

## SHOW 304 - "SPECIAL FROM EGYPT AND ISRAEL"

Episode Open

Saving The Coral Reef: Reef Madness

Stairway to Heaven: The Pyramid Builders

Neot Kedumim: Nogah's Ark

That's My Baby: Newborns and Their Moms

Desert Rescue: Stork Haven

Wingate Institute: Sports Imports

Parting the Waters: Miracle in the Red Sea?

Ancient Flutes: "Tunes From the Tomb"

### EPISODE OPEN

WOODIE FLOWERS Welcome to this special edition of FRONTIERS. I'm Woodie Flowers, and right now, I'm in the Old City of Jerusalem. The faithful of three great religions come here to worship. And fabled monuments draw tourists from all over the world. Sightseers on an exotic vacation, true believers on a pilgrimage...participants in a never-ending procession. But our itinerary in the next hour will take us on yet another kind of tour, as we explore science and technology here, in Israel ... .. and here, in neighboring Egypt. We're going to reveal some new discoveries about the astonishing achievements of ancient times -- like these pyramids -- and we'll see some delightful ways science is influencing life in this region today. So come on along, for this rare and exciting look at the Middle East. First we're going to leave Egypt, and head back to Israel -- where we'll plunge into an underwater paradise.

[back to top](#)

### SAVING THE CORAL REEF: REEF MADNESS

NARRATION The Red Sea is home to one of the richest coral reefs in the world. These are the corals, living animals which give the reef its color and vibrancy. The reef itself is made up of the skeletons of many generations of dead corals. Reef building takes hundreds of years. A stunning variety of fish and more exotic marine animals --like this octopus -- are attracted to the reef for the food and shelter it provides. And there's one more species that likes it here. Israel has less than one mile of reef, and almost a million visitors each year who come to see it. For the resort town of Eilat, the reef is a gold mine, and the tourist business is booming. But just beneath the surface, there's trouble in paradise. The reef here is extremely shallow, and simply by stopping to rest on it, or breaking off a tiny piece, snorkelers and divers are destroying it, bit by bit. In many places, the fragile living layer of corals is gone. Hudi Benayahu of Tel Aviv University has a mission: a life long student of the reef, he's now setting out to save it.

Surprisingly, the key to the reef's survival may be here, in this man-made structure. You'd never guess from looking at it above water, but this enormous oil jetty houses one of the richest reef environments in Eilat. And for Hudi, it has become an underwater laboratory. In the 5 years he's been diving here, Hudi has witnessed an astonishing population explosion in corals and fish. In fact, the reef on this artificial structure is growing even more rapidly than a healthy, undisturbed natural reef.

HUDI It's very exciting for reef scientists, because we have here a huge diversity of organisms that developed here within a very short time. Normally, we are speaking about long term processes, and here we got, well not everything, but many things within 2 decades.

WOODIE FLOWERS But why are corals here multiplying so furiously? Figure that out, Hudi realized, and he'd have the power to try something really bold: to build his own reef. It's an ambitious goal, but Hudi's just the person to tackle it. 20 years of research have made him one of the world's experts in coral reproduction. With his student Nogah Hareuveni Shiloach, he's now reconstructing the life history of a species called heteroxenia.

HUDI Oh, this is nice. There's a very young polyp that just settled last night this is the first time that I've seen this.

