

## What is BIOTEX...

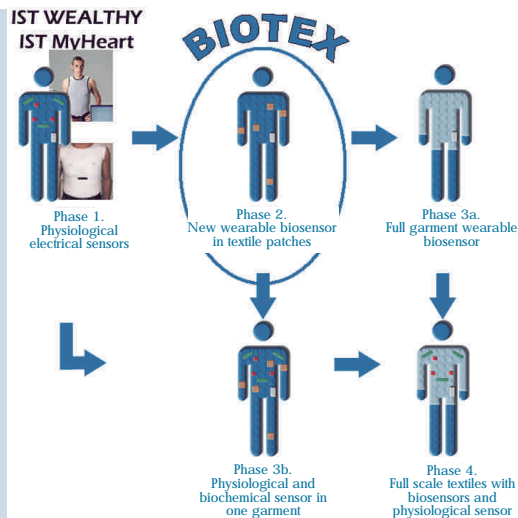
Integration of health monitoring tools into textiles brings the benefits of safety and comfort to the users. Instrumented clothes will provide remote monitoring of vitals signs, diagnostics to improve early illness detection and metabolic disorder and benefits to the reduction on medical social costs to the citizen. Ambulatory healthcare, isolated people, convalescent people and patients with chronic diseases are addressed.

The BIOTEX project aims at developing dedicated biochemical-sensing techniques compatible with integration into textile. This goal represents a complete breakthrough, which allows for the first time the monitoring of body fluids via sensors distributed on a textile substrate and performing biochemical measurements. BIOTEX is addressing the sensing part and its electrical or optical connection to a signal processor. The approach aims at developing sensing patches, adapted to different targeted body fluids and biological species to be monitored, where the textile itself is the sensor. The extension to whole garment and the integration with physiological monitors is part of the roadmap of the consortium.

The BIOTEX project is a Specific Targeted Research or Innovation Project (STREP) part of the Sixth Framework Programme of the European Commission, Priority 2&3, joint call between IST (Information Society Technologies) and NMP (Nanotechnology and nanosciences, knowledge-based multifunctional materials and new production processes and devices).

Financially supported by the 6th Framework IST Programme of the European Union

Contract number:.....016789  
European call identifier:.....FP6-2004-IST-NMP-2  
Project start:.....September 1, 2005  
Duration: .....30 months  
Total cost: .....3.1 M€  
Commission funding:.....1.9 M€



The work to be addressed with the project BIOTEX (circle in the above figure) is the integration of new type of sensors on the textile, biosensors. Here the sensors are seen as textile patches, of relatively small surface. The technology will be developed to be later extended to the entire garment (Phases 3a, 3b and 4).

The two former projects, WEALTHY and MyHeart (Phase 1), are sensing physiological parameters (ECG, temperature, movement, respiration) while in the BIOTEX project, biochemical parameters will be monitored.

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# BIOTEX

Bio-sensing  
textile  
for health  
monitoring

[www.biotex-eu.com](http://www.biotex-eu.com)

BIOTEX is supported by the 6th Framework  
IST Programme of the European Union

## Consortium

Coordinator: Jean Luprano  
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	Role(*)	Participant name	Short name	Country
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2	CR	Commissariat à l'Energie Atomique	CEA	France
3	CR	Smartex s.r.l.	SMARTEX	Italy
4	CR	University of Pisa	UP	Italy
5	CR	Thuasne	THUASNE	France
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(\*) CO = Coordinator and CR = Contractor

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## Technical objectives

The BIOTEX project will develop basic technology modules and ad-hoc electronic control and analysis modules for biochemical sensing compatible with integration into sensing textile. The aim is to demonstrate the feasibility of functional biochemical sensors and their integration onto a textile substrate ("sensing patch"). Key parameters to assess will be the sensitivity, accuracy and dynamic range of measurement for each type of sensor. Three physical methods, adapted to specific measurements will be explored for sensing:

1. Sweat monitoring: perspiration rate), over salinity, specific ions (like K<sup>+</sup>, Na<sup>+</sup>, Cl<sup>-</sup>, Mg<sup>+</sup>; Ca<sup>+</sup>), pH
2. Infection detection through blood and body liquid monitoring for burnt persons
3. Blood oxygen saturation for medical, sport and security applications.

Detection methods include optics, electrochemistry and electricity (impedance monitoring). For each sensing method, the main deliverable will be a sensing patch on textile substrate.

Studies for patch fabrication will include:

- Material aspects
- Conductive yarns for connecting electrodes to the read-out and power through the garment
- Innovative hollow fibres, hydrophilic and hydrophobic yarns to collect the fluids
- Innovative electrochemically sensitive polymers for selective dosage in sweat
- Processing aspects like weaving, knitting, embroidering, embedding optical fibres, lamination.

These patches will be qualified in terms of their sensing performance by measuring calibrated fluid models to validate their compatibility with targeted uses. They will also be assessed in terms of the textile behaviour: efficiency, reliability, durability, cutaneous tolerance and antibacterial properties.

In order to get relevant data for complex analysis, the project will ultimately deliver multi-parameter sensing patches gathering some of the developed sensing methods (e.g. a complete sweat analysis patch could combine an optical pH sensor and an electrical sweat rate sensor).

## BIOTEX goals

- Simultaneously comfort and monitoring (for safety and/or health)
- Non-invasive measurements, no laboratory sampling
- Continuous monitoring during daily activity of the person
- Possible extension to multi-parameter analysis and monitoring
- Distributed sensing thanks to access to 90% of the body surface if integrated on clothing.

Measurements of on-body fluids (sweat, blood, urine) will be needed to open a dramatically wider field of applications.

Biochemical analysis of these measurements could be performed during daily activities by the user himself if integrated into clothing. For instance, on-body sweat analysis which is potentially very rich in health related information. However, such analysis is hardly performed today because of the difficulty to sample sweat in sufficient quantity. Only a real textile sensor embedded in a garment through textile techniques will allow direct collection of sweat and a large body surface; moreover lower fabrication costs are expected. For blood analysis, the main interest will be to avoid invasive sampling and to allow continuous analysis.

## Target definition

Ambulatory healthcare, isolated people, convalescent people and patients with chronic diseases, sport and fitness applications are addressed. Possible target applications of BIOTEX project are for monitoring of:

- Health status of obese children
- Diabetics people
- Metabolism during sport activities
- Wound healing
- Transplanted organ-rejection

The most appropriate targets will be chosen during the first part of the project.