EXHIBIT IMAGE SIZES AND DESCRIPTIONS

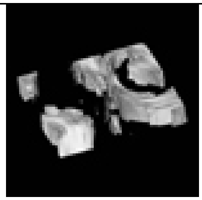
Image Identification	Image Thumbnail	Maximum Print Size cm (WxH) & KB	Printed Image Sizes cm (WxH) & KB	Comments
3D Bone Structure Movie			digital movie projection of image "a-c" (below)	3D image of a blood vessel with it's surrounding bone layers (lamellae). This 3D image of a 72 micron thick portion of bone is part of a larger bone cross section taken from the middle of a human thighbone. Twenty-four-2D images, each 3 microns in depth, were taken vertically through the bone in a series, comprising a digital 24-image 'data set'. This data set was then virtually reconstructed into the 3D bone block using our Biomedical Imaging software. After reconstruction, the 'virtual' bone section was separated into red and blue stereo images, which were then manipulated in order to explore the 3D virtual reconstruction in detail in order to enhance understanding of the bone structure. The movie begins by demonstrating a bone section being rotated on it's X, Y, and Z axes simultaneously, allowing for a better visualization of areas of interest. During rotation, the bone matrix is slowly rendered transparent, allowing greater access into the layers (lamellae) surrounding the blood vessel. When the viewing angle and bone transparency level are suitable, a 'plane' slowly digitally removes each lamella revealing it's inner structure. Virtual 3D models of bone reconstructed from imaged 2D serial sections, coupled with cutting edge imaging software technology, allows for a clearer and more expanded interpretation of bone architecture. Specimen courtesy of Haviva M. Goldman Original Image Size 1.5 mm Warren Pardi

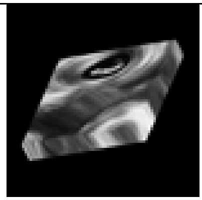
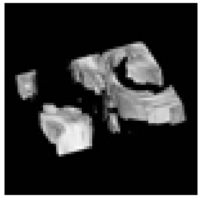
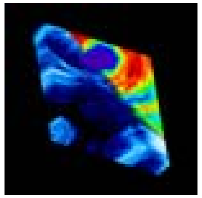
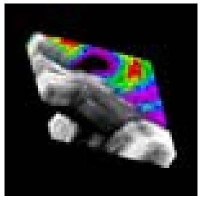
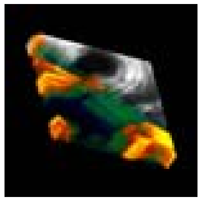
Image Identification	Image Thumbnail	Maximum Print Size cm (WxH) & KB	Printed Image Sizes cm (WxH) & KB	Comments
3D Bone Structure x6 a-f	a)  b)  c)  d)  e)  f) 	a-c) 100x100 cm 60,569 KB d-f) 100x100 cm 181,667 KB		a) 3D gray-level image of a blood vessel with it's surrounding bone layers (lamellae). This 3D image of a 72 micron thick portion of bone is part of a larger bone cross section taken from the middle of a human thighbone. Twenty four-2D images, each 3 microns in depth, were taken vertically through the bone in a series, comprising a digital 24-image 'data set'. This data set was then virtually reconstructed into the 3D bone block using our Biomedical Imaging software. b-c) 3D Bone gray-level images showing isolated areas of interest, while outer areas of surrounding lamellae are rendered transparent. d-f) Rendering the 3D image by varying the color spectrum as well as the degree of opacity and transparency enables novel features within bone to become apparent. Specimen courtesy of Haviva M. Goldman Original Size 1.5 mm Warren Pardi

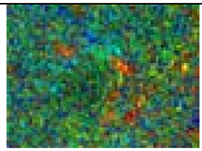
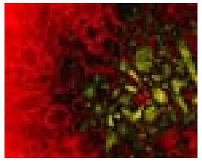
Image Identification	Image Thumbnail	Maximum Print Size cm (WxH) & KB	Printed Image Sizes cm (WxH) & KB	Comments
a) Atapuerca Cave Attack 1 b) Atapuerca Cave Attack 2	a)  b) 	a) 143x108 cm 283,404 KB b) 300x240 cm 297,178 KB	a) 143x108 cm 283,404 KB b) 143x114 cm 297,178 KB	a) Image of bone microanatomy by portable confocal scanning optical microscopy. A novel portable Nipkow disk-based confocal microscope was employed in the imaging of bone from human and bear skeletons discovered from fossil bearing deposits at Atapuerca, Spain, approximately 0.4-0.7 m.y old. Bones from Atapuerca have been severely affected by bacterial attack during fossilization, eliminating much of the internal microanatomy, but leaving the external macroanatomy in perfect condition. In order to visualize any remaining microanatomy it is necessary to use the autofluorescence potential of bone. Thus, instead of using normal white light, the microscope is configured to image the fluorescence of bone when using ultraviolet light. The image obtained here is a 3D image of bacterial attack, the colors depicting damage at various levels from top (blue) to bottom (red). The colors are very mixed up because of the degree and nature of the attack. Original size 700 µm b) Image of tooth root (dentine) microanatomy by portable confocal scanning optical microscopy. A novel portable Nipkow disk-based confocal microscope was employed in the imaging of bone from human and bear skeletons discovered from fossil bearing deposits at Atapuerca, Spain, approximately 0.4-0.7 m.y old. Bones from Atapuerca have been severely affected by bacterial attack during fossilization, eliminating much of the internal microanatomy, but leaving the external macroanatomy in perfect condition. In this case the bacterial attack occurs in “plaques” of damage, roughly circular areas of damage. Imags courtesy of the Departamento de Paleontología de la Universidad Complutense de Madrid. Original size 700 µm