WOODIE FLOWERS For Hudi to build a successful reef, he'll have to recreate in the ocean all the events that are now going on in this small dish of water. That's not so easy. Coral reproduction is a pretty complex affair. Take a look at what's happening right now in this microscopic world. These are newborn corals, called larvae. They're about 3 millimeters long. This larva is searching for a home. Like all animals, it needs food and shelter, so it chooses a surface that is coated with algae and other living organisms. This is why the jetty is such a magnet for corals. Its protective barbed wire provides lots of surface area, all covered with algae. Once it's settled, the larva starts to contract and change shape; soon, tentacles start to form. At this young age, the polyp, as it's now called, is in an extremely vulnerable state. Here's why: Most natural reefs are horizontal and flat. That means even an innocent swimmer can stir up a fatal cloud of loose sand and debris. When that cloud settles on the reef, it suffocates any young polyps in its way. The jetty has an essential advantage here: it's vertical, offering the unprotected polyps a much better chance of survival. And that's why the jetty reef is growing so much more rapidly than the natural reef. If the polyp survives this stage, it starts to grow. In a remarkable way, called budding. The large polyp on the right has just budded to form the smaller one. Eventually, the original polyp grows into this huge colony. Once it's made it to this stage, it will probably survive. But one colony can only grow so big, the key to a healthy reef is reproduction. And that's the next step. Here are the eggs and sperm sacs. These

white dots are developing embryos. Soon, a larva emerges. Pushed out of the parent colony, the larva now must try to establish a new colony on a different part of the reef. It starts its search for a home. And here it is: a coral dream home. Surface area galore, and all of it vertical. 8 tons of steel, 40 feet high. Everything Hudi's learned about coral reproduction is embodied in this enormous double pyramid. In the spring of 1992, the pyramid was lowered to the ocean floor. Now it's up to the forces of nature to finish the job. 5 months later, Hudi and Nogah are setting out to check on the pyramid's progress.

HUDI This is the spot over here, you see these buoys here, 50 meters below, this is the spot. The site is deep and remote, to keep it hidden from wandering divers. But Hudi dives here every month, to see if the pyramid's attracted any permanent settlers. And he's not disappointed. No corals yet, but the steel pyramid is teeming with life. A wide variety of species are creating just the kind of organic carpet that coral larvae like to settle on. It's amazing -- within a period of 5 months, the whole structure is covered with many many organisms -- a lot of invertebrates. We saw quite a lot of fish as well. At this rate, the first coral settlers should be arriving within just a few months. Then, many more fish will come. And, if all goes well, maybe as soon as a decade from now, this steel pyramid will be transformed into a thriving coral reef. But Hudi has an even grander vision: build a dozen pyramids, and create a new paradise for divers. And that's how Hudi hopes to save the reef: by giving it the time it needs to rebuild itself, undisturbed. This might be the best way to preserve both the tourist economy of Eilat and the natural treasure it depends on.

back to top

## STAIRWAY TO HEAVEN: THE PYRAMID BUILDERS

NARRATION Home to 15 million people, Cairo is the largest city in Africa. But here, where the modern metropolis meets the edge of the desert, is the Giza Plateau, site of some of the wonders of the ancient world. This whole complex was designed by the pharaohs and their architects more than 4,000 years ago. Their age, their silent eloquence, make them seem eternal. How did those early Egyptians build these monuments? It seems like every archaeologist has a different theory. One thing all those theories have in common is that there must have been a whole lot of very skilled people. But while almost everyone knows something about King Tut, no one has a clue about the people who actually did the work. That's the biggest remaining mystery of ancient Egypt. But now -- for the first time -- we're finally getting a glimpse of who those workers were, and how they lived. It's early morning, and this team of Egyptian archaeologists is heading to work. Four thousand years ago, their ancestors used this same gate each day, as they walked to work at the pyramids. In those days thousands of construction workers and their families must have lived here on the Giza Plateau.

And yet, no trace of them has ever been found -- until now. Egyptian archaeologists have combed the sands of Giza and revealed a fascinating discovery: Within sight of the pyramids -- a graveyard of the pyramid builders. Each one of these stone piles is the tomb of an ancient worker. There are small tombs, shaped like mini-pyramids, for common laborers. And there are larger, fancier tombs for managers. Archaeologist Mansour Radman found this one belonged to a foreman.

MANSOUR RADMAN And here is a wonderful vaulted ceiling made of mud brick with a false door. And above this false door a stella which contains the name of the owner of this tomb. And you can read here that this is an offering were given by the king and also by the god Anubis for the beloved person Ptah Shepshu.

