

C-CIT AG

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Providing Innovative Solutions in Chemical Sensor and Bioassay Technology

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Abstract: We herein present an overview of the history, goals and activities of C-CIT AG, a spinoff company from the ETHZ. C-CIT's mission statement is to be the world's leading provider of innovative sensor technology solutions and service excellence for the benefit of our customers. The common concept our products share is the 'State of the Art Lab Comes to the Sample'. Our unique role remains our focus on developing innovative and value-added services and products in chemical sensor and bioassay technology.

Keywords: Biosensors · C-CIT AG · Chemical sensors · Custom-made solutions · High-throughput real-time analysis · Lab-in-the-Bag®

1. History and Mission

C-CIT AG was founded in January 2002 to undertake development and commercialization of projects and products in the field of advanced chemical sensors and analytical devices, and related measuring technology; aimed at bioprocesses for life sciences and related fields.

C-CIT has specifically evolved from CCS (Center for Chemical Sensors) at ETHZ founded and headed by Prof. Ursula Spichiger-Keller [1] (for the latest developments at CCS, see [2] in this issue of CHIMIA). Prof. Spichiger-Keller chairs the Expert Advisory Panel at C-CIT and is a

member of the Board of Directors which also includes a European patent attorney and business experts. Through such a spinoff an efficient knowledge- and technology-transfer is made available to the industry and to society at large.

The start of the operations of **C-CIT** took place at Technopark Zurich. At the end of 2002, C-CIT moved their offices and laboratories to the Grow-Center of Waedenswil in the proximity of the Departments for Biotechnology, Food Technology and Horticulture of the Fachhochschule Waedenswil. This venue offers options for expansion at this stage and is ideal for a growing company. Having moved the major operations to Waedenswil, **C-CIT** retains its connection with the Technopark Zurich through the joint projects (KTI and others) with CCS.

2. Projects and Goals

The **C-CIT** technology, namely advanced chemical sensors and associated analytical and measuring devices, occupies a unique and interesting niche in the biotechnology and life sciences fields. The technology is well placed to provide a range of innovative solutions in biomedical, environmental monitoring, and process (bio-

process, process development and manufacturing) fields. Potential end-user industries include pharmaceutical, medical, food, environmental, chemical and agri- and aquaculture. Our unique role remains our focus on developing innovative and value-added services and products in chemical sensor and bioassay technology. Recent and upcoming governmental and global regulatory legislation are expected to favorably affect the growth of our business activities in many of these markets.

C-CIT has access to an extensive network of working relationships with key international pharmaceutical, biotechnology and other life sciences companies, and their suppliers, developed through the work inside CCS. Through this network, a number of partners have been identified and some are already collaborating on the development of our products.

Patents rights have been secured, applied for or are being developed for the applicable processes. Protection of intellectual property rights (IPR) continues to receive high priority at **C-CIT**.

C-CIT has achieved the following milestones since its foundation:

- It has moved into its own new facilities at the end of 2002.
- It has obtained the license of the Lab-in-the-Bag® label and its mobile laborato-

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ry and environmental applications; the low-cost glucose sensor for bioreactors and the endotoxin test.

- It was awarded a KTI (Commission for Technology and Innovation) project.
- It has established a development partnership for its product: the low-cost sensor for bioreactors.
- It has acquired its first third-party development project in the field of food technology.
- It has organized its first Forum on Chemical Sensors and Biosensors.

There are three major innovative products of sensor technology under development that represent the initial 'fill' for C-CIT's product pipeline; with others already identified. The development of the following products has been launched: the low-cost sensors for bioreactors, Lab-in-the-Bag® and the endotoxin test. Our current pipeline includes a portable wine analyzer among other products.

3. C-CIT's Current Activities

Derived from C-CIT core competence, a range of activities is primed. The implementation and development stages of our activities are illustrated in the Fig. and are described as follows:

Services/Consulting

C-CIT team's know-how and twenty-year legacy in chemical sensor and bioassay technology are deployed to offer a

range of value-added services centered on state-of-the-art chemical information technology. Our team members have a proven track record in solving industrially relevant problems in an efficient and cost-effective manner. Our repertoire of services includes: development of third-party products, tailored tools and solutions to monitor biomarkers *on-site* and immediately in order to yield *real-time* chemical information, as well as consultancy and educational programs. It is anticipated that the major applications of C-CIT technology will be in the life sciences and novel biotechnological processes.

We also offer tailor-made courses in the fields of analytics and chemical and biochemical sensors.

Additionally, we have recently organized 'The Economic Forum on Sensors' at Technopark, Zurich (see our website; presentations are available upon request). The success of the inaugural Forum demands its evolution into a distinguished tradition. At the Open Panel session, the participants from key players as well as SME businesses confirmed that outsourcing specific activities can increase the profitability and efficiency of a core business. Most business specialists agreed that it is an effective method of partnership. It was also recognized that spin-offs are more fitting partners than universities for the later stages of a product development. An interdisciplinary approach was identified to be pivotal for a new technology development. The economic and technical challenges to imple-

ment new technologies on the mainstream market were also addressed at the Open Panel discussions.