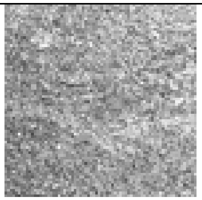
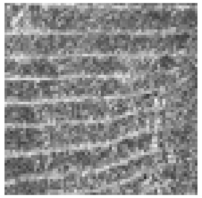
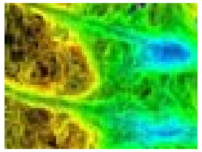
Image Identification	Image Thumbnail	Maximum Print Size cm (WxH) & KB	Printed Image Sizes cm (WxH) & KB	Comments
a) Chernobyl Abnormal b) Chernobyl Normal	a)  b) 	a) NO MAXIMUM b) NO MAXIMUM	a-b) 125x125 cm 53,253 KB a-b) 250x250 cm 212,893 KB	Tench fish (*Tinca tinca*) scale detail of fish from Russian lakes. a) Scale from fish living in lake near to the Chernobyl nuclear power plant in Russia. b) Scale from fish living in a lake distant from the Chernobyl nuclear power plant in Russia. The rings, called circuli, of a fish scale represent increments of growth; their departure from uniform widths between rings is an indication of variation in growth rate. Thus waters that are polluted, too warm, or too cold, affect the growth rate of the fish and its scales. We notice that the rings of fish living near to the Chernobyl nuclear power plant following the April 26, 1986 disaster are of a different character than those living far away. Specimen courtesy of Dr. Igor Smolyar, National Oceanographic and Atmospheric Administration, Maryland. Original Size 250 µm Timothy G. Bromage and Mary Blanchard No maximum potential size *ONLY* when using a “vector-based” imaging program, such as Adobe Streamline, which is then combined with Adobe Illustrator or Photoshop. Negotiate sizes with Tim, who can create the file, *AND* the printing company.

Image Identification	Image Thumbnail	Maximum Print Size cm (WxH) & KB	Printed Image Sizes cm (WxH) & KB	Comments
a) Cutmark 3D b) Cutmark Color Relief c) Cutmark Model	a)  b)  c) 	a) 100x76 cm 138,922 KB b) 300x229 cm 312,450 KB c100x76 cm 138,896 KB	a)100x76 cm 138,922 KB b) 100x76 cm 138,905 KB	Images from a bone "plaque" from the Grotte du Taï, France, ca. 10,000 BC, which records a continuous serpentine sequence of sets and subsets of daily engraved marks for a period of more than three years. a) The image stack is reconfigured as left and right views that are here color coded as green and red respectively. Such an image, referred to as an anaglyph, permits the viewing of a 3D image with the aid of red-green glasses. b) Depth characteristics are rendered as a color-coded map. From deepest to highest, the colors grade from dark blue, through greens at intermediate heights, and yellows, reds, and brown at highest points on the tool. c) Using sophisticated three-dimensional (3D) imaging methods, numerous high magnification views (an image stack) of two marks were compiled into a pseudo 3D model. The Taï plaque has raised significant interdisciplinary psychological and neuropsychological discussion. Study of the plaque in AMICA has concentrated on reconstructing the behavior of the engraver by examination of the marks in 3D. It can be confirmed that the marks change their characteristics every 28 days, thus representing a lunar calendar. Photomicrographic analysis is currently underway in order to ascertain what tool may have been used to carve the plaque. Specimen courtesy of Dr. Alexander Marshack, Harvard University, Massachusetts. Original Size 1.5 mm Timothy G. Bromage and Stephen McJonathan The "Cutmark 3D" image ("a") is *ONLY* for display with red/green 3D glasses. Check 3D glasses with Tim before final printing and displaying this image.