NARRATION Ptah Shepsu was just a foreman. But it's clear that he commanded respect. In fact, the whole site resolves a long debate: the pyramid builders were not slaves. They were workers and artisans, valued for their individual skills. And at the dig, new evidence is coming in every day to reinforce this idea. To Zahi Hawass, it's a stunning breakthrough. He's one of Egypt's leading archaeologists and director of the entire pyramids complex.

DR.ZAHI HAWASS This statuette is for an overseer of the workmen. This discovery proves also that these people were not treated by the king poorly. No, they were treated and respected by the king because those are the people who built the pyramids and tombs. Those are the people who made the king eternal. Without them the king will never be a god. That's why he cared about them, they were buried beside him. And they made beautiful statues, even more beautiful than kings and queens and nobles. The builders came here to help their pharaoh prepare for eternal life. But astonishingly, they prepared themselves in the same way! These tombs were more than a final resting place, they were vessels for a journey into the afterlife. That's why the dead were sent on their way with beer jugs. No one who lived and worked in the desert would embark on eternity without something to drink. This woman was sent along to grind grain for bread. Statues like this are common in royal tombs. Finding one here symbolizes everything that's being revealed at the site: the workers, like the pharaoh they served, were entitled to respect, in life and in death. More exciting information is emerging with each excavation. So there's great anticipation at the site when one of the small tombs is opened. Each layer of rock and sand is carefully removed and sifted for clues. Two feet down, they come to the outline of a coffin. It's a box made of sycamore wood, which must have been imported at great cost.

NARRATION Beneath the coffin, the edge of a skeleton is revealed. This is a human hip bone. The vertebrae. Then, a hand at rest. For the Egyptian archaeologists, it's a powerful sensation to come face to face with their own history.

INSPECTOR MUHSIN It is a very strange feeling. How to meet this man or woman. You can feel that you are talking to him and he's talking to you, saying hello or something like that, after all these years of silence. From the shape of the pelvic bone, Dr. Azza el-Din can identify the remains. She was a young woman, just twenty years old when she died. Though she was lovingly prepared for death, her life was short and full of hard work.

DR. AZZA EL-DIN From looking at the spine we can see if there is any compression of the vertebrae or any lipping at the edges. We can tell that they work hard or that they carry heavy weights or something like that.

NARRATION This cemetery on the Giza Plateau is rewriting the story of the pyramid builders. From the lives and deaths of ordinary people comes a priceless discovery.

ZAHI HAWASS People always look for gold inside tombs and treasures. But gold and treasures never reconstruct the Egyptian history. All what we find at the Giza Plateau reconstructs a very important part of the Egyptian history. It gives information about people that we never knew. It gives information about how they worked, how they did it, how they cut the stone, how they built the pyramid, how they lived, how they died. All this information for the first time, people are going to know about it.

back to top

#### NEOT KEDUMIM: NOGAH'S ARC

NARRATION Israel is the land of the Bible, and here people take that quite literally. Every part of this 625 acre park is designed to bring the flowers, tree, and plants of the Bible to life. That's why it's called Neot Kedumim, "oasis of the ancestors." I've asked its founder, Nogah Hareuveni, to take me on a tour.

NOGAH HAREUVENI What I would like to show you -- these 2 plants -- why they are planted here together. This is cedar of Lebanon -- its seeds brought from Lebanon and planted here. And this is the hyssop which grows out of the rock as it's written in the bible. And together they come in the bible as symbols -- two contradicting symbols. The cedar of Lebanon was the symbol of haughtiness, of pride -- very tall -- and King Solomon brought them from Lebanon in order to build the temple and to build his palace. The hyssop -- it is much more useful, as a medicinal plant and in many other uses. So Jesus, when he was on the cross, they gave him hyssop. This also was the symbol of humbleness.

NARRATION Then Nogah took me to see the most important prop in another famous Bible scene -- the story of Samson and Delilah.

