

*First image obtained with an innovative X-ray system that has been designed for low-income countries  
(courtesy from CODEV, EPFL)*

## Annual Report 2014

*“Creating a world where access to the benefits  
of medical technology is universal”*

## First light!

Since 2010 when it was created, the foundation has spent considerable efforts on the question of global access to medical diagnostic x-ray imaging. This modality, which is essential to modern medicine, incorporates many of the issues that hinder the deployment and effective usage of medical devices in developing countries. It is a complex technology still generally making use of consumables -i.e. film and chemicals- which represent a big financial and logistic challenge for remote and resource-poor hospitals. Involving high voltages – up to 150 kilovolts – and ionizing radiation, it requires complex maintenance as well as specific skills at making and interpreting the images. All these difficulties make this technology a top priority to be addressed, with the potential to blaze the trail for many other medical technologies. The foundation has taken up the challenge by initiating the GlobalDiagnosiX project.

Recognizing the complexity of the challenge, the foundation has initiated an alliance of prestigious and multidisciplinary partners and placed the project under the leadership of the Swiss Federal Institute of Technology in Lausanne (EPFL) in 2011. The Alliance has been extended since then, to include up to 40 researchers, physicians, engineers and specialists from Switzerland and Cameroon, who all accepted the challenge to build the first digital x-ray system specifically designed for developing countries.

The term “first light” designates the very first image that a new telescope generates after it has been commissioned. GlobalDiagnosiX had its “first light” on December 12, 2014 as the first x-ray image of a hand’s phantom was made with the system. The prototype, which at this stage is a first feasibility demonstrator, was made possible by the dedication and incredibly hard work of the GlobalDiagnosiX alliance.

The EssentialMed foundation is proud to be part of this effort to solve a reputedly intractable issue that was first identified by the World Health Organization in the 1970’. With this year’s achievement, we are one big step closer to the goal we have set ourselves back in 2010. This was made possible by the efforts of all partners of the project whom we hereby congratulate and thank.

The adventure is not over yet however, the prototype needs one more year of research before it can start to be industrialized. So far already 3.5 million CHF have been invested in the project; finding additional financial partners will be one of the challenges of 2015.

In order to anticipate the deployment of appropriate medical x-ray systems, the Foundation has initiated an ambitious capacity building program which aims to develop radiology, radiography and maintenance skills.

In the same vein than GlobalDiagnosiX, the foundation also participates in the development of another essential device: an appropriate infant incubator.

In addition to inappropriate technologies and insufficient local competences, failing infrastructures are integral part of the problem. Consequently the foundation invests in the CURES center in Cameroon, which is dedicated to improve access to modern energy services in district health facilities.

Dr. Guy Morin  
President of the Board

A handwritten signature in blue ink, appearing to read "Guy Morin".

# Diagnostic imaging for the Global South

*In spite of its crucial importance for diagnosis -and adequate subsequent treatment of health conditions such as traumatic injuries, tuberculosis and pneumonia- radiology remains out of reach for 2/3 of humanity*