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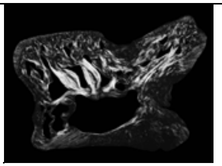
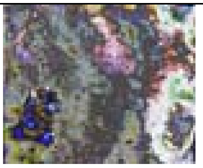
Didelphis		61x46 cm	61x46 cm	A 100-micron thick section from the calcaneus (heel bone) of *Didelphis virginiana*, an opossum. Evolutionary biologists often study opossums because their skeletal structure is thought to be similar to that of the ancestor to marsupials and other mammals. In the image seen here, circularly polarized light is used to highlight differences in the orientation of the collagen fibers present in the bone, as represented by different shades of gray. The patterns of collagen fiber orientation reflect the forces the bones are subjected to during life, which vary depending on the way members of a species move. By comparing the patterns we see in fossil bones to those in living species, we can reconstruct the locomotion of extinct animals. Specimen courtesy of Dr. Frederick S. Szalay, Hunter College, CUNY. Original size 8 mm Johanna Warshaw
Early Homo Enamel		100x83 cm	100x83 cm	Image of enamel macro- and microanatomy by portable confocal scanning optical microscopy. A novel portable Nipkow disk-based confocal microscope was employed in the imaging of an early human tooth discovered from fossil bearing deposits on the eastern shore of Lake Turkana, Kenya. Enamel surface macro-anatomy is characterized by vertical bands representing near 7-day increments of enamel deposition, called perikymata, while subsurface microanatomical details of enamel prisms are visible as a regular arrangement of small circular spots. Color is imparted to the grey-level image based on reflection intensities. Specimen courtesy of the National Museums of Kenya, Nairobi, Kenya Field width 0.6 mm

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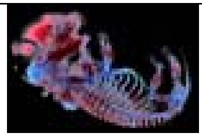
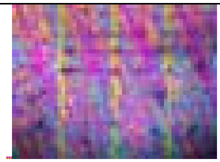
Embryo		152x100 cm	152x100 cm	Sixteen and a half-day embryo of a "knockout mouse", a mouse in which a gene coding for an enzyme responsible for cell division has been inactivated. Genetic manipulation of the mouse reveals roles that genes play in the differentiation and development of the skeleton. The embryo here was cleaned of soft tissues and stained to separately reveal cartilage (blue) and mineralized bone (red) for study. Research on gene knockout mice is contributing vital information concerning normal and abnormal development, which may then be used in future work on problems ranging from the evolution of skeletal structure to therapies for clinically relevant skeletal disorders and other diseases in humans. Specimen courtesy of Dr. Andrew Koff and Dr. Anxo Vidal, Memorial Sloan Kettering Cancer Center, New York City. Original Size 1.5 cm Timothy G. Bromage and Nancy Yeh
Emu		100x75 cm		Image of bone from the femur (thigh) of an Emu, a large flightless bird from Australia. The image was acquired by incident optical microscopy of a rough cut block surface of the bone. The image has been color coded according to depth in the bone. Dark blue-to-black illustrates a deep plexus of vascular canals, coursing more or less from left to right, that run circumferentially around the bone. Light blue striae represent near-surface marks left by the sawing of the bone and yellow striae are such marks at the very top surface of the bone block. Original size 1750 µm

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Fish In Space		75x59 cm	75x59 cm	Scale of Zebra fish (*Xiphophorus helleri*) flown aboard the NASA Space Shuttle. Fish scales grow from the small inner ring outward, the number of rings corresponding to the age of the fish. Measurements of widths between rings help to describe how the fish reacts to zero gravity. Preliminary studies indicate that growth rate is little perturbed, establishing the future possibility of developing aquaculture in space. Specimen courtesy of Professor Volker Blum, Ruhr University of Bochum, Bochum, Germany. Original Size 2 mm
Human Enamel		152x76 cm	152x76 cm	Thin section of human tooth enamel. This polarized image highlights the incremental structure of enamel; each diagonal line (lower left to upper right) marks approximately one week of enamel growth. Such information can be used to age young individuals in forensic cases or to determine how long a tooth crown took to grow to completion. Specimen courtesy of Anthropological Database, Odense University, Denmark and University of Newcastle Dental School, U.K. Original size 1 mm Rebecca J. Ferrell

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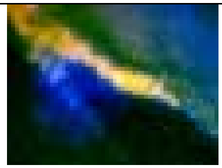
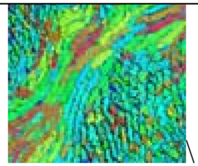
Human Enamel Crack		100x75 cm	–	Image of human molar enamel that was mechanically tested to generate a crack. The image was acquired by incident optical microscopy of the crack, which had been stained with colored inks to reveal its propagation through the enamel. In this instance, a major crack, colored yellow, separated the enamel around the boundaries of enamel formed by adjacent enamel forming cells. Here, these boundaries are represented as an undulating upper and lower border to the yellow crack. Original size 175 µm
Human Enamel Prisms		100x85 cm	100x85 cm	The enamel of modern humans and their ancestors varies in microanatomical structure in ways that are thought to resist the propagation of cracks. To examine this problem it is necessary to image and observe the orientations of units of enamel structure called prisms that course outward from the junction with underlying dentine to the outer surface of the tooth. In this example of modern human enamel deep to the surface of a cut and polished tooth and imaged by backscattered electron imaging in the scanning electron microscope, we see that the prisms have divergent courses. Some prisms are seen to course longitudinally and wander lengthwise in the plane of the image while others course in and out of the plane of the image and appear semicircular. This heterogeneity provides crack propagating resistance to a tooth, enabling it to withstand the mechanical forces of chewing. Some early hominins with large robust teeth have more anti-crack propagating heterogeneous enamel than other species. Color was imparted to the image by an image analysis program for measuring prism orientation. Original size 180 µm