NOGAH HAREUVENI Woodie, I would like to demonstrate to you -- a little demonstration -- how the rope can be twisted from the bark of this Yitran bush. I just can peel the bark and be very careful to peel only a narrow strip, not to kill the branch. We have only a few of them here.

NARRATION How are we going to get rope out of that?

NOGAH HAREUVENI The fact that this bark has such thin fibers -- very fine fibers -- this is the secret of these pieces of bark which enables us to make ropes. And now just to show you the beginning of twisting a rope. Remember, Delilah was a secret agent for the Philistines, and while Samson pretended to be asleep, she tied him up with seven strands of rope made from this Yitran bush. His reputation as the strongest man in Israel really took off when Samson "burst these ropes asunder."

NARRATION As we continued our trek around Neot Kedumim, Nogah showed me many more trees and plants that echo passages from the Bible. In times of drought, a thicket of myrtle -- which flourishes without much water -- symbolized hope for a successful harvest. The willow tree is an emblem of the Promised Land. The Israelites camped under willows when they arrived on the banks of the River Jordan. That was their deliverance from years of wandering in the Sinai desert -- commemorated here by these date palm trees. This place really lets you see and experience the settings of the Bible .... That's my kind of history lesson.

back to top

## THAT'S MY BABY: NEWBORNS AND THEIR MOMS

NARRATION At Shaare Zedek Hospital in Jerusalem, a baby is about to be born. As director of neonatal care, Arthur Eidelman has witnessed thousands of births. But he has never ceased to wonder at the mysterious process of bonding that goes on in these first moments. Hebrew University Psychologist Marsha Kaitz has teamed up with Dr. Eidelman to learn more about how mothers and infants bond. They're starting at the beginning. They want to find out how a mother can even tell which baby is hers immediately after birth. So, strictly for scientific purposes, Marsha is taking baby pictures. Susan gave birth 24 hours ago. Since then, she has spent 3 hours with her baby. Arthur asks her to pick out her baby's photograph. As it turns out, this is not Susan's baby. This is Susan's baby. Marsha and Arthur have found that new mothers have trouble recognizing their babies by sight until they've spent at least 5 hours together. This woman is a control subject in the experiment. She is not a mother. Without being told why,

she has been asked to spend one hour with this newborn. The astonishing finding here: most non-mothers can pick the right photograph after spending just one hour with an infant. Remember that new mothers need at least 5 hours. What's going on here? Why are they so bad at recognizing their babies by sight. Maybe something happens to new mothers after the rigors of childbirth.

MARSHA It dawned on us that maybe their intelligence or other cognitive senses may not be working as they did prior to the birth, something goes on after birth that somehow changes the cognitive layout of the women.

NARRATION An IQ test sheds light on this theory. Susan now has to recall the details of this simple story. She's having trouble. And when Marsha gives her a visual memory test, Susan does no better. In fact, for 24 hours after childbirth, most women's test scores are below average. Marsha and Arthur call it the mushbrain effect. But mushbrained Moms do know which baby is theirs. To find out how, Marsha is collecting undershirts. The tests only measure higher brain functions, like intelligence and memory. Marsha thinks something much more basic might be at work here.

MARSHA We know that animals who can recognize their own babies use smell, so we're testing whether human mothers might also be able to use smell to identify their babies.

ARTHUR Take out the undershirt from the bag, smell it and tell me which one belongs to your baby.

NARRATION Elana has spent less than one hour with her baby since birth. She has three undershirts to choose from.

ARTHUR Are you ready to choose?

ELANA This one.

ARTHUR Are you one hundred percent sure?

ELANA One hundred percent.

NARRATION And she's right. So smell seems to work. What about touch? This mother, who has both her eyes and nose blocked by the blindfold, has to pick out her baby by feeling the back of its hand. She, too, chooses the correct baby without hesitation. So mothers can recognize their babies by touch or smell. That's an important finding for the researchers, but it's no surprise to the mothers.

ELANA A mother knows her own baby's smell, it's part of being a mother.

