a kind of energy... A kind of dynamics.

ALAN ALDA (NARRATION) The forest provides Chinese medicine's remedies to treat those disease concepts that we in the west find so hard to grasp. It's a unique, complete system.

XIA QUAN This is a traditional herbal tea, used for the... to treat internal heat, you know, caused by a bad metabolism.

ALAN ALDA (NARRATION) This expedition is systematically collecting useful plants, based on local traditions. Chinese medicine is a classic empirical science -- if it works, use it. There's a cure for everything.

XIA QUAN In Chinese medicine it's called purple peel. So its function is to stop bleeding.

ALAN ALDA (NARRATION) This tree treats skin infections. Herbal remedies tackle simple problems and complex, even immune or nervous system disorders.

XIA QUAN In Chinese medicine this have interesting name called, go for brain.

ALAN ALDA (NARRATION) For thousands of years, most herbal remedies have been drawn from the tropical forests and mountains of southern China. And now

these remote areas are being developed. The reservoir of plants and knowledge is disappearing, to the alarm of scientists.

XIA QUAN We have just one world. So everybody should have an idea about the environment and the traditional knowledge for the... for us and for the future of all of us. So let us cross the finger.

ALAN ALDA (NARRATION) This is the pharmacy of

Dr. Weng's hospital. It contains the five hundred most commonly used herbs. Li Shizhen's classic herbal encyclopedia, written in the sixteenth century and still the key reference, lists about two thousand herbs. Dr. Weng's patient has four problems -- deficient qi, blood stagnation, low appetite, and weak kidney. The kidney is one of the five critical yin organs that cool body heat.

ALAN ALDA What's in this that she's putting in the dish?

DR. WENG Huang qi.

ALAN ALDA Is there an English word for that that you know?

DOCTOR Er, no. It's for nutrition the qi.

ALAN ALDA It's for the qi?

DOCTOR Yes.

ALAN ALDA What is this?

DR. WENG Dan shen.

ALAN ALDA Dan shen?

DOCTOR It's for stimulate blood circulation

ALAN ALDA (NARRATION) Altogether 12 different herbs are in the prescription that comes into the extraction room. Here it will be made into tea, alongside hundreds of other individualized prescriptions for the rest of the patients in the hospital. It's a system in use in thousands of hospitals and pharmacies across the country. And it's something that most Chinese have faith in. So does it work?

PATIENT (SUBTITLE TRANSLATION) It's very hot.



ALAN ALDA (NARRATION) It's hard to say. Because little, if any analysis has been done using western style scientific methods.

PROF. XIAO Here is the herbarium...

ALAN ALDA (NARRATION) But it's a question which Professor Xiao hopes to answer. He runs the main institute that collects medicinal herbs, and he's seeing an explosion of interest. Recently he concluded an agreement to send three thousand different samples to a big European pharmaceutical company for testing. They'll share royalties from any new drugs. Several other companies are exploring this ancient treasure house of folk medicine. There's some optimism that major problems like cancer, AIDS, and heart disease can be affected. The Chinese are just as interested in exploiting their medical heritage themselves. One new drug they're testing is extracted from a plant traditionally prescribed for dizziness. So one test to apply is this. A few weeks ago these mice learned to swim a maze. Here they're being re-tested and timed over the same course. It's a standard test of memory, used widely in the west. This subject isn't doing so well. Eventually it runs over the two-minute time limit. But mice fed an extract of the traditional dizziness plant performed significantly better. There is hope that the plant could form the basis for an anti-aging drug. This kind of process, developing drugs for use within China, has been going on for some time now.

PROF. XIAO From 1980 until now, three hundred new drugs...

ALAN ALDA Three hundred new drugs, yeah...

PROF. XIAO Were originated from natural products.

ALAN ALDA Now, of those three hundred, how many came from traditional medicine plants, and how many came from plants that you just went out and found randomly?