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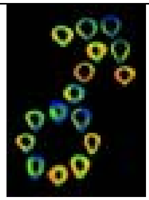
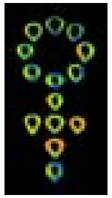
a) Human Femur Figure Mars b) Human Femur Figure Venus	a)  b) 	a) 520x710 cm b) 390x710 cm	a) 146x200 cm a) 183x250 cm b) 107 x200 cm b) 134 x250 cm	Collage of polarized light montages of human thighbones. These images, from the middle of the thighbone of thirty males and females through the adult age range, represent colorized versions of circularly polarized light images, highlighting regions of collagen fibers of differing orientation. Areas assigned warm colors (yellows, pinks and reds) represent collagen fiber orientations resistant to compressive forces during life. Areas assigned to cool colors (dark blues, light blues and greens) represent collagen fiber orientations resistant to tensile forces. We use these color maps to document between-individual variation in walking and way of life, about which you can see there is considerable variability. Individuals in their twenties are at the base of the Venus and Mars figures. The tip of the male figure is comprised of individuals in their eighties, while the top of the female group comprises women from their mid-fifties to seventies, equivalent in age to the men's stem of the arrow. Specimen courtesy of Dr. John G. Clement, University of Melbourne School of Dental Science and the Victorian Institute of Forensic Medicine, Australia. Original size 2.5-35 cm each Haviva M. Goldman Confirm existence of: a)183x250 cm b) 134 x250 cm

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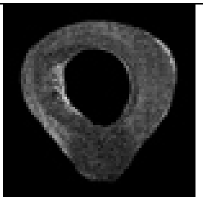
Human Femur Polarized		204x204 cm	204x204 cm	Human thighbone of bone in a 28-year-old woman. This image across an entire section through the thighbone is actually made up of over 250 polarized light microscope images that have been automatically montaged together to form a single high-resolution view. This image provides information about the degree of orientation of the collagen fibers within the bone, which in turn can tell us about the ability of the tissue to resist different kinds of mechanical stresses encountered in everyday life. Comparing the organization of bone tissue between individuals of different ages and sexes can help us to understand more about how bone structure varies over the lifespan - important information for the understanding of the prevalence of bone diseases, like osteoporosis. Specimen courtesy of Dr. John G. Clement, University of Melbourne School of Dental Science and the Victorian Institute of Forensic Medicine, Australia. Original size 3.5 cm Haviva M. Goldman

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Human Tooth		628x506 cm	400x323 cm 628x506 cm	Thin section of a permanent molar from a medieval human from Denmark. The enamel of this tooth crown indicates that life in medieval Denmark was not easy. The multiple heavy lines following the contour of the tooth were created when enamel-forming cells were subjected to repeated stress associated with disease and malnutrition. Teeth are one of the best natural records of life history available to anthropologists because tooth enamel does not remodel during life and is often well preserved in archaeological contexts. Specimen courtesy of Anthropological Database, Odense University, Denmark and University of Newcastle Dental School, U.K. Original size 1 cm Rebecca J. Ferrell

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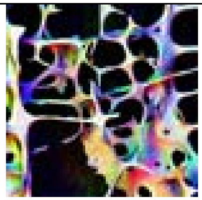
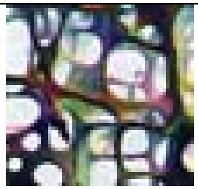
Human Trabecular Bone 1		104x104 cm	104x104 cm	Spongy (trabecular) bone from the lumbar vertebra of an 89-year-old female is observed by backscattered electron imaging in the scanning electron microscope (SEM). Color hue shows the spatial orientation (direction in which it is facing) and color intensity shows the slope of the surface. Eleven levels (in-focus planes at consecutive depths) of 250 microns each were recorded separately to provide an image in good focus at all depths. The world's first in-focus multi-level SEM image is presented here. This image, and the technique employed to produce it, allows a better discrimination of bone surface activity than has been achieved before. In this elderly female the beams of bone making up the inner architecture of the vertebra are significantly thinned compared to pre-menopausal woman. The novel imaging methods portrayed here affords a new perspective on osteoporosis. Original Size 4.45 mm wide and 2.8mm thick Alan Boyde
Human Trabecular Bone 2		104x100 cm		Scanning electron micrograph of vertical slice of cancellous bone from a fourth lumbar (L4) vertebral body from an elderly female. Composite made from 36 backscattered electron images, 12 focus levels at 250 micron Z separation. At each focus level, 4 images were recorded with separate backscattered electron detector sectors. Three of these images were combined by assigning the grey level image to one of three RGB colour channels. This gives the pleasing back-lit effect with subtle colour tones. All in focus iamge makes it possible to see all structural detail over all surfaces over a large depth range. Original Size 4 mm Alan Boyde

