

**Science to Art
Works by Gopal Murti**

March 18–May 13, 2016

GALLERY GUIDE

For nearly 40 years Murti studied the biological world-ranging from molecules to tissues-using confocal, multi-photon and electron microscopes. His images received awards and adorned the covers of over 30 scientific journals as well as *Time* magazine. After retirement in 2008, Murti became a watercolor painter, moving from technology to paint and brushes to create works of art. This exhibition highlights Murti's work both as a scientist as well and an artist and the transition seen through his processes. Learn more about Gopal at www.artofgopalmurti.com



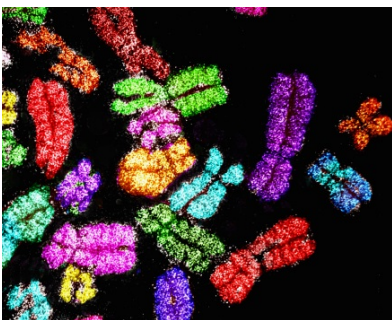
Hot Dog and Spaghetti

Transmission Electron Micrograph, 1970
Framed 34 x 28 inches, \$400

This image is that of DNA leaking out of a ruptured *E. coli* bacterium. *E. coli* has a circular DNA molecule that measures about 1500 microns (1 micron = 0.001 millimeter) and it is squeezed into a shell that is about 0.5x2.0 microns. It is a technical feat to achieve controlled disruption of this bug so that you can preserve the shell and the DNA. To my knowledge, there is no other picture comparable to this and it has been used in hundreds of Biology and Medical text books, genetic

engineering brochures etc. This is probably the most popular picture that I ever produced. This image won multiple awards in scientific photography competitions.

There is a story behind this picture. In 1973, J.D. Watson (yes, the Nobel Laureate) invited me to the Cold Spring Harbor Symposium (Long Island, N.Y.) to speak on chromosome structure. As I was browsing through their institutional book store, I saw a T shirt with a massive DNA molecule imprinted on it. The title was *E. coli* DNA and the image was produced by Dr. Ruth Kavenoff. I met her at the reception and congratulated her on the fine image but I said that the picture would have been spectacular if she preserved the shell of the bug. She said that it is impossible to do so because conditions that preserve the shell will not release the DNA. I told her that I would give it a try. I used a strain of *E. coli* that is osmotically "shockable" and tried about 10 times disrupting thousands of bacteria before I got this picture. I achieved controlled lysis of the bacterium to release the DNA while keeping most of the shell intact. I initially used food colors to paint the DNA and the shell on a photograph but I updated the image with Photoshop 20 years later.

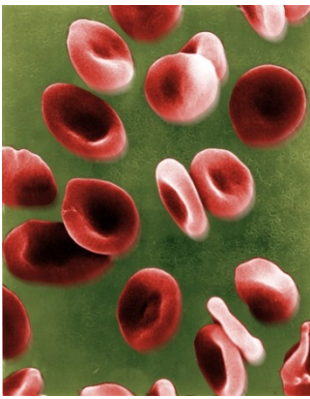


Human Chromosomes

Scanning Electron Micrograph, 1992
Framed 30 x 24 inches, \$350

These are human Metaphase Chromosomes colorized in Photoshop. Just to make it pleasing to the eye, each chromosome was tinted with different color. Each of these chromosomes is composed of two Chromatids (one arm of the "X") and each Chromatid is a long coiled DNA molecule complexed with protein. In the Metaphase stage of cell division, the two halves of the chromosomes are pulled to opposite poles to form two daughter cells. Abnormal chromosomes, where broken pieces are

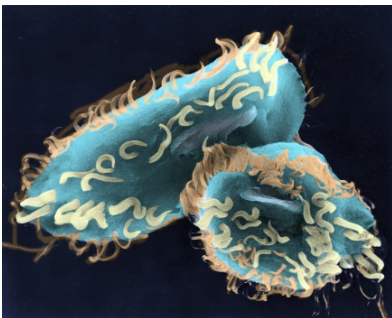
exchanged between chromosomes (translocations), can cause cancer. Cytologists can identify these abnormalities by viewing the chromosomes of Metaphase cells under the microscope and Molecular Biologists can determine the precise changes in DNA base pairs by sequencing the DNA.



Human Red Blood Cells

Scanning Electron Micrograph, 2000
Framed 30 x 20 inches, \$350

These are human red blood cells. Red blood cells or erythrocytes have the shape of biconcave discs and are one of the most important cells in our body. They have no nucleus and have an iron-containing Hemoglobin protein that can bind oxygen. As the red blood cells traverse the body, they deliver oxygen to the tissues. Defects in red blood cells cause major diseases like Sickle Cell Anemia. This is an interesting image of red blood cells. We (my assistant Ken Barnes and I) tried to make the cells look as close to their native state as possible. We added a “blur” to each cell (of course, with Photoshop) as if they are moving inside the blood.