PROF. XIAO So I dare to say, almost ninety percent, and that means most of these are originated from our traditional Chinese medicine.

ALAN ALDA Traditional medicine.

ALAN ALDA (NARRATION) A western-style computer system is being used by Dr. Weng to standardize traditional tongue color measurements. It seems there's something of a two-way street developing here between eastern and western medicine.

ALAN ALDA How are you feeling now?

REN JUN Oh he feels much better.

ALAN ALDA When do you think you'll be finished with the treatment?

REN JUN He hopes in another ten days.

ALAN ALDA Ten days? Is that what the doctor thinks too? Does the doctor think that?

REN JUN The doctor doesn't agree.

ALAN ALDA He doesn't agree?

REN JUN No, he doesn't agree.

ALAN ALDA He thinks it will be longer?

REN JUN He said I should listen to the doctor.

ALAN ALDA Does the doctor want him to stay longer?

REN JUN Why the doctor wants him to stay longer because the doctor wants him to stop smoking.

ALAN ALDA Ah... Now does the doctor feel that there's any connection between the smoking and the heart problem?

REN JUN Yes.

ALAN ALDA Do you think if he doesn't stop smoking that he'll be back here with the same problem?

REN JUN Yes.

REN JUN (SUBTITLE TRANSLATION) So you'll have to give up.

PATIENT (SUBTITLE TRANSLATION) Yes.

ALAN ALDA (NARRATION) Finally it was my turn.

REN JUN Do you eat a lot?

ALAN ALDA Do I eat a lot? Yeah.

ALAN ALDA (NARRATION) Dr. Zeng's questions were uncomfortably perceptive.

ALAN ALDA How can he tell that I eat a lot by feeling my wrist? That's what I don't get. I mean it's not an especially fat wrist, you know.

REN JUN Headache?

ALAN ALDA Headaches? Sometimes I get headaches.

REN JUN Do you feel dizziness?

ALAN ALDA Hmmm?

REN JUN Do you feel dizziness sometimes?

ALAN ALDA I felt dizzy this morning in the other room.

ALAN ALDA (NARRATION) And he soon told me that my body had too much heat. I told him I eat a lot of spicy food, and he agreed that can cause heat. But my heat and cold were significantly out of balance.

DR. WENG (SUBTITLE TRANSLATION) Look -- there's the sign of heat on the back of the tongue.

REN JUN You can see you got yellowish coating of the tongue, especially of the root of the tongue.

ALAN ALDA What's that? That's bad or good?

REN JUN That's heat.

ALAN ALDA Heat. Heat. [CHINESE]

REN JUN If you don't treat it, it can cause like headache or dizziness, and maybe hypertension.

ALAN ALDA Really? You say a thing like this to a person?

ALAN ALDA (NARRATION) Ginseng and chicken soup were prescribed. Well, they didn't have the soup, but Professor Xiao did have some American ginseng.

PROFESSOR XIAO We prefer to use...

ALAN ALDA You prefer the American ginseng.

PROFESSOR XIAO ... American ginseng, because by our traditional, the theory of our traditional Chinese medicine, American ginseng, the property is mild.

ALAN ALDA (NARRATION) American ginseng is supposed to be cooling, to balance my excessive internal heat.

ALAN ALDA Here's to your health.

PROFESSOR XIAO On the other hand, if Korean ginseng...

ALAN ALDA (NARRATION) I wasn't used to the taste, and I wasn't sure what it would do to me.

ALAN ALDA Very refreshing.

ALAN ALDA (NARRATION) And now I had this new problem of internal heat.

ALAN ALDA Mmmm...

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## TIME TRAVELERS

ALAN ALDA (NARRATION) I'm heading into the back streets of old Beijing in search of a little history.