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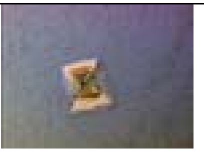
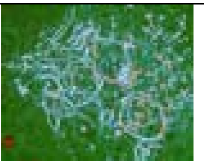
Indent		100x75 cm	100x75 cm	To determine the strength of a material, such as this human dentine from a molar tooth, a diamond point is applied to the surface with a known force. The resulting indent diameter is related to how deep the diamond is able to penetrate the surface with that force. This method, therefore, measures density, which is of interest to many disciplines, including health science and materials science. We find it also interesting that this mark provides a record of an event and, as such, reflects the "culture" of science. Original size 0.6 mm
Lucy Fiber Orientation		153x110 cm	153x110 cm	Image of bone microanatomy by portable confocal scanning optical microscopy. A novel portable Nipkow disk-based confocal microscope was employed in the imaging of femoral bone from the famous "Lucy" discovered from fossil bearing deposits at Hadar, Ethiopia, approximately 3.0 m.y old. This image provides information about the degree of orientation of the collagen fibers within the bone, which in turn can tell us about the ability of the tissue to resist different kinds of mechanical stresses encountered in everyday life; green is collagen perpendicular with the plane of the screen, and light blue represents collagen parallel with the screen. Comparing the organization of bone tissue between Lucy, belonging to the species *Australopithecus afarensis*, with other species of early human, can help us to understand more about how bone structure and function has varied over human evolutionary time. Imaging courtesy of the Ethiopia National, Addis Ababa, Ethiopia Original size 0.6 mm Iraklion image must be eliminated and reprinted

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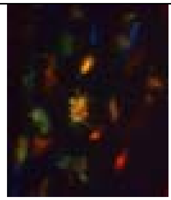
Lucy Osteocytes		126x150 cm	126x150 cm	Image of bone microanatomy by portable confocal scanning optical microscopy. A novel portable Nipkow disk-based confocal microscope was employed in the imaging of femoral bone from the famous "Lucy" discovered from fossil bearing deposits at Hadar, Ethiopia, approximately 3.0 m.y old. This image provides information about the degree of orientation of the cell spaces beneath the surface of the bone, which in turn can tell us about the way in which the bone was growing during childhood. Well oriented cells means that the surface was depositing bone during growth, while randomly oriented cells means that the surface was resorbing bone during growth; bone deposition, coupled with bone resorption, is how bones grow. Comparing the organization of bone cells between Lucy, belonging to the species *Australopithecus afarensis*, with other species of early human, can help us to understand changes in how bones grew over human evolutionary time. Imaging courtesy of the Ethiopia National, Addis Ababa, Ethiopia Original size 110 µm

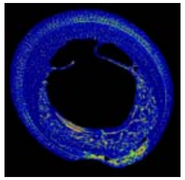
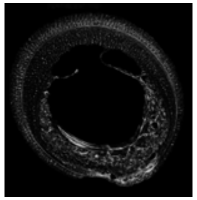
Image Identification	Image Thumbnail	Maximum Print Size cm (WxH) & KB	Printed Image Sizes cm (WxH) & KB	Comments
a) Mulatta LM b) Mulatta LUT c) Mulatta Polarized	a)  b)  c) 	a) 80x80 b) 80x80 c) 80x80	a) 80x80 b) 80x80 c) 80x80	Thigh-bone of a growing 2-year old rhesus macaque monkey (*Macaca mulatta)*. Rhesus macaques live in a wide range of habitats, from near-desert conditions to deciduous forests, which stretch from Afghanistan and India to South China and Thailand. This individual lived in a captive free-ranging colony in South Carolina, and affords the opportunity to study the growth patterns of rhesus macaques living in a controlled temperate environment. c) A 100-micron thick section of the thighbone imaged in circularly polarized light to reveal changes in the organization of the collagen (protein) component of bone during growth. Differences in the orientations of collagen fibers are reflected in different shades of gray. a): The same field-of-view was imaged in ordinary transmitted light for the identification of different types of bone tissues deposited at different times during growth, as well as so called growth arrest lines representing periods of temporary suspensions in growth. b): As the human eye and brain can more readily discriminate color (versus gray-scale) information, the polarized light image (Left) was converted to a pseudo-colorized image in Adobe Photoshop. This image facilitates visual inspection of changes in collagen fiber orientation during growth. The microscopic organization of bone tissues provides information about the rate at which those tissues were deposited, as well as the forces the bones were subjected to during movement, at different times during development. The formation of a growth arrest line situated mid-way through the cortex and running circumferentially around the bone, may reflect seasonal variation in the rate of growth of this individual. Examinations of animals from different environments can provide information about how different climates and patterns of seasonality influence individual growth patterns. Specimen courtesy of the Morgan Island Breeding Colony, South Carolina. Original Size 8.2 mm Shannon C. McFarlin