Products

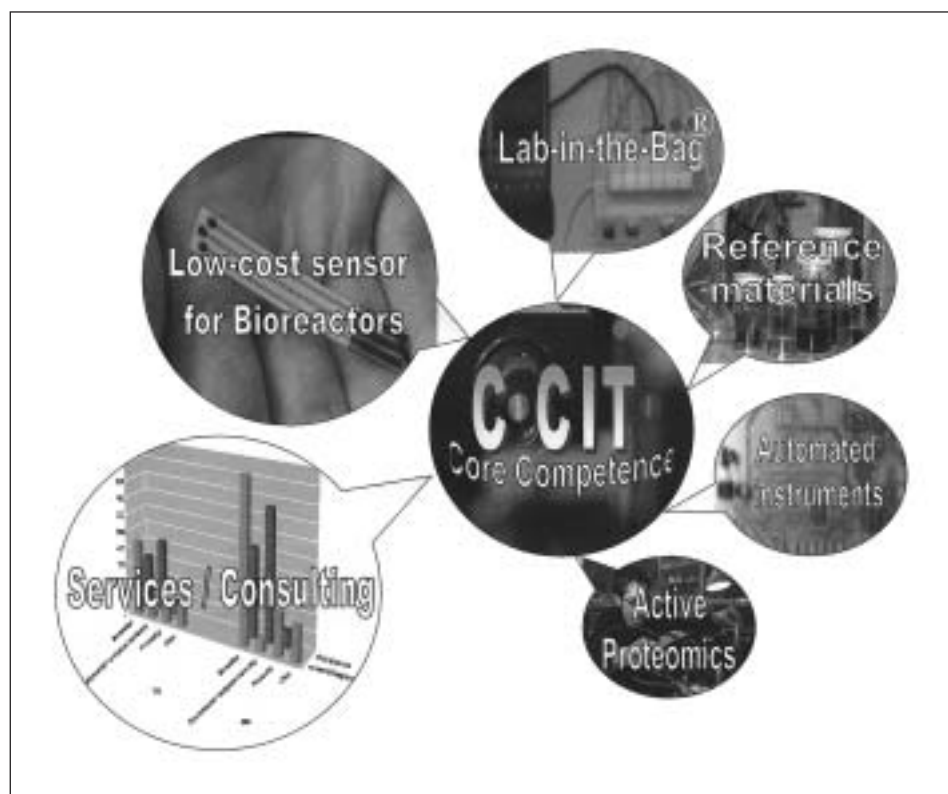
The common concept that our products share is the 'State of the Art Lab Comes to the Sample'. Obvious advantages are instantaneous real-time analysis, high throughput of dedicated information and omitting tedious sample preparations which results in reduction of lead times and a prominent return on investment.

Low-Cost Sensors for Bioreactors

These are incorporated in disposable bioreactors for fast and continuous measurement of cell cultures. Currently available measurements are D-glucose, L-lactate and others such as IgG. The advantages of such a product concept include: real-time information, no need to collect samples, no risk of contamination, improved reproducibility and significant cost savings. This product is aimed at the biotechnology and pharma industries.

Lab-in-the-Bag®

This is a portable device with a multi-analytical system based on three sensor modules, namely amperometric, potentiometric, and optical chemical sensors or biosensors. It can be used for simultaneous measurements of more than one analyte from different analyte classes (*e.g.* glucose and magnesium). It provides on-site and real-time measurements with low detection



limits from ppm to ppb depending on the analyte under investigation. Since it offers reagent-less analyses, reading errors due to chemical side reactions are excluded.

The target industries are environmental technology (e.g. SHE compliances), agricultural business, analytical laboratories and veterinary medicine.

Reference Material for Chemical Sensors

Developing reference material for sensors is a joint ongoing activity at CCS and C-CIT. Such projects have a high impact on enhancing the quality of the information by rendering it more accurate and by making available reference standards for substrate measurements leading to an international system of units.

Automated Electrochemical Instruments

A third-party product development in the field of food technology is currently in progress.

Active Proteomics

Under this activity theme, C-CIT is a partner in a KTI project involving the development of an endotoxin test. This product concept is just emerging from research and the underlying idea is the ability to test sterile preparations for pyrogens, chemical compounds from the wall of microorganisms that can create fever in a patient. This could well be a must for companies with high quality control issues. The aim is to carry out the tests *via* an optical chip. In a first approach the goal is to develop an optical chip mounted into a flow-cell connected to an optical reader for screening tests to be run alongside the production and dispensing lines. In its final setup, the optical chip will be adapted for measurements in biological fluids.

4. Closing Remarks

It is a lengthy path from the development of an innovative technology to its implementation in the mainstream market and based on a recent analysis from *mstnews* [3], comprehensive commercialization of bio/chemical analysis is not expected prior to 2008!

Turning to a recent report from Frost & Sullivan's [4]; it was revealed that many worldwide governmental agencies already employ biosensors to study food contamination and pollution (FDA, NATO, etc.). Yet commercial expectations in the chemical sensor and biosensor fields are for 3–7% annual growth through 2003. Medical re-

search is expected to do better, with an annual growth of 10–14%. However, advanced technologies and manufacturing, particularly 'Laboratory on a Chip' technology, could improve sales in all areas by as much as four-fold per year for both chemical sensors and biosensors! One needs only to look at the current size of the \$10-billion-a-year analytical laboratory instrumentation market to evaluate the enormous growth potential for these technologies.

To close, there is no room for complacency in view of such a favorable environment of technological synergies!

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