ALAN ALDA This is Lin Xuan Qin, an artist who makes chops. These are stones with your name carved in them, that are used for stamping your signature on documents. Chops are giving way to western style signatures now, but they have a very long history in China. They're the forerunner of printing using moveable type, which was invented in China nearly a thousand years ago, five hundred years before Gutenberg invented moveable type in Europe. [CHINESE]

ALAN ALDA (NARRATION) Lin Xuan Qin was carving my own personal moveable type.

ALAN ALDA (SUBTITLE TRANSLATION) Is it ready?

LIN XUAN QIN (SUBTITLE TRANSLATION) Ready.

ALAN ALDA (SUBTITLE TRANSLATION) Is this my name?

LIN XUAN QIN (SUBTITLE TRANSLATION) Yes. Ao-de.

ALAN ALDA No, no, that's toward me, like this. O.K.

ALAN ALDA Ah, O.K.

SUBTITLE "AO-DE"

ALAN ALDA The list of firsts in Chinese inventions is staggering. They invented gunpowder, the magnetic compass, paper, the wheelbarrow, the decimal system, porcelain, relief maps and on and on and on. So you probably think I'm going to say these stamps were invented in China too. Actually, they weren't. They came to China from the Middle East, three thousand or so years ago. So were most important things invented in China or in the west? Well, history is never that simple.

ALAN ALDA (NARRATION) We're in the far west of China. This arid land has been yielding up some extraordinary finds. They are the mummies of Xinjiang. Xinjiang Province is the overland bridge between China and Europe. In the early part of this century, Europeans exploring Xinjiang began uncovering mummies, in shallow desert graves. More recently, Chinese archaeologists have made discoveries. The mummies were brought to Urumqi, the provincial capital. Xinjiang is largely Moslem, its people drawn from many parts of central Asia. An archaeology institute has some of the mummies. And the rest are at the local museum. Ours were the first TV cameras allowed to film the mummies. This is the oldest, dating from about four thousand years ago. Once a year the mummies are cleaned and examined for insect damage. Blocks of insecticide are replaced. The hat with the eagle feather is felt, and the woven robe is wool. They're all vulnerable to insects. As are the cowhide boots. The child is from the same period as the first mummy. It was carefully wrapped in a large woven, woolen cloth, held together with wooden pegs. This child, from about three thousand years ago, is wrapped in a fine wool blanket, tied with braided cord. The reasons for the stones and wool nose plugs are unknown. It lies on a bed of felt, with a cow horn drinking cup. This man is one of the museum's finest examples. He has a sunburst decoration, again of unknown significance. The state of preservation is extraordinary, a result of the dry, salty desert soil, and also it seems, some kind of glue-like coating that the bodies were treated with. One striking fact about the mummies stands out. They don't seem to be Chinese. Their full beards and prominent noses are clear Caucasian features. So where did they come from? Close analysis of the skull types suggests that they came from what's now Kazakhstan in the northwest, and from Pakistan in the southwest. In that period, Chinese skull types from the east are only found at the edge of Xinjiang. Xinjiang's spectacular mountain ranges once fed streams and rivers which rushed down into the desert. The ancient settlers clustered around those desert oases. It's drier here now, but the local Kazak people still follow the herding

lifestyle, along the riverbanks closer to the mountains. The wonderfully preserved objects found with the mummies, show how they lived. These are three thousand-year-old lamb ribs, complete with barbecue spit. The Kazaks live in houses called yerts, covered entirely with felt they've made from matted wool fibers -- just like the child's felt bed in the museum. Inside, the yerts are decorated with woven strips, finished with braided cords. The men ride horses, as they did in ancient Xinjiang. This saddle was also found with the mummies. If it weren't for this man, the mummies would probably have remained an obscure curiosity. Victor Mair, a China scholar from the University of Pennsylvania, visited the museum soon after we'd filmed. For several years he's brought various western specialists to examine the mummies. This time he wanted two textile experts to be given access.

VICTOR MAIR Now we're going up to see the mummy room...

