

HUMAN HEALTH

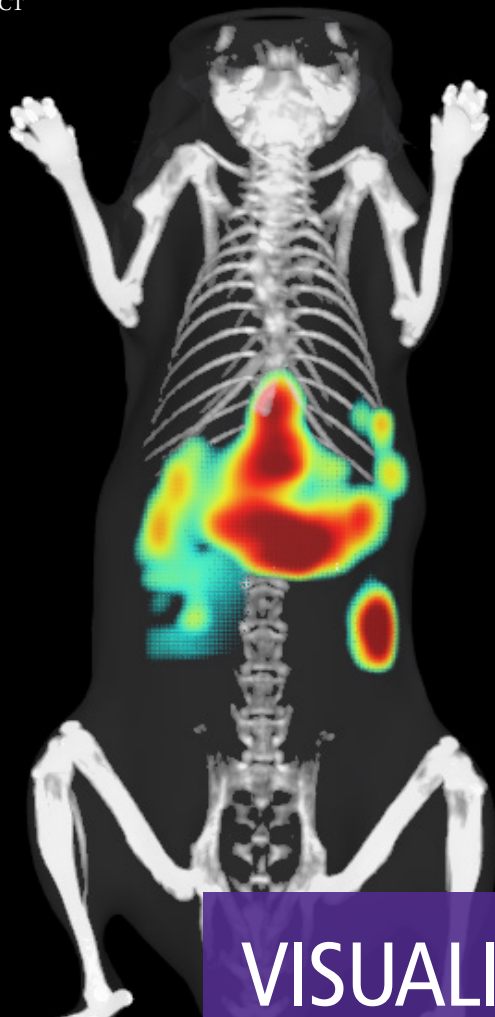
ENVIRONMENTAL HEALTH



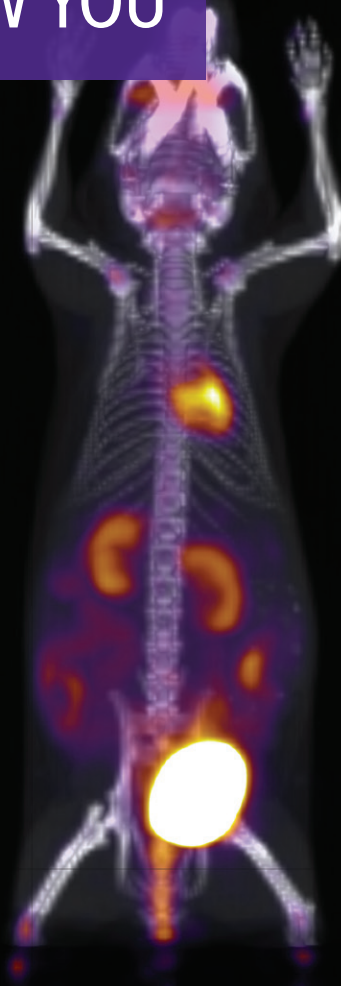
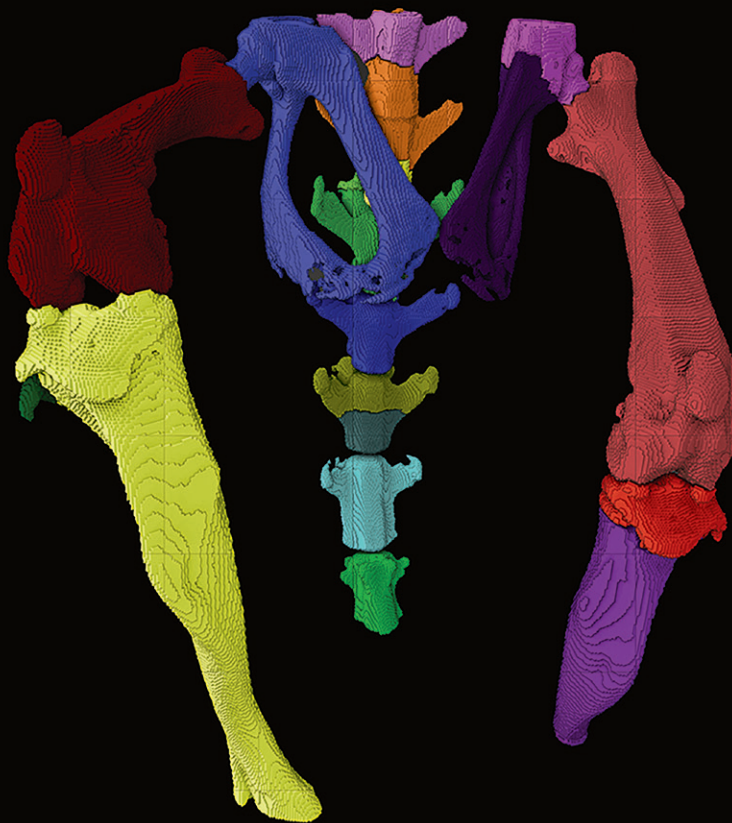
WHEN MODALITIES COMBINE
YOU SEE DISEASE
IN ALL ITS DIMENSIONS