## GlobalDiagnostix

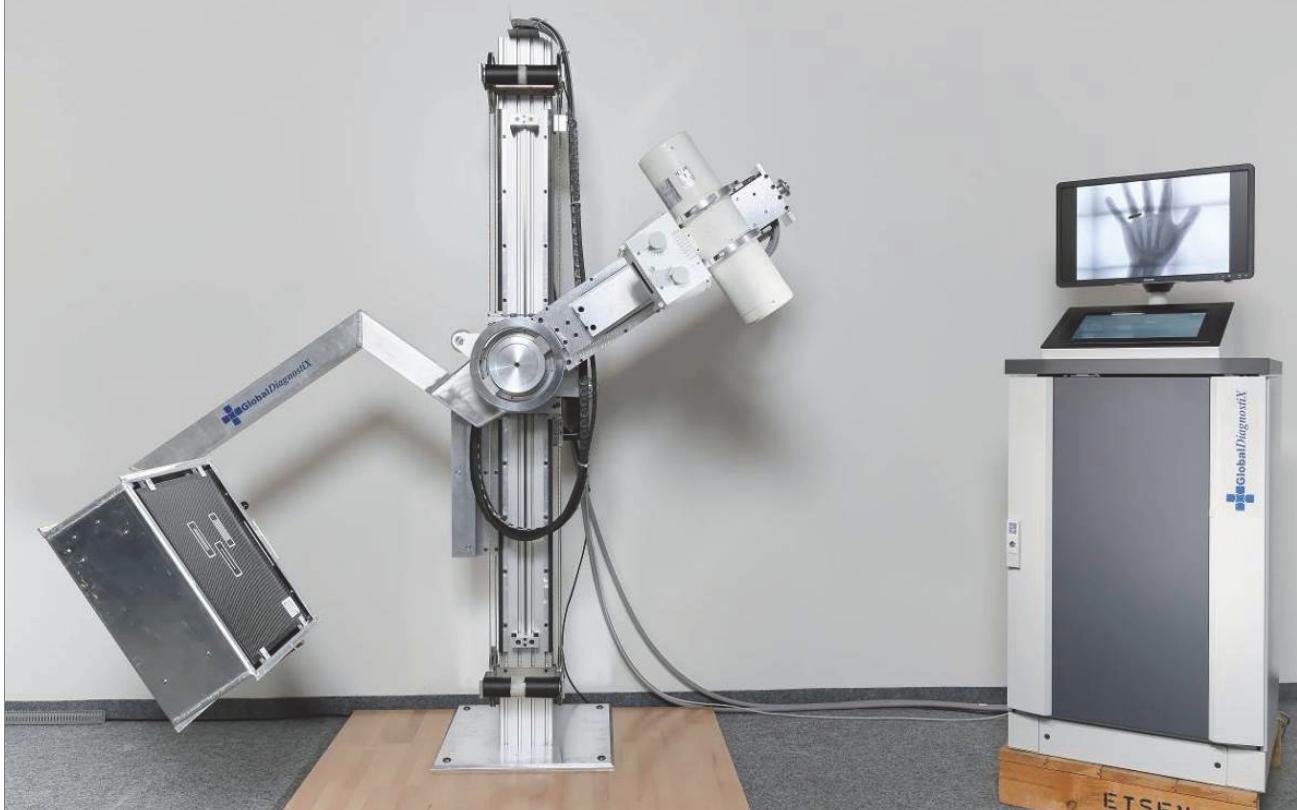
The project addresses the problem of access to diagnostic imaging by developing an **affordable and robust digital x-ray system adapted to the context of low-resource settings**.

The Foundation has actively participated in the development of the first feasibility demonstrator which was made available in December as planned. EssentialMed's engineers have guided the alliance of partners with regards to industrialization and deployment issues. The Foundation's interns conducted two studies in Cameroon: one regarding the issue of radioprotection and the other on the question of how to properly identify and record patients' data.

Together, the partners of the GlobalDiagnostix project have achieved the following results in 2014:

- Built a functional prototype with a fully mechanical and balanced stand, obviating the need for electrical controls which are prone to failure in harsh environment.
- Constructed a power generator designed for contexts with unstable and weak electrical supply. The generator includes a high-capacity, maintenance-free battery compensating for black-outs.
- A low-cost robust digital detector was built which allows making state-of-the-art x-ray images.
- The digital interface is completely rethought to allow for an easy operation of the system even for insufficiently trained users.

Much more development is needed in all these modules but the ground work has shown the way forward and feasibility is demonstrated



*Mechanical stand and digital detector (Courtesy from EPFL, Alain Herzog 2015).*

*Power generator with digital user-interface (Courtesy from EPFL, Alain Herzog 2015).*

[www.globaldiagnostix.org](http://www.globaldiagnostix.org)

# Diagnostic imaging capacity building for resource-poor settings

*In the domain of medical imaging, the competence profile of health and technical staff in most developing countries is often poor. Training courses are nonexistent or outdated and poorly adapted to the new technologies.*

## Teach&Train

Skilled health staff is a key factor of success for diagnostic imaging – for appropriate indication, realization of the investigations and finally the interpretation of the images. The project aims to develop, run and evaluate advanced teaching and training units for medical doctors, radiographers and technical maintenance personal in the domain of medical imaging (X-ray and ultrasound) at the district level. It is urgently needed as a response to the evolution of medical technologies, e.g. digital x-ray or tele-diagnostics, and will make use of modern pedagogical tools such as multimedia tutorials and simulators. This program will strongly contribute to strengthen the local health system to be more attractive for the patients and for the health staff. It will contribute to reducing the brain drain from rural to urban sites and from developing countries to the industrialized world. The pilot country to implement the project will be Cameroon where the foundation has long lasting and positive experience of cooperation.

Thanks to a grant from the Symphasis Foundation, the development of the first phase – the training targeting medical doctors – will start in 2015. In collaboration with local academic partners, an innovative and adaptable training approach will be built up, taking into account the various basic competence levels existing in the field. This project will be realized in a close contact with the local partners in Cameroon. In particular, a close collaboration is will be initiated with the Ministry of Health and Ministry Education for the recognition of the training.



The project will start by conducting a study to identify the needs, context, and resources. The next step will then be to build up the program corresponding to the defined profile of competence. And finally, the strategies needed for sustainable implementation of the training kit in Cameroon will be described including financial aspects, accreditation and recognition. The vision involves a future scale-up in all of the developing countries. Photo: Courtesy from EPFL, Sylvain Liechti 2015

**[www.globaldiagnostix.org](http://www.globaldiagnostix.org)**

## 2.9 million newborns died in 2012

Hypothermia (low body temperature) represents a significant share of infant mortality; it is estimated that 20 to 40% of newborn deaths could be prevented with adequate thermal management<sup>1</sup>. Skin-to-skin mother care is the preferred method, but it is not always possible; infant incubators are then necessary. They are required in situations such as when the child is sick and needs medical treatment or when phototherapy is indicated for the treatment of neonatal jaundice. Unfortunately, existing incubator and infant warming technologies are expensive, fragile and not adapted for use in developing countries.

### GlobalNeonat

The GlobalNeonat project aims to develop an entirely new technical concept for providing thermal therapy combined with phototherapy. It will be affordable and adapted to the environmental constraints of low-resource settings. In 2014, the project has progressed to a stage where a demonstration of feasibility was reached for a solution ensuring temperature regulation despite frequent power cuts. An innovative solution was proposed based on phase-change materials which are able to store and release energy in the form of heat. The solution is cheap and sustainable. In November, the foundation partnered with EPFL to set-up a special symposium at the UNAPSA<sup>2</sup> congress in Yaoundé. The concept of GlobalNeonat was validated in an interactive session with more than 250 pediatricians from over 20 different countries in Africa. More work is needed to build a complete incubator with this solution included. In particular, a heat exchanger must be developed. Financial support is actively sought for by all partners.



*Due to local conditions, systems designed for industrialized countries quickly fail as can be seen on the right, where the hospital personnel had to place hot water bottles inside the incubator to compensate for black-outs.*

*Courtesy from EPFL, Sylvain Liechti 2015*

[www.globalneonat.org](http://www.globalneonat.org)

<sup>1</sup> Darmstadt GL, Bhutta ZA, Cousens S, Adam T, Walker N, Bernis LD et al. Neonatal Survival 2 Evidence-based, cost-effective interventions : how many newborn babies can we save ? Lancet. 2005;365:977–88.

<sup>2</sup> Union of National African Pediatric Societies and Associations

# Electrical power failures jeopardize primary healthcare development

*Electrical power supply in hospitals of developing countries is mostly unstable and unreliable. This is a major limitation to the availability of healthcare services and regularly causes critical equipment breakdowns, fires and even deaths (e.g. in the operating theatre).*

## CURES

*– Centre Universitaire de Recherche sur l'Energie pour la Santé*

Recognizing reliable power supply as an essential prerequisite for operating medical devices, the EssentialMed foundation has taken part in the creation of a joint centre in Cameroon: CURES. The centre's mission is to reinforce primary healthcare by developing solutions and services to provide a reliable, safe and sustainable electric supply. Dr. Beat Stoll is representing EssentialMed in the CURES steering committee.

In November 2014, the CURES center organized an international seminar regarding electrical problems in the hospitals. The 24 participants were teachers and PhD students selected from six African countries and 11 different universities. Dr. Beat Stoll from EssentialMed was involved in the teaching seminar, addressing the importance of access to modern energy services on primary healthcare. Two lecturers from EPFL and 3 lecturers and a researcher at the ENSPY (Ecole Nationale Supérieure Polytechnique de Yaoundé) addressed this crucial issue related to the safety, reliability and efficiency of electrical systems, through theoretical and practical courses in the laboratory and in a district hospital.



*A laboratory experiment on electrical protection systems at the CURES center, Yaoundé, Cameroon*

**[www.energy-cures.org](http://www.energy-cures.org)**

# A powerful alliance



## *Swiss Federal Institute of technology in Lausanne (EPFL)*

- Cooperation & Development Center (CODEV)
- Distributed Electrical Systems Laboratory (DESL)
- Signal Processing Laboratory 5 (LTS5)
- Laboratory of Composite and Polymer technology (LTC)
- Laboratory of Applied Photonics Devices (LAPD)



Haute Ecole Spécialisée  
de Suisse occidentale

## *University of Applied Sciences Western Switzerland (HES-SO)*

- Heig-vd - Power Electronics Laboratory (IESE)
- Heig-vd - Institute of Design, Materials and Packaging (COMATEC)
- Heig-vd - Institut for Industrial Automation (iAi)
- HES-SO Valais - Energy Conversion Institute
- Hepia - Industrial Science and Technology Institute (inSTI)
- Heds - Health school - Medical radiology technology
- HE-ARC - Anthropotechnology Institute (EDANA)
- écal – école cantonale d'art de lausanne



## *Paul Scherrer Institute (PSI), Villigen, Switzerland*

- Laboratory for Macromolecules and Bioimaging (LSB),  
X-ray Tomography group



## *École Nationale Supérieure Polytechnique, Université Yaoundé 1, Cameroun.*

- Centre Universitaire de Recherche sur l'Energie pour la Santé (CURES)



## *Geneva University Hospital (HUG)*

- Department of Neonatology



## *Lausanne University Hospital (CHUV)*

- Department of radiology
- Department of pediatrics - Neonatology service



## *Swiss Tropical and Public Health Institute, Basel*



## *University Hospital Yaoundé, Cameroon*

## About the foundation

***Its aim is to foster universal, sustainable and equitable access to the benefits of health technology in general, and to medical devices and instrumentation in particular.***

### EssentialMed

The foundation strives to reduce the global inequalities in access to health technologies. Paying attention to the specific needs of impoverished populations, the foundation makes every possible effort to provide access to affordable technologies which are adapted to the needs of local communities.

Since September 15<sup>th</sup> 2010, the foundation is formally registered in the Register of Commerce of Canton Vaud, Switzerland, and is recognized as a non-profit organization. As required by law, the foundation is under the supervision of the Swiss Federal Authority for Surveillance of Foundations.



A district hospital in Cameroon (Courtesy from EPFL, Sylvain Liechti 2015).

**[www.essentialmed.org](http://www.essentialmed.org)**

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*Chief Medical Officer*

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## Thanks to our sponsors, supporters and friends

The EssentialMed Foundation would like to express its gratitude to the Symphasis foundation for its substantial support. EssentialMed also wants to thank all its Partners. A very special thank go to the EPFL, and in particular to its Center of Cooperation & Development (CODEV) for its great support. EssentialMed is also most grateful to the Medicine Faculty of the University of Geneva for continually helping to deploy operations in Cameroon.

We are particularly grateful to the interns and employees of the foundation: they are the foundation's life and blood, they are at the heart of our success in promoting our vision of a universal access to life-saving technologies.

Finally we want to thank all the people who believed in this initiative and helped us spread the word.



*(Courtesy from EPFL, Sylvain Liechti 2015).*