ALAN ALDA (NARRATION) But Victor Mair is a terrible thorn in the side of official China. He's working on a theory that the mummies represent people who originated far to the west in Europe, bringing with them new technologies that the Chinese did not have. Of course, we were interested in recording the visitors' first reactions. But even though we'd already filmed the mummies earlier and paid the required fee, the museum authorities wouldn't allow it. We were asked to leave. The experts were fascinated by what they saw, particularly this piece, which they identified as probably a practice weaving sampler.

ELIZABETH BARBER In a way that... That almost touched me the most.

VICTOR MAIR Yeah, because it really brings --

IRENE GOOD Because I have one too that looks just about as bad.

VICTOR MAIR Ones that you've tried to make?

ELIZABETH BARBER Yeah, the first piece you weave looks really crummy.

ALAN ALDA (NARRATION) Most interesting was the fact that it's too big to have been made on the type of loom that the Chinese had at the time.

IRENE GOOD I'm very interested in that sampler because I'm starting to wonder if some of my ideas about the loom...

ELIZABETH BARBER The loom that was used.

IRENE GOOD May be confirmed by that particular piece.

VICTOR MAIR The width of it for example.

IRENE GOOD The width and also there were some other garments that had a very wide swath to them.

ELIZABETH BARBER Yes, it's not being done on the narrow body tension loom.

ALAN ALDA (NARRATION) Today Xinjiang's desert highways are busy with trucks. Seven hundred years ago it was Marco Polo's camels. This is the ancient Silk Road, between Europe and Asia. If the mummies were the trailblazers along this great world trade route, four thousand years ago, it could mean that China acquired important new ideas from the west. And that's what irritates the government. It's possible that the wheel entered China this way. They've been unearthed in the desert, although the dates aren't yet clear. It does now seem that bronze came to China from the west, a fact which Victor Mair's Chinese colleagues are beginning to accept.

VICTOR MAIR When I first started this project I was getting in hot water for saying that hey, why do we have bronze out here now, and you get it earlier, and it ends up in China later, and I got in trouble for that. But I'm very relieved now, because empirical evidence eventually wins. And Chinese archaeologists have no problem with empirical evidence.

ALAN ALDA (NARRATION) But a problem for the government concerns these Uyghur people. They're the dominant group in the province, and they have a growing Uyghur nationalist movement. Victor Mair's ideas could encourage them.

VICTOR MAIR We know that the Uyghurs themselves didn't get here until the eighth century of our era, so...

ELIZABETH BARBER And we're talking about the second millennium, BC

VICTOR MAIR The second millennium, so that's really a specious argument. And so the Chinese shouldn't worry.

ELIZABETH BARBER It really has nothing to do with it.

VICTOR MAIR No. It has nothing to do with Uyghur nationalism. So we can omit that one and I don't really think I should get in trouble with that ever.

ALAN ALDA (NARRATION) But Victor Mair continues to get in trouble. Soon after his visit, the government newspaper published a long attack on his ideas. In China, even technical archaeological arguments can't be conducted freely. Will freedom of expression eventually come to China? Well, times are changing.

ALAN ALDA I think the most striking thing about this trip to China for me has been the tremendous sense of change I've seen here. I made my first trip to China about 15 years ago, and it was nothing like this. There are rich people here now. There's neon. People dress differently. In those days it was hard to find somebody who didn't wear a Mao suit. Now it's almost impossible to find somebody who does. And they dress stylishly too. And they move stylishly. In those days, getting across the street involved a kind of a utilitarian walk. Now they stride across the street. There's a sense of self-presentation. And there's karaoke now. You almost can't go into a Chinese restaurant without hearing karaoke. A few years ago I tried to get them to sing for me, and they wouldn't do it. I said, teach me a Chinese song. They said, no, there's a saying -- The bird that sticks its neck up above the flock gets its head cut off. Well, as surprising as these changes have been, there seem to be even more profound changes under the surface. I hope I'll be back before too long to see those changes. This has been our special China edition of Scientific American Frontiers. Until next time, zaijian.

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