Multimodality Imaging


PerkinElmer[®]
For the Better



VISUALIZE EVERYTHING
DISEASE HAS TO SHOW YOU



It's simple: More information means more understanding

For today's researchers in oncology, infectious diseases, inflammation, neuroscience, stem cells, and other disciplines, there's an increasing need for *in vivo* imaging that enables you to visualize multiple events simultaneously and to extract the maximum amount of information from each subject – leading to greater biological understanding.

Multimodal imaging enables a better understanding of disease biology. By utilizing *in vivo* optimized bioluminescent and fluorescent agents and radioactive probes, researchers can measure depth, volume, concentration, and metabolic activity, providing a wealth of information for untangling the mysteries of disease.

Coregistration allows researchers to overlay images from multiple imaging modalities, providing more comprehensive insight into the molecular and anatomical features of a model subject. For example, optical imaging data can be used to identify and quantify tumor burden at the molecular level and, when integrated with microCT, provides a quantitative 3D view of anatomical and functional readouts.

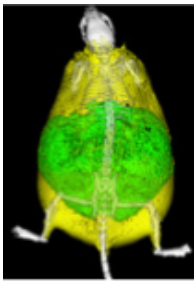
At PerkinElmer, we've developed industry leading imaging technology for preclinical research. Our technology integrates 3D optical and PET modalities with microCT to provide a better understanding of disease. And that means better monitoring of disease progression, earlier detection of treatment efficacy, and deeper understanding of metabolic changes that take place throughout disease development.

BETTER IMAGING MEANS BETTER UNDERSTANDING

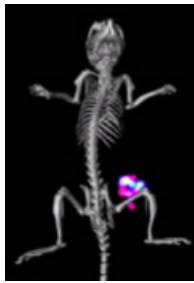


IVIS SpectrumCT Pre-clinical *in vivo* Imaging System

Optical and microCT



Metabolic disease

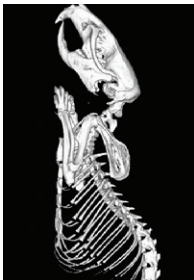


Cancer targeting

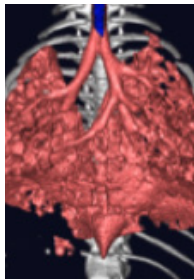


Multimodal imaging

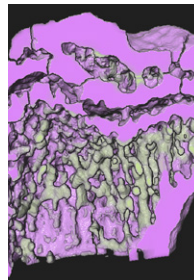
High Resolution microCT



Gross anatomy

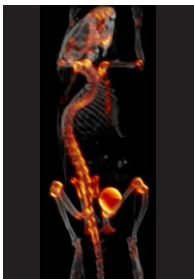


Pulmonary disease

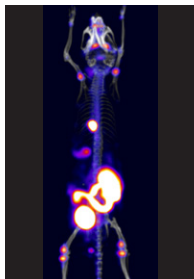


Trabecular bone imaging

PET/CT



Bone metabolism (NaF-18)



ImmunoPET with 89-Zr labeled antibodies



18F-Fallypride imaging of dopamine receptors in a rat brain

IVIS SpectrumCT: Combined optical and computed tomography

The IVIS® SpectrumCT enables simultaneous molecular and anatomical imaging for longitudinal studies, providing researchers with essential insights into complex biological systems in small animal models. The constant horizontal gantry motion and the flat-panel detector provide unparalleled performance for low-dose imaging and automated optical and microCT integration. The stable revolving animal platform rotates 360° to acquire full 3D data. Multiple animals can be scanned simultaneously while maintaining an average dose per scan at about 13 mGy, with a scanning and reconstruction time of less than a minute. Optical and microCT modalities can also operate independently.

Topographic data is essential for the accuracy of 3D tomographic reconstructions. And the IVIS SpectrumCT system allows for true topographic surface mapping of the subject.