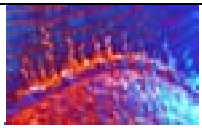
Image Identification	Image Thumbnail	Maximum Print Size cm (WxH) & KB	Printed Image Sizes cm (WxH) & KB	Comments
On the Cusp		TBA	93x137	The cusp of a human molar tooth is a wonderfully complex structure. While the mechanisms remain obscure, we can observe the behavior of enamel forming cells by the tooth material they lay down during development. In this histological thin section, the "hill" below, is the dentine of the tooth. From the surface of the dentine, enamel developed upward in swirling patterns that have some relevance to the biomechanical resistance of the tooth to chewing forces. The junction between enamel and dentine is called the enamel-dentine junction, or EDJ. At tooth cusp tips this swirling phenomenon renders a tissue called "gnarled enamel" for its appearance. Other characteristics observed in this image are "enamel tufts", which are enamel deficient defects arising from the EDJ upward into enamel, which here are like flames on the surface of dentine. Color in this image arises from the employ of circularly polarized light imaging by a conventional compound light microscope. Typically, apart from their general growth trajectory away from the EDJ at cusp tips, because the enamel cells regularly swirl into and out of the plane of section, the enamel is formed in patterns that, when mineralized, reveal crystal orientations that appear in orange when in the plane of the section, or blue when passing up and down through the section. Field width = 1.65 mm

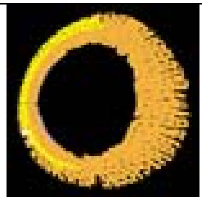
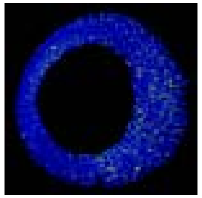
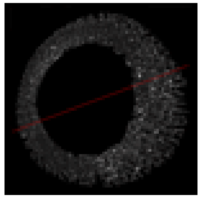
Image Identification	Image Thumbnail	Maximum Print Size cm (WxH) & KB	Printed Image Sizes cm (WxH) & KB	Comments
a) Oto Cartoon b) Oto LUT c) Oto Polarized	a)  b)  c) 	a) 50X50 cm b) 50X50 cm c) 50X50 cm	a) 50X50 cm b) 50X50 cm c) 50X50 cm	A 100-micron section from the femur (thigh bone), of *Otolemur crassicaudatus*,, a bushbaby. The animal was about 1 month old when it died. Bushbabies, small primates native to Africa, are often extraordinary leapers. a) Colorization in Adobe Photoshop makes the differences in collagen fiber orientation more obvious to the human eye and brain. b) Different kinds of bone tissue were identified, outlined in Adobe Photoshop, and assigned colors. c) Circularly polarized light was used to highlight differences in the orientation of the collagen fibers present in the bone, as represented by different shades of gray. The red line indicates the axis along which the bone is strongest when bent. Tissue types provide information about the rate at which the bone is being deposited. In this juvenile we see mostly fast-growing bone, as is usually the case for very young mammals. The patterns of collagen fiber orientation, as well as the red axis, reflect the forces the bones are subjected to during life, which vary depending on the way members of a species move. Examination of juveniles as well as adults can provide information about the growth pattern of a species, and the changes in behavior that occur with age (e.g. baby humans locomote by crawling, while adult humans walk). Specimen courtesy of Dr. Carl Terranova, Howard University. Original size 3.5 mm Johanna Warshaw

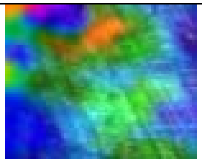
Image Identification	Image Thumbnail	Maximum Print Size cm (WxH) & KB	Printed Image Sizes cm (WxH) & KB	Comments
Paranthropus Enamel		300x240 cm	250x200 cm	Fractured enamel surface of an early hominin Paranthropus robustus molar from Swartkrans, South Africa, ca 1.5-2.0 m.y. Imaging deep to the surface reveals incremental enamel microanatomy; striae seen from upper left to lower right, across which course the enamel prisms.. Overlain on this image is a color relief map of the actual 3D topography of this surface; superficial orange and blue to green regions somewhat deeper. Imaging courtesy of the Transvaal Museu, Pretoria, South Africa. Original size 450 μm Must eliminate and reprint 250x200 image from Toledo