NARRATION Their relationship will get more complicated soon, but we now know that mother and child start their lives together at a very primal level.

ARTHUR Nature apparently has designed a way for the mother to recognize that that infant is hers, and to begin to build that attachment and the sooner that she builds that strong attachment, the better it is for the baby in the long run.

back to top

## DESERT RESCUE: STORK HAVEN

NARRATION Every fall, Israel gets about 150 million of these magnificent visitors -- all migrating from their summer homes in Northern Europe to their winter grounds in Africa. The migrating birds get a boost from the geography here: hilly terrain and high temperatures create warm air drafts called thermals. The birds hitch a ride on these thermals, and glide for miles without having to do much work. Since their total migration stretches thousands of miles, this Middle Eastern vacation is welcome. But the birds don't have the skies to themselves. Air Force pilots train constantly over the tiny patch of land which is Israel, and since they train low, they use exactly the same air space as the birds. During migration season, collisions have become inevitable, and often fatal. So bird watching teams like this one have staked out the width of Israel, one group every 2 or 3 kilometers. They've come from all over the world to be part of an unusual military operation -- doing reconnaissance on birds. For 6 weeks the birdwatchers watch the skies all day, every day. The teams' sightings are collected by Chaim Alfiya, whose van doubles as a mobile radar station. I've asked Chaim to show me what's in the skies today.

CHAIM We can just see a long stream of storks entering the screen from north northeast -- that's about 2,000 storks entering and it's all one, a long stream, one is following the other. The speed here is about 20 to 30 miles per hour, which is quite fast. It means that they are gliding now.

NARRATION Immediately, Chaim communicates this information to the Air Force. The dispatcher then relays details of the flock migration to the training commander. Flight patterns are altered, and the storks continue undisturbed. So far, the program has been a resounding success, saving the lives of pilots and of birds. But a safe right of way through Israel does not mean that the birds are home free. We'll see they still have a tough journey ahead of them, as they fly on into Egypt. This barren land is the Sinai desert ... no water, shade or food. As they fly south the birds must cross the mountainous peninsula. This is the most grueling leg of the long migration. Then, at the tip of the Sinai, beside the Egyptian tourist town of Sharm el Sheikh, they hit the Red Sea, stretching out



before them toward Africa. The storks have stopped here for hundreds of years to rest up before crossing The sea. Each fall, about forty thousand storks stop over. There's water, rest, and as on any long trip, some arguments. But now, there's a new attraction that lures the storks. On the outskirts of town is the regional landfill. For the hungry birds it's an appealing food source ... and a deathtrap. This "home video" shows the lethal hazards -- trash fires, barbed wire, plastics and glass kill hundreds of birds. Three years ago Adly Mestikawy decided that the storks deserved a better welcome in Sharm el Sheikh. And, since he owns a local hotel, he invited them over. Everyone in town has gotten behind the idea, so these days Adly's lobby is full ... of white storks. This is the reception desk for a unique stork rescue center. Injured birds are transferred to the center's field hospital. It's a shoestring operation. Staffed and funded solely by volunteers, it's a safe haven for birds in trouble. Adly directs the project with the help of veterinarians Jim and Susan Dinsmore. This patient burned his foot in the dump. The wound's so bad that he's worn his elbow off standing on it. They have to act fast to save this one.

JIM This bird has a very bad systemic infection from the burns. He's got gangrene in his left leg, it's going to have to be amputated. Right now we're worried about secondary septicemia, blood poisoning. A shot of tetracycline will stem the infection. This kind of emergency room care was what the stork rescue center was set up to do. But today the volunteers find themselves confronting a much broader health crisis. Many more storks are being found like this -- too weak to move. Completely dehydrated and malnourished, this bird is near death.

RESCUE WORKER How many cc's of Nutracal do you think he needs?

SUSAN Oh what do you think, forty?

NARRATION The diagnosis is migratory stress. And the prescription is force feeding with a high-calorie formula. SUSAN Okay, just open your mouth a bit.

