

## RESEARCH PROFILE

---

Ari Ide-Ektessabi



### **Research Activities of Professor Ari Ide-Ektessabi's Laboratory**

The Research activities of the laboratory are focused in high precision measurement and analyses using particle beams and light, including synchrotron radiation. Recently we use the words “analytical imaging” or “functional imaging” to explain the research fields of our interest.

The members of the laboratory are 12-15 students, 8 research staff, and about 20 collaborators from 5 different companies and research organizations. The close collaborations among the laboratory, companies and institutes provide a platform to conduct research in a wide range of fields related to imaging and analyses.

■ **The analytical imaging using synchrotron radiation in cell micro biology is illustrated in the book: Ari Ide-Ektessabi “Application of Synchrotron Radiation in Cell Microbiology and Medicine, Springer, Heidelberg, 2007”**

The monograph includes the research achievements (during 1997-2007) on the following topics.

- Synchrotron Radiation X-ray Fluorescence imaging using micro SR beams
- Development of computer programs for quantitative XRF imaging
- Elemental images of single neurons by using SR-XRF
- Chemical state imaging and selectively induced x-ray emission spectroscopy
- Chemical state imaging of iron in nerve cells from a patient with Parkinson-dementia complex.
- Interactions of nano-particles within cells using micro-beam imaging techniques
- Imaging of elements in a single cell

■ **The laboratory was granted a NEDO (New Energy and Industrial Technology Development Organization) project in the field of developing new material for “next generation plasma display material”. This project initiated several research topics related to material analysis techniques, software and equipments related to plasma display such as:**

- Ion beam modification system flexible display systems applications with a linear ion source
- Ion beam modification of polymeric films for electronics paper
- Micro ion beam processing and fine patterning (FIB)
- Ion beam assisted sputter deposition of thin films display system applications
- Secondary electron measurement system for plasma display research
- Discharge voltage measurement of micro plasma for plasma displays

- The laboratory has been granted FIVE projects in the fields of application of analytical imaging techniques in art and world heritage since 2004.



- 1) JST Comprehensive Support Program for Creation of Regional Innovation: Key Seed Projects for Regional R&D, "Development of High-resolution Large Flatbed Scanner for Digitizing Large Artworks and Non-Destructive Pigment Estimation" (FY 2004-2007)
- 2) JST Comprehensive Support Program for Creation of Regional Innovation: Regional R&D Resources Utilization Type, "An Integrated System for Secure and Dynamic Display of Cultural Heritage" (FY2006-2008)



- 3) Ministry of Education, Culture, Sports, Science and Technology (MEXT), Realization of the System and Basic Technical Elements of Digital Museum, The Feasibility Study Program 2009, "Developing the Technical Foundation for International Digital Museum" (FY2009)
- 4) Ministry of Education, Culture, Sports, Science and Technology (MEXT), Official Development Assistance UNESCO Activity Grant, "Education Program for Recording and Utilization of Asian Cultural Heritage-UNESCO Japan, Kyoto University Project-" (FY2011)



- 5) Ministry of Education, Culture, Science and Technology (MEXT), Special Coordination Funds for Promotion of Science and Technology, Asia-Africa Science and Technology Strategic Cooperation Promotion Program, "International Joint Research on High Resolution Digitization of Asian World Heritage" (FY2009-2011)

**The research topics in the academic year 2007-2011 were:**

- Multi-function scanner for non-contact digitizing and analysis of cultural heritage using visible light
- Analytical imaging of biomaterials (hydroxyapatite) using synchrotron radiation
- Discharge characteristics of micro cell plasma for plasma display applications
- Development of Computer Program for Displaying Elemental Distribution Images and Quantification of SR-XRF Spectra
- Improvement of TCO (transparent conductive oxide) material for plasma display
- Development of a three dimensional camera for imaging of western paintings
- Estimation of the original colour of old paintings (colour deterioration of the pigments)
- Development of multi-band camera for pigment analysis using visible light reflectance spectroscopy
- Investigations of structural vibration of large flat-bed scanner
- Studies on materials and techniques of traditional Korean paintings using visible analytical imaging
- Studies on materials and techniques of traditional Japanese paintings using visible analytical imaging
- Synchrotron radiation analysis and accelerator mass spectrometry of old Mongolian clothes
- Material analysis based on colour
- Ultra high resolution non-contact scanner development

- Digital restoration of old Japanese paintings using non-contact scanner high resolution imaging techniques (Pigmalion)
- Development of media art using analytical imaging for educational purpose with scientific material information based on cultural heritage
- Development of a new system (viewer and editor) for large files (higher than 20 GB)
- Development of a new material analysis software for cultural heritage using multiband spectroscopic techniques (MS Pigmalion)
- Super Resolution imaging technology
- Material investigation of gold and other metallic elements in cultural heritage
- 3D Image grabbing system development
- Polarized light imaging scanner
- Development of light sources for museum applications
- Mesoscopes as new tools for industrial inspection systems
- Emission Mesoscopy for LED light source evaluation (industrial inspection system)
- Ninnaji digitization project (pigment data base of early Edo Era)