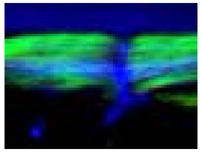
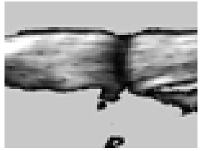
Image Identification	Image Thumbnail	Maximum Print Size cm (WxH) & KB	Printed Image Sizes cm (WxH) & KB	Comments
a) Rat In Space Binary b) Rat In Space Fluorescence c) Rat In Space Polarized	a)  b)  c) 	a) 150x106 b) 140x106 c) 140x106	a) 150x106 b) 140x106 c) 140x106	Forelimb bone of a growing rat (*Rattus rattus*) flown aboard the NASA Space Shuttle. a) The polarized image was digitally processed to preferentially reveal the linear detail (left to right). b): The section was imaged in ultraviolet light to reveal fluorescent markers (blue) given to the rat before and after the Space Shuttle mission. To this image were added Left and Middle images to make a composite for study. c): A 100-micron thick section of the bone was imaged in polarized light. Each lineation represents a daily increment of bone growth from the bottom to top of the image. Measurements of the widths between increments help to describe how rat development is affected by zero gravity. Our research shows that bone growth is significantly compromised in space. This Space Shuttle research is necessary for appreciating issues related to astronaut health in space and, ultimately, the NASA mission to colonize space: This includes communities complete with growing children. Specimen courtesy of Dr. Emily Holton, NASA-Ames, Moffett Field, California. Original Size 270 µm

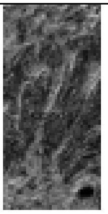
Image Identification	Image Thumbnail	Maximum Print Size cm (WxH) & KB	Printed Image Sizes cm (WxH) & KB	Comments
Root Storm		110x56 cm	110x56 cm	Thin section of a wisdom tooth root from a medieval human from Denmark, approximately 25 years of age. Tooth root sections can be used to estimate how long a tooth has taken to develop to completion. This tooth root has grown in a “gnarled” pattern. Three-dimensional (3D) imaging methods and polarized light microscopy capture the complex structure of this root anomaly. Specimen courtesy of Anthropological Database, Odense University, Denmark and University of Newcastle Dental School, U.K. Original size 3 mm Rebecca J. Ferrell
SEM Of Bone Surface		187x400 cm	187x400 cm	The external surface of bone immediately adjacent to cartilage lining the knee joint of a marmoset monkey (*Callithrix jacchus*) is observed by scanning electron microscopy. Many tendons, ligaments, and muscles make their attachments to the thighbone via collagen fibers. In this image, collagenous attachments arc downward from the knee joint capsule rim (top). A blood vessel opening is visible at the bottom right. Other visible features include the many bone cell spaces, which appear as little pockmarks, residing on the surface in this part of the bone. The study of attachment structures is important to human health and function because of disorders, such as osteoarthritis, that involve these sites. In anthropology, the systematic study of attachment structures may contribute to our understanding of skeletal function in extinct primates. Original Size 600 µm Jeremy Tausch and Timothy G. Bromage There is also a large vinyl image from Iraklion; size ?

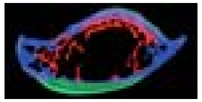
Image Identification	Image Thumbnail	Maximum Print Size cm (WxH) & KB	Printed Image Sizes cm (WxH) & KB	Comments
Tachy		NO MAXIMUM	200x100 cm	This image is a color-coded map representing variability in bone tissue types across a single 100-micron-thick section of the femur (thigh bone) of an adult echidna (*Tachyglossus aculeatus*). The echidna represents a group of mammals referred to as Monotremes. They are of considerable interest to biologists because they shed light on the early evolutionary history of mammals. They retain many details of their skeletal structure and reproductive biology that more closely resemble that of reptiles than other mammals; for instance, they lay eggs. The particular bone tissue types deposited at different times during life is a reflection of individual growth patterns, as well as the loads borne by the skeleton resulting from the way organisms move (i.e. posture and locomotion). By comparing the patterns we see in fossil bones to those in living species, we can begin to reconstruct the evolution of particular growth patterns and habits observed in modern mammals. Specimen courtesy of Dr. Frederick S. Szalay Original Size 1.14 cm Shannon C. McFarlin No maximum potential size *ONLY* when using a "vector-based" imaging program, such as Adobe Streamline, which is then combined with Adobe Illustrator or Photoshop. Negotiate sizes with Tim, who can create the file, *AND* the printing company.