NARRATION The hardships of the desert crossing bring on the symptoms of migratory stress ... birds that leave Europe unprepared for a 6000 mile trip just run out of steam in the Sinai.

SUSAN They're non getting enough to eat before they come. But their migratory instinct is so great that when it kicks in they fly. And they're too weak to fly when they leave but they come anyway. And so by the time they get here they're totally exhausted. To reach exhausted birds before they need intensive care, the center has launched a mass feeding campaign. High protein fish and squid donated by hotels make a welcome feast that's a life saver for many storks.

NARRATION Back at the hospital, the burn victim has recovered from his amputation. This traveler won't need Adly's hospitality much longer.

ADLY Once he can eat normally and drink he will be released and hopefully he can make it and fly with the rest of his people.

NARRATION With only basic supplies and clever techniques, the volunteers are making a real difference.

JIM We're going to have a lot of gloves with missing fingers!

SUSAN Well, it's working nicely anyway.

NARRATION But some birds don't make it. And what's worse, Jim is detecting a pattern behind these deaths. On a healthy stork, bones are smooth to the touch. But on many of the birds that die of migratory stress, the bones look different. They're porous and pitted instead of smooth. To Jim that's a tell-tale sign of poisoning.

JIM These birds were born with these deformities. More than likely this is due to ingestion of insecticides, or possibly herbicides or maybe chemical wastes. We saw more this year than last year and I'm afraid we'll see more next year than this year. The effects are damaging. Healthy bones are full of marrow. But the porous bones are almost empty ... which weakens the birds.

NARRATION Jim believes the cause of the problem is far away ... in Europe where the storks summer and raise their young. Feeding on earthworms and insects, the chicks are exposed to harmful chemicals. And because of these environmental hazards, the migration claims more lives than it has to.

NARRATION So in the Sinai, they face a tough job. But the volunteers believe that saving the storks is worth it. Today, with the help of new recruits -- a visiting school group-- more patients are ready to head home.

ADLY "You release this one ...

NARRATION It's a successful send-off. With luck, these storks will be back again next year, and the volunteers are planning an even warmer welcome.

ADLY We're just learning. For three years we're learning, what's the problem and how to solve it. Every day we release one. Every day we catch one before it dies and help. I think it makes me feel I'm a human being and I'm not that bad at the end.

## WINGATE INSTITUTE: SPORTS IMPORTS

**NARRATION** Welcome to the Wingate Institute, training ground for Israel's top athletes. At the Wingate, success comes from lots of hard work, the right technology, and a new competitive edge: Recent Russian immigrants. In the last few years, almost half a million Soviet Jews have immigrated to Israel. These are some of the lucky ones -- Russian sports scientists now working at the Wingate. Most of the new immigrants -- many of them scientists and professionals -- are still struggling to find work in their field. But the Wingate welcomed this group with open arms. The Soviets had a long tradition of Olympic excellence, so they have a lot to offer Israeli sports. Boris Blumenstein was a top sports psychologist in the Soviet Union. He's coaching Alex, in blue, also a recent immigrant. Alex represented Israel in the last Olympics. But occasionally his concentration falters. These lapses cost him dearly. This is where Soviet expertise can help. Boris has developed a biofeedback technique to help athletes improve their concentration. Electrodes placed on the scalp muscles will measure Alex's state of excitement. After a brief period of relaxation, Boris plays a tape of the match. As Alex starts to get involved, his excitement level rises. The goal here is control: Boris is teaching Alex to raise and lower his excitement level at will, so he'll be able to use this concentration tool in action. After taking his excitement level to a fevered pitch, Alex must then bring it down again.

**BORIS** This technique of learning to control relaxation and excitement, this is the basis of all good sports, the ability to relax and mobilize yourself at any given moment.