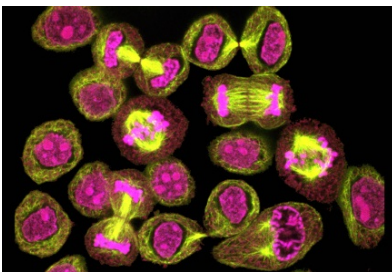
Ciliated Protozoan

Scanning Electron Micrograph, 2002
Framed 40 x 30 inches, \$450

These bugs are single-celled organisms that live in ponds. They are called Oxytricha (a close relative is Paramecium) and I submitted my Ph.D thesis on the chromosomes of these bugs. In the 1970s, I made some wild observations on these bugs and became a celebrity scientist. Dr. Tom Cech won a Nobel Prize in Chemistry* in 1989 by showing the enzymatic capability of RNA (Ribozyme)--his experimental system was a related ciliated protozoan, Tetrahymena. He later on shifted to Oxytricha and to my

Alma matter (following some of my studies) and made many more important discoveries especially concerning the ends of chromosomes or Telomeres. Telomeres are now shown to be important in cancer and ageing. All this goes to show that lowly unknown bugs in your local pond can yield a Nobel Prize (if you are a smart scientist!).

* The Nobel Prize in Chemistry has been awarded 107 times to 172 Nobel Laureates between 1901 and 2015.

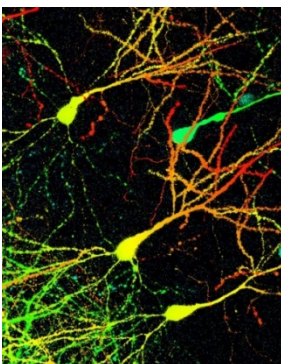


Dividing Cells

Confocal Micrograph, 2003
Framed 40 x 30 inches, \$450

These are dividing HeLa tissue culture cells. The DNA (nucleus, chromosomes) was labeled pink and the microtubules (spindle) were labeled yellow using fluorescent dyes. By a fortunate coincidence, you can see cells in every stage of cell division in this image. In Prophase, the chromosomes begin to condense and the two poles (asters) form. In Metaphase, the spindle forms and the chromosomes align at the center.

Then, in Anaphase, the chromosomes are pulled apart to opposite poles. Once in Telophase, a membrane starts enveloping the chromosomes at opposite poles, and the cytoplasm begins to pinch in the middle. Finally the two daughter cells separate.



Neurons

Multiphoton Micrograph, 2006
Framed 30 x 20 inches, \$350

Neurons are the cells in the brain. They are responsible for electrical and chemical signal transmission and form an extensive network emanating from the brain. Structurally, they have a “head” or the cell body which contains the nucleus, and a “tail” which is called axon and could measure as much as one meter. The head has branches or dendrites which interconnect with axons of other neurons forming an extensive network that transmits chemical and electrical signals throughout the body. Our response to stimuli (light, sound, touch) and our movements are all carried out by signals between brain and body mediated by neurons.



Atoka (TN) Spring Swing

Watercolor on paper, 2011
Framed 32 x 25 inches, \$500

I find many incredible landscape subjects in and around Memphis. My favorite areas are Shelby Farms, Lichterman Center, Mississippi River etc. One spring, I visited a friend's farm in Atoka and was blown away by the beautiful scenery there. I started this painting with the tire swing because it symbolizes (for me) simple, easy, care-free and laid-back life. Slowly I added the rest of the scenery. I particularly liked including the cows and their slow-paced life processes.



Stress Relief

Watercolor on Paper, 2012
Framed 38 x 27 inches, \$600

A woman, purple curtains, glass window, light and shade were all common denominators to six paintings I did over the years. In each one of these paintings, the women were in a state of emotional turmoil. In this painting, the lady is stressed but as a relief she is playing the piano. The idea is derived from my youngest daughter who would run home from school and starts playing piano. By the song she played one can guess if she had a good or bad day at school. The woman in the painting does not totally resemble anybody in my family but shares some Indian features.



Equi Modestus

Watercolor on paper, 2013
Framed 39 x 27 inches, \$500

This is rather a unique painting because it incorporates my training as a Scientist (Biological Sciences). I was a medical researcher at St. Jude for over 3 decades and my specialty was to image tissues, cells, cell parts and molecules (DNA and Protein) using powerful microscopes including the electron microscope, which lets you to look at objects magnified up to a million times. If you (with some biology background) look closely at this painting, you will notice the squiggly threads of DNA in the background, and patches of tissue culture cells at the upper right and lower left corners. Additionally, you may be able to recognize cell parts like endoplasmic reticulum, lysosomes, myelin figures, Golgi complex etc. on the bodies of horses.



Tabagie-St. Jean

Watercolor on paper, 2013
Framed 28 x22 inches, \$400

About 2 years ago, I went to Quebec (Canada) in early December. The temperature was below zero and there were piles of snow on the curb. It was sunny and bright but that had no effect on snow or cold. Needless to say, I remained in the hotel and never came out till it was time to go to airport. It is amazing that the local people were least bothered by the weather. I was looking across my hotel window at a convenience (Tobacco) store and found two women window shopping. They were looking at everything transfixed for more than an hour. I shot some photos of them just to remember the legendary human endurance. When I was looking through old photos, I felt I have to immortalize the women through my painting.