- Integrated optical and microCT technology
- 3D tomography for bioluminescent and fluorescent reporters
- Enhanced spectral unmixing for multispectral imaging
- Dynamic Contrast Enhancement (DyCE™)
- Low-dose, ultra-fast microCT
- Multi-mouse microCT imaging (two-mouse manifold)



Quantum GX microCT Imaging System

Quantum GX: High-resolution, low-dose, high-speed microCT

Our Quantum GX microCT imaging system provides high-resolution images at an X-ray dose low enough to enable true longitudinal imaging capability. With scan times as low as eight seconds, the Quantum GX supports a higher throughput workflow, ideal for longitudinal imaging of multiple animals.

The Quantum GX system also comes with an optional user-friendly software package for advanced bone analysis, with exceptional visualization tools that minimize the need for third-party microCT software tools.

- High resolution (4.5 micron voxel size)
- High speed (eight-second scan time)
- Two magnifications for high, medium and low resolutions
- Two-phase respiratory and cardiac gating
- Low-dose imaging for longitudinal studies
- Coregistration of functional optical signals with anatomical microCT
- Mouse/rat/rabbit imaging capabilities



G8 Multimodal PET/CT Imaging System

G8 PET/CT: High-performance benchtop PET/CT system

PET imaging for small animals is an essential tool in translational research. The G8 PET/CT delivers fast, convenient, cost-effective PET imaging with an intuitive user interface and efficient workflows, ensuring subject monitoring throughout preparation and imaging – all in a compact footprint that makes PET accessible to any lab.

The G8 PET/CT imaging system is designed to maximize workflow efficiency and experimental accuracy. The system enables you to queue up multiple subjects in imaging chambers and docking stations to increase your throughput – and decrease your setup time.

The increased PET sensitivity of the G8 system (14%) means lower doses of radioactivity need to be injected into each animal. Less radioactivity mean less perturbation to the *in vivo* environment, while also reducing radiation exposure to the animal and the user. Additionally, the panel detector architecture increases uniformity across the entire imaging field of view, meaning you can acquire quantitative data wherever your probe tracks to *in vivo*.

- High sensitivity with increased uniformity across FOV
- High-speed, low dose CT
- Basic and PET Physicist software modes for increased flexibility
- Efficient workflows for improved throughput
- Dynamic scanning of a whole mouse in one scan

EVERYTHING YOU NEED TO COREGISTER WITH CONFIDENCE

3D multimodality that's greater than the sum of its parts

To generate more meaningful information from imaging research, scientists are looking to more longitudinal data using a variety of different modalities to extract the maximum amount of quantitatively significant data from each model. That's the idea behind our comprehensive array of multimodality imaging systems, designed with coregistration in mind – systems that enable researchers to use optical and microCT platforms to obtain anatomical and functional data from the same study.

The combination of high-resolution Quantum GX microCT and highly sensitive tomographic optical imaging systems such as the FMT® and IVIS Spectrum Series provides greater understanding of molecular events, and of anatomical reference and secondary effects of the disease process.

The highly accurate and sensitive FMT 3D solution allows you to discover more about biological targets, processes, and pathways in the living subject. Using our proprietary tomography tools on the IVIS Spectrum Series and FMT platform in conjunction with our *in vivo* imaging agents, you can generate noninvasive, deep-tissue quantitative data for preclinical research applications.

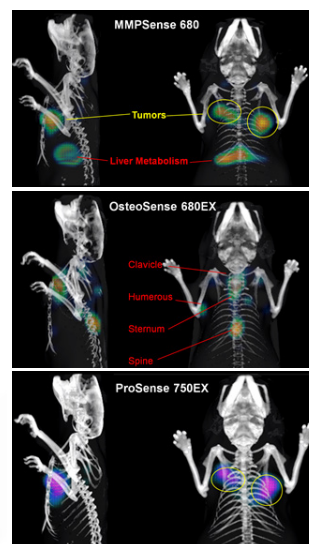
What's more, the Multispecies Imaging Module (MSIM) for our FMT platform opens up the possibility of studying disease models in larger animals. The module is available for noninvasive quantitative imaging of adult rats in a range of these systems.