**NARRATION** A few days later, Alex has a rematch; his concentration is already improving. Igor Dobroy is a mathematician with a specialty in biomechanics. He also worked with the Soviet Olympic team. Now he's applying his skills to Israeli sports. His partner is Dario Lieberman. This weight lifter's coaches think he has great potential, but right now he seems to be stuck at 250 pounds. Using sensors to analyze his motions, Igor and Dario might be able to help. They have built a computer model of the ideal or expected weight lifting motion -- that's on the left. Then, with the sensors, they can reconstruct the observed motion -- that's on the right. The next step is just to compare the two. It's easy to see that at this point, our weight lifter's knees are not bent enough, he's leaning too far forward. Here, this becomes an even bigger problem; he's about to lose his balance. Although it looks obvious on the computer, it's a subtle problem that was impossible for the coaches to see during training. Igor is also working with Ilan, a young Israeli runner. This thin sensor will record the rhythm of Ilan's stride as he runs. Here's the problem Dario and Igor want to solve: Ilan is inconsistent. During this 400 meter run, his speed goes up and down. The beeps yield a surprising amount of information: how long each stride is, how much time between steps, when the heel and toe of each foot touch down. A mathematical model then puts this

information together with Ilan's height and weight, and comes up with his ideal tempo. The steps are slightly faster than what Ilan was doing on the track, which means each stride will be a little shorter. But most important, the rhythm is unchanging. Internalizing this rhythm will help Ilan make the best use of his power. It could even be his ticket to the next Olympics. Israel has never been a serious contender in world sports. But now, with the help of the new immigrants, things might be about to turn around.

back to top

## PARTING THE WATERS: MIRACLE IN THE RED SEA?

WOODIE FLOWERS It's really hard to believe that right along here just may have been the site of one of the Bible's most miraculous moments. Scene from "Ten Commandments"

MOSES What is it Joshua, what is it?

JOSHUA Pharaoh's chariots!

MOSES I've ordered men to block the pass. How can we fight chariots?

JOSHUA Nothing can stop them.

MOSES Order the men to move back, Joshua.

JOSHUA Move back... Where into the sea?

MOSES Behold HIS mighty hand!

WOODIE FLOWERS How could this account be history? Is it possible that these waters actually parted? To think about those questions, we first have to look at the big picture.

## NASA FOOTAGE

WOODIE FLOWERS So take a look from the space shuttle. The green triangle at the bottom is the fertile Nile delta, and the large body of water is the Red Sea proper. We're here, at the shallow entrance to a long, narrow channel of the Red Sea called the Gulf of Suez. An Israeli scientist who studied this terrain has come up with an intriguing idea. Doron Nof teaches oceanography at Florida State University. I've asked him to help me understand his theory.

DORON Imagine that this is a physical model of the Red Sea. So this part right here will represent the Gulf of Suez, which is long and narrow, and the deep part is represented here. We have constructed a ridge here and in a minute or so you will see why it's there, and what I'm going to do, I'm going to represent the water with this corn syrup that I have. Pouring it... slightly above the ridge.., just a tiny bit more. That's good. The biblical story speaks about a wind that was blowing over the Red Sea and the wind is going to be simulated with this hair dryer.

NARRATION Doron figures this wind would actually have to blow at 40 knots for about 12 hours.

DORON The wind starts blowing now, and you can see how water is blown away from this side into the deeper part. A wind that strong in the Gulf is rare -- but possible. Watch what could happen.

DORON And after a while, you can see that part of the ridge is exposed. The Israelis crossed from this side to this side, and they had water on that side and on this side. Of course, at some point the wind relaxes and you see that when that happens there is a wave coming back and presumably this is the wave that drowned the Egyptians that were following the Israelis.

NARRATION Does this mean there was no miracle?