Anticipation

Watercolor on paper, 2013
Framed 38 x 26 inches, \$500

I was watching a news item about the return of our soldiers from Iraq. It is a very moving scene with men, women and children running to meet their spouses, fathers, mothers, sons and daughters. There were many tears punctuated by laughter. I saw a very pregnant woman slowly making her way towards the arriving soldiers. She was searching hard for her husband/boyfriend among the soldiers but could not find him. She stood there crying and that broke my heart. Eventually her man came running and hugged her tightly. It was a happy ending. This scene triggered my painting entitled *Anticipation*. Here, the lady is anticipating the arrival of the little bundle of joy or the return of her soldier husband or both. This, for me, is a very special (and haunting) painting.



If MLK Were to Meet MKG

Watercolor on paper, 2013
Framed 33 x 26 inches, (NFS)

This is a fantasy painting because Dr. King and Mahatma Gandhi belong to two different generations and never met. Dr. King was a teenager when Gandhi died. Dr. King practiced the non-violent civil disobedience movement started by Gandhi and brought sea changes in the race relationships in the USA. Gandhi was assassinated by a radical Hindu, who was against Gandhi's teachings of secularism. Likewise, Dr. King was assassinated by a radical who did not like racial equality. If these two were to meet, Gandhi would have loved Dr. King immensely and would have given him a bear-hug. Mr. Arun Gandhi, a Grandson of Mahatma Gandhi, once said that Dr. King was more qualified to be the grandson of Mahatma Gandhi than himself!



Pedis Maximus

Watercolor on paper, 2013
Framed 39 x 27 inches, \$500

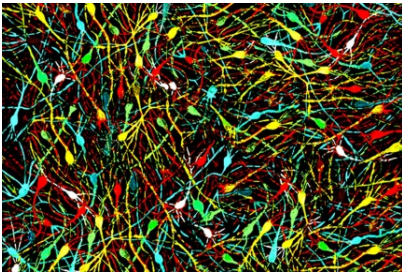
I absolutely adore painting this kind of a landscape. This is all completely made up, adding more stuff as I continued (i.e., not well thought out). One purpose of this painting is to figure out if I can paint snow in the forest. At this time I was still a learner and everything was a challenge for me. This painting has something hidden in it. The clue is the Latin title. See if you can figure out. Over the years, only 2 or 3 people found it.



Panni Stesi Sul Canale

Watercolor on paper, 2014
Framed 40 x 27 inches, \$700

Translated into English, this Italian title simply means "laundry drying over the canal". This scenery is painted from a reference photo from my Italian collection. Actual photo is quite dull and looked black and white. I introduced a lot of color into the painting by painting the buildings in different colors and by painting their reflections in the water. There are many human figures hidden in this painting. See if you can find them. I don't particularly like this painting because it looks muddy and gaudy. However this was a hit with judges because it garnered multiple awards in local and national shows.



Quagmire

Watercolor/Digital Photography, 2014
Framed 38 x 27 inches, \$300

This painting is a product of both Science and Art. The objects in the painting are neurons in a mouse brain. I photographed the neurons in a microscope and painted them on paper applying different colors. I digitized the image and increased its complexity in Photoshop. Finally, I got the image printed on photographic paper. For me it looks like a painting by Jackson Pollock.



In the Beginning

Watercolor collage on paper, 2015
Framed 38 x 27 inches, \$500

One has to really spend some time looking at this painting to figure out what it is.. This painting was inspired by the *Paleolithic* art (40 thousand years ago) from all over the world. Most of this art is seen in caves and usually depicts the life style of humans at that time. Most of the subject matter concerns their primary avocation, hunting of deer, horses, bison, mammoths etc. The humans are painted like stick figures. This painting shows some of this and in addition, shows the headman in a procession (see if you can find it).



Anyone for Kabuki?

Watercolor on paper, 2015
Framed 40 x 30 inches, \$800

This is the Painting of a scorpion fish, a most colorful species of fish found in the Indo-Pacific waters. Fifty plus years ago, I was a Marine Biologist in India with a Master's degree (before I moved to US and changed into Cell and Molecular Biology). For my dissertation, I had to survey the fauna and flora of an area on the coast of Bay of Bengal. During a field trip, I saw this strange fish with fluorescent colors and bat-like, out-stretched fins (and an ugly face) swimming in a tidal pool. I tried to pick it up by scooping it in my hands, not realizing that the fish is venomous and can sting. Next thing I remember was the piercing pain in my hand. Recently, when I felt the urge to paint a highly colorful painting, I remembered the fish. I studied many photos of the fish and came up with this image. Fred, my mentor, thought that its face reminded him of the gaudy, painted face of a Japanese *Kabuki* dancer and hence the title.