With 3D multimodality, you benefit from:

- **Better data:** 3D tomography facilitates improved fluorescence signal detection, providing better qualification of the probe concentration
- **Accurate:** 3D tomography accurately identifies optical source location and improves quantification
- **More information:** High-resolution microCT provides anatomical context to molecular and functional readouts obtained by optical reconstructions



IVIS Spectrum



3D coregistration of fluorescence signal from various imaging reagents (MMPsense 680, Osteosense 680EX, ProSense 750EX) with microCT



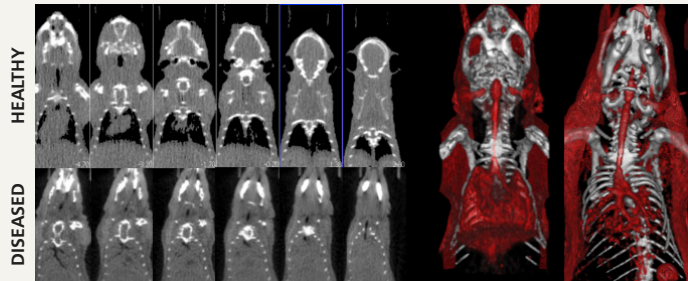
FMT Tomographic Imager



3D coregistration of FMT image showing cathepsin activity in orthotopic 4T1 tumors detected by ProSense 750EX with microCT

Multimodality at work in the real world

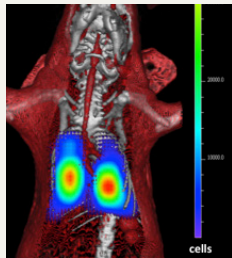
CASE STUDY - 3D OPTICAL COREGISTRATION WITH MICROCT



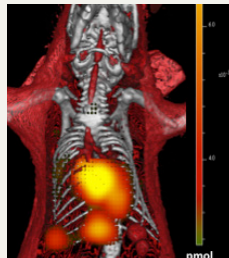
The benefits of using multiple modalities in one experimental study are clear: Here, longitudinal microCT imaging shows the decrease in lung air volume in the diseased animal. Adding 3D optical imaging provides additional functional data, such as upregulation of certain biological events or the precise number of cells in the diseased lungs.

The experiment was conducted in the following manner:

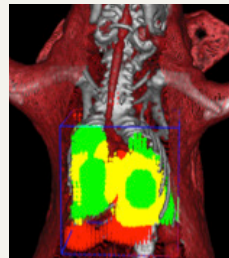
- One million 4T1-Luc injected directly into the lungs two weeks prior to imaging
- IntegriSense™ 750 was injected 24 hours prior to imaging
- Diseased lungs showed decrease in lung air volume via microCT



Bioluminescence signal expressed in # cells



Fluorescence signal expressed in pmol



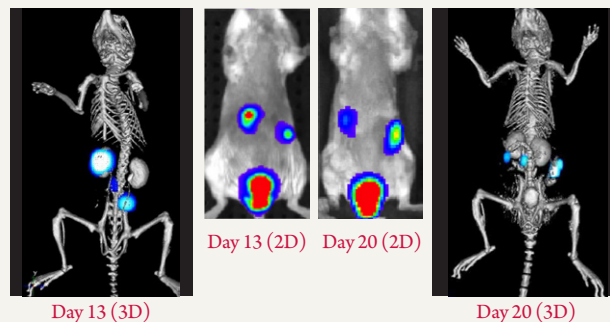
3D Overlay - BLI (green), FLI (red), Colocalized (yellow)

Coregistration provided the following findings:

- Heavy tumor burden in lungs, with approximately 40 million viable cells causing decrease in air volume
- Approximately 2 nmol of IntegriSense 750 detected in the lung cavity, specifically in areas of heavy tumor burden as indicated by colocalized signal
- $\alpha_v\beta_3$ Integrin upregulation in tumor cells, indicating growth, viability, and angiogenesis

CASE STUDY - ACCURATE 3D COLOCALIZATION OF UTI

In this case study, 2D imaging on Day 13 identifies bacterial foci in the kidney (disease destination) and the ureter (migrating disease). The 3D image shows the ability of the SpectrumCT to perform tomography to localize the bacterial foci in the kidney and ureter. The system's microCT capability provides high-resolution anatomic context to the 3D optical data through visual validation of target organs using contrast agents. But 3D tomography coupled with microCT on Day 20 localizes the signals to the intestine and stomach, not the urinary tract. Without 3D multimodal visualization, this new disease focal point would have been missed.



UPEC are inoculated into the bladder and ascend the ureter to cause pyelonephritis

For more information, visit www.perkinelmer.com/Multimodality-Imaging

PerkinElmer, Inc.
940 Winter Street
Waltham, MA 02451 USA
P: (800) 762-4000 or
(+1) 203-925-4602
www.perkinelmer.com



For a complete listing of our global offices, visit www.perkinelmer.com/ContactUs

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