DORON Believers can find the existence of God in the creation of the right wind than we need for that process just as they can find it in any other type of miracle. All we are saying is that it is physically possible because of the particular geometry and geography of the Gulf of Suez for something like that to happen. But that's very risky. These are fragile artifacts. Just blowing into one could shatter it! So while restoration proceeds the research team will make exact replicas that can be tested safely. To guarantee an authentic sound they have to capture every nuance of the original. Then, Mahmoud calls on Cairo's bamboo merchants. It's a scene that hasn't changed much in three thousand years. Like the ancient musicians, he wants bamboo with just the right resonance. Mahmoud's artistic judgement is exactly what's called for. Then, step by step, a bamboo stalk from the banks of the Nile is transformed into the instrument that entertained the pharaohs. At least that's what they're hoping for -- and the researchers now have a precise replica to test.

ANCIENT FLUTES: "TUNES FROM THE TOMB"

This is modern Arabic music at its finest. The bamboo flute is in the hands of Mahmoud Effat, one of Egypt's most famous musicians and a scholar of music history. Mahmoud is spearheading a unique project to rediscover the ancient roots of Egyptian music. He's teaming up with the Egyptian Museum - home to a

fine collection of old instruments. Here, in the conservation laboratory, they're restoring ancient bamboo flutes found in tombs. No one knows what Egyptian music was like three thousand years ago. But these old flutes may be their best bet to find out.

MAHMOUD EFFAT I found that the old stringed instruments can never be returned to their original tunings, but the flutes keep their dimensions, their shape over the years. So if you try the flutes now they will have the same sounds as they had 3000 years ago.

NARRATION: The hope is that with restoration, Mahmoud can play them. But that's very risky. These are fragile artifacts. Just blowing into one could shatter it! So while restoration proceeds, the research team will make exact replicas that can be tested safely. To guarantee an authentic sound they have to capture every nuance of the original. Then Mahmoud calls in Cairo's bamboo merchants.

It's a science that hasn't changed much in three thousand years. Like the ancient musicians, he wants bamboo with just the right resonance. Mahmoud's artistic judgement is exactly what's called for. Then step by step, a bamboo stalk from the banks of the Nile is transformed into the instrument that entertained the pharaohs. At least that is what we are hoping for -- and the researchers now have a precise replica to test.

MAHMOUD It looks great. Thanks to Allah!

NARRATION Meanwhile, at the step pyramid of Sakkara, the rest of the team is searching for how the flute was played. The originals came from these tombs ... so computer scientists Fathy Saleh and Bob Cribbs hope to find some record of their use. In this four thousand year old painting a band plays for the owner of the tomb -- a singer harmonizing with harp and flute. But the flute pictured here is played differently from a modern one.

BOB CRIBBS Look how he has to stretch his chin up in the air and hold his hands very very low.

FATHY SALEH That means the flute is producing a very low frequency note. And it doesn't exist in our time now.

NARRATION They hope to recover these lost notes with the help of a computer. So Mahmoud brings his replicas to Cairo University, where Fathy and Bob are set up to analyze sounds on a computer. They've written software to study the frequencies, but when he starts to play they don't even need it. Sound familiar? You don't need a computer to tell this is a modern western scale. The history

books say the Greeks invented it ... but here it is, on an Egyptian instrument a thousand years older than that.

BOB CRIBBS Fa, so, la, re, do, re, me, fa, so.

NARRATION Even Mahmoud never dreamed they'd hit upon such an extraordinary discovery.

MAHMOUD EFFAT I think this group of flutes is the musical equivalent of the Rosetta Stone. Just as it let us discover the language of the ancient Egyptians, so with these flutes we are able to start decoding the music of the ancient Egyptians.

NARRATION Their next challenge will be finding the actual tunes ancient musicians played. Thousands of undeciphered tomb paintings like these may contain valuable clues. Perhaps in these mysterious hand signs are the finger positions for a lost melody. But for now, Mahmoud is reaching out to Egypt's past in another way. Back at the museum, one of the originals has been restored. You're about to hear a flute come to life for the first time in three thousand years.

MAHMOUD EFFAT This makes a beautiful and deep sound that matches the deep feeling in me. I don't know what music the ancients played, but the flute and I are both Egyptian, so I play what comes from this feeling in my heart.

[back to top](#)