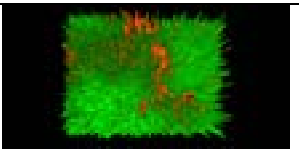
Image Identification	Image Thumbnail	Maximum Print Size cm (WxH) & KB	Printed Image Sizes cm (WxH) & KB	Comments
Taung Bacterial Attack		100x50 cm	100x50 cm	Image of bacterial attack in bone by portable confocal scanning optical microscopy. A novel portable Nipkow disk-based confocal microscope was employed in the imaging of facial bone from the famous "Taung Child" skull discovered from fossil bearing deposits at Taung, Boputhatswana, South Africa, approximately 3.0 m.y old. This image illustrates the nature in which bacterial attack has removed tunnels of bone beneath the surface. The image was acquired by using the autofluorescence potential of bone. Thus, instead of using normal white light, the microscope was configured to image the green colored fluorescence of bone when using ultraviolet light. The image obtained here is a 3D image of bacterial attack, the orange color depicting damage at depth, surrounded by intact bone that is colored green. Imaging courtesy of the University of the Witwatersrand Medical School, South Africa. Original size 74 µm

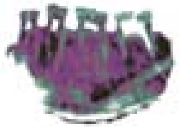
Image Identification	Image Thumbnail	Maximum Print Size cm (WxH) & KB	Printed Image Sizes cm (WxH) & KB	Comments
UR 501 CT		150x115 cm	150x115 cm	This human jaw from Malawi, attributed to the species *Homo rudolfensis*, is the earliest representative of the genus *Homo*, about 2.4 million years old. The Computed tomograph (CT) displayed here of a 1.5mm slice through the teeth and jaw was originally acquired as a gray-scale (monochrome) image. The image was color coded in Adobe Photoshop to better reveal details of internal structures for study, as humans discriminate color more readily than gray levels. Photomicrographic analysis has shown that earliest *Homo* had significantly larger teeth and tooth roots than humans today. This specimen (UR 501) was recovered by Professors Tim Bromage and Yusuf Juwayeyi of Hunter College and Friedemann Schrenk of the University of Frankfurt. Professor Frans Zonneveld of Utrecht University undertook the CT of UR 501. Original Size 7 cm Timothy G. Bromage and Frans Zonneveld

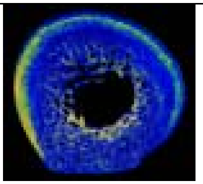
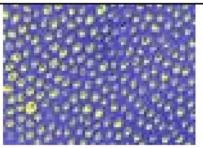
Image Identification	Image Thumbnail	Maximum Print Size cm (WxH) & KB	Printed Image Sizes cm (WxH) & KB	Comments
Wombat Bone		550x510 cm	400x370 cm 204x189 cm	A 100-micron thick section from the femur (thighbone) of *Vombatus ursinus*, a wombat. Wombats are members of Marsupiala, the highly diverse group of mammals that includes pouched animals such as the kangaroo, koalas, opossums, and many other species. Native to Australia, wombats are powerful, robustly built, dog-sized diggers. The thickness of the bone seen here is a good indication of the strength of a wombat. The colors in this image represent differences in the orientation of collagen fibers present in the bone, as viewed in circularly polarized light. Despite their close evolutionary relationships to one another, marsupials are expected to show a diversity of collagen fiber patterns, depending on the way that they move during life and the resulting forces to which their bones are subjected. Specimen courtesy of Dr. Frederick S. Szalay Original size 18 mm Credit to Johanna Warshaw 400x370 cm (100 dpi) image on vinyl from Iraklion. Maximum 550x510 cm size has not been printed or saved on disk.

Image Identification	Image Thumbnail	Maximum Print Size cm (WxH) & KB	Printed Image Sizes cm (WxH) & KB	Comments
Zebra Dentine		120x88 cm	120x88	The upper molar root dentine of a southern African zebra (Equus burchelli) is observed by backscattered electron imaging in the scanning electron microscope. The image derives from the polished cut surface of a tooth sectioned through its center. The image is called a "density-dependent" image; black represents holes (i.e. no dentine), blue is least densely mineralized (i.e. relatively less hard dentine), and yellow is most densely mineralized (i.e. relatively more hard dentine). Each hole actually represents a tube associated with one long dentine cell process in life. The number of holes and the proportion of yellow to blue may characterize certain species and relate to their feeding habits. This research concerns interests in the skeletal and conservation biology of African mammals. Ongoing efforts include the collection of animal skeletons immediately upon death (of natural causes) from National parks in South Africa, Zambia, Malawi, Tanzania, and Kenya. Information obtained from our imaging research is expected to highlight the effects of environmental change, disease, and possibly the stresses related to living in protected game reserves (e.g. overcrowding and tourism). The results are also expected to be useful for environmental reconstruction of sites of importance to ancient human life. Original Size 265 μm Timothy G. Bromage