

## **B. Evaluation of the individual teams**

### **Evaluation of the Team: 113 - Laboratory of Molecular Structure Characterization**

#### **1. Introduction**

Within the extensive structure of the Institute of Microbiology, this group plays a very important role in providing its cutting-edge instrumentation and expertise in three different areas: (a) mass spectrometry (MS); (b) nuclear magnetic resonance (NMR) spectrometry; and (c) advanced microscopy facilities. In addition to providing valuable service and collaborative support to other teams within the Institute, the laboratory has been greatly recognized regionally for its numerous collaborations with academic and other scientific institutions in Czech Republic while maintaining in a well-balanced repartition between original researches and services. This is particularly due to its outstanding MS facilities and the expertise in structural elucidation of complex biological molecules through different techniques.

The scientists in this laboratory have been involved in virtually all aspects of “omics technologies” (proteomics, lipidomics, metabolomics, etc.) Inspiration through important biological problems has led the laboratory members to come up with technical improvements in analytical methodologies and even file patent applications. They are also involved in some contractual research and services. The portfolio of different scientific activities is very substantial. The MS facilities and researchers are outstanding and the NMR part is at least satisfactory. The microscopy facilities seem to fulfill more of a service function for the entire campus. The structural biology subgroup, which represents some of the most outstanding researchers, is in the progress of splitting and moving to the new campus in Vestec (Biotechnology and Biomedicine Center – a joint venture between the CAS and Charles University). The MS facilities include some of the most advanced and unique instrumentation in the region. The core equipment is based on the Fourier-transform MS using high-field magnets as well as advanced time-of-flight MS instruments. Among the most promising instrumental projects is imaging MS. These outstanding MS capabilities attract numerous collaborators from the campus as well as other institutions. There is also a substantial number of international collaborators (e.g., from France, New Zealand and the U.S.). The NMR spectrometric capabilities facilitate work with both large biomolecules and small (secondary metabolite) molecules using a combination

of liquid chromatography with NMR. Altogether, this is a very large team with a very favorable age distribution across the entire range. The excellent facilities and quality of scientific investigations obviously attract a large number of young scientists.

## **2. Strengths and Opportunities**

Important biological problems and excellent analytical chemistry approach are evident in numerous activities of this large team. The MS group has offered to the collaborators proteomic, peptidomic, lipidomic, glycomic and metabolomics profiling and quantitative (comparative) measurements at the highest level of MS resolution facilitated by the FTMS instruments. In response to different biological and biomedical problems of the collaborating groups, the laboratory has also developed capabilities for chemical crosslinking of proteins and hydrogen/deuterium exchange MS investigations for the studies of biomolecular interactions. Several ancillary techniques of MS were also developed through these collaborations and are documented in the analytical literature. More recently, considerable attention has been extended toward the area of biomolecular MS imaging, which is clearly a “high risk/high benefit” area necessitating breakthrough advances in sample treatment and instrumental design. The first promising results of biomedical importance were already published by the group, but future undertakings will necessitate careful strategies in view of this increasingly competitive field. The laboratory is planning very worthwhile investigations in LC-NMR and LC-MS screening efforts in the areas of “severe civilization diseases” such as asthma and diabetes. With the acquisition of new equipment in high-resolution electron scanning microscopy, this part of the laboratory will receive significant upgrade and increased role in the overall mission of the Institute. As a regional center of excellence in structural characterization, the laboratory also assumes an important function of promoting some research activities at Palacky University (Olomouc), Charles University, and Institute of Chemical Technology (Prague).

## **3. Weaknesses and Threats**

No serious weaknesses or threats are currently perceived by this Committee. The team is highly productive, having a healthy age distribution and student participation. Many interesting collaborative projects are in place. Some questions may arise in future concerning the separation of this team into the Krč and Vestec locations.

#### **4. Recommendations**

The present activities should be continued in a close collaboration style as has been done in the past period. There are no specific other recommendations at this time.

#### **5. Detailed Evaluations**

As a regional center of excellence with considerable knowledge, expertise and cutting-edge instrumentation, the team has done outstanding job in (a) developing unique analytical methodologies; (b) collaborating effectively with biological scientists and organic chemists; (c) proliferation of MS techniques to different fields of interest; (d) educating others in an important area of analytical chemistry; and (e) providing visible service activity and transfer of technologies. There were numerous scientific outputs during the evaluated period. The published work is reported in respectable journals. The pedagogical activities of the team members are outstanding, reaching numerous students at different levels. The university students seem drawn to the main areas of investigation in the laboratory. The societal relevance of these activities is quite high, including the fields of microbiology, biomedical research, disease biomarkers, biotransformations, and organic synthesis. Several senior team members are internationally recognized scientists who participate in major scientific meetings and serve on important committees and editorial boards. There are significant scientific collaborations with academic institutions domestically and internationally. Although the maintenance of instrumental capabilities and keeping up with new technologies are very expensive, the risks of limited sustainability appear minimized, given numerous directions of the field and the needs of biomedical research. The future plans and strategies appear reasonable, although it is less clear how will the research responsibilities be divided between Krč and Vestec.