

**Complex Systems in BioMedicine. Embracing Complexity for Better  
Healthcare**  
**Proposal for a Workshop at the NECSI 9th International Conference**  
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Healthcare systems and clinicians are now facing more diverse and complex biological and management challenges than in the past. This increase in complexity demands the development of complex medical capabilities in preventing, diagnosing and treating illnesses. Physicians are constantly confronted with "non- textbook" situations which mandate a new way of knowledge sharing and decision making; patients exist within a complex environment which includes their lifestyle, relationships, approach to their medication, other potentially harmful habits such as drug taking, and of course other medical conditions. A clinician needs to understand that context to help the patient. Future medicine will focus on a predictive, preventive, participatory and personalized "P4 Medicine" approach. New technologies are currently being developed that will support this evolution, such as deep learning and artificial intelligence (AI), which can assist the clinical staff in complex decision-making processes. As a result, it can be predicted that in view of the shortage of physicians and nursing staff, and concurrently with the development of the technology, there will be an increasing number of technology and information experts (eg, software and other engineers), who will become an integral part of the healthcare system and clinical staff.

Ethical issues will have to be dealt with, sometimes to a greater extent. Issues such as patients' will, family involvement, medical data protection, and economic aspects of medical care, are becoming a major concern for caretakers and medical systems.

All of the above are significant issues that play an important role in the continuum of care, starting from the prevention stage to the intensive care unit, and finally, end of life.

Complex systems can be observed on different levels, from the human organism to the healthcare infrastructures. These complex challenges demand complex solutions which can emerge in complex enabling infrastructures, based on Complexity Theory. It proposes that systems are unpredictable, but constrained by order-generating rules. Organizations can be treated as complex adaptive systems (CAS) as they exhibit fundamental CAS principles like self-organization, complexity, emergence, interdependence, space of possibilities, co-evolution, chaos, and self-similarity.

During the last months, Edna Pasher Ph.D. & Associates have been involved in a pioneering action research project at the Rabin Medical Center in Petach Tikva Israel, a leader in innovation and Implementing AI technology in complex medical processes. In this action research, we are implementing principles of complexity theory in a pilot project, in which we experiment with new management ideas based on complexity theory to derive innovative insights and reinvent the future hospital as a healthcare "Living Laboratory".

## **A short description of the workshop**

### **Aim**

The purpose of the workshop is to bring together stakeholders from the whole continuum of health-care interested in implementing complex systems theory and methodology. The aim is to share insights regarding the challenges and the potential solutions, which are emerging in current research and projects using complex systems thinking to improve the continuum of care.

### **Scope**

1. Using complex systems theory to improve the continuum of healthcare.
2. Managing complexity in healthcare.

### **Target Audience**

Academics and clinicians

### **Format**

Peer learning - Inspiring short examples followed by a “Knowledge Cafe” - round tables conversations followed by idea “harvesting” in the full group of participants.

### **Expected Outcome**

1. New insights and ideas for innovative and novel projects that will emerge from the interdisciplinary conversations at the workshop.
2. A community, composed of members with a passion to further practice and study complex systems in medicine and healthcare. A group that aspires to lead issues which engage the, both locally and globally. This is in the interest of promoting “smart health” in “smart cities” for the benefit of all the citizens of the world.

## **A list of confirmed and prospective speakers:**

### **Workshop Facilitators: Dr. Edna Pasher & Dr. Boaz Tadmor**

**Prof. Pierre Singer MD** - Head of The Intensive Care Unit of Rabin Medical Center.

Dr. Singer has over 35 years of clinical and academic experience and is currently director of the General Intensive Care Department, Rabin Medical Center, Beilinson Campus, Petach Tikva, Israel (1995-present), head of the Institute of Nutrition Research (2006-present) at Rabin Medical Center, director of the Metabolism laboratory at the Felsenstein Medical Research Center and Full Professor of Anesthesia and Intensive Care at the Sackler school of medicine, Tel Aviv University. Dr. Singer was President of the Israel Society of Intensive Care Medicine (2000-2004), Israel Society for Clinical Nutrition (ISCN) from 2005-2009., Chairman of the Department of Anesthesia and Intensive Care, Sackler school of medicine, Tel Aviv University (2009-2013), and Chairman of the European Society for Clinical Nutrition and Metabolism (ESPEN) (2010-2014). Dr. Singer has presented over 350 lectures, published more than 140 original articles, 55 review articles, 36 book chapters, and more than 350 abstracts. He has been cited more than 11,000 times (more than 1530 times in 2017) and his index-h is 44, with an i10-index of 111. He is the co-chairman of the ESPEN Guidelines editorial board (2014-2018) and director of the Israel Intensive Care Clinical Trials Network.

**Dr. Boaz Tadmor MD** - Head of R&D of Rabin Medical Center.

Dr. Tadmor is a certified physician in Internal Medicine, Allergology and Clinical Immunology .(1995)

Dr. Tadmor served 23 years in the Israeli army as physician in combat units, Medical research and chief medical officer of the Home Front Command.(1981-2004), he is a retired Colonel.

From 2007-2014 Dr. Tadmor was the CEO of Beilinson Hospital, the biggest acute care hospital in Israel, an academic, tertiary, level 1 trauma center.

From 2014 Dr. Tadmor is head of research authority of the Rabin Medical Center The biggest acute care medical center in Israel.

Dr. Tadmor has a medal for bravery from the American army

Dr. Tadmor was part of a DARPA grant of 3000000 \$ and an NIH grant while being at Columbia University in NYC -2003-4

From 2014 Dr. Tadmor is interested in complexity of patients in an academic tertiary medical center.

**Dr. Edna Pasher PhD**, Founding Partner of “Healthcare Living Labs” at the Pasher Management Consulting Group

**Edna Pasher PhD & Ass. Ltd, (EP)** founded in 1978, is a leading management consulting firm located in Israel. We are the first management consultancy in Israel to specialize in leading strategic change management processes implementing complexity theory, and involved in international R&D state-of-the-art ICT based projects. EP is a leader in the areas of Social Research, Policy deployment, Sustainable Development, Strategy Management and Strategic Renewal, R&D Excellence and Innovation Management, Intellectual (intangible) Capital Management, Knowledge Management and more. EP research work focuses on facilitating change, addressing social and human aspects within communities and organizations. It has vast experience in leading the business potentials and social impacts of various projects under the EU 5<sup>th</sup>, 6<sup>th</sup> and 7<sup>th</sup> framework programs as well as H2020 as partners in international consortia. EP consultancy team work with NGOs, public, governmental and private organizations, covering the fields of: sustainability, innovation, social justice, healthcare, education, municipalities, welfare, digital communities and many more. The EP group routinely hosts and mentors academic students in their practical research work towards MSc and PhD degrees.

**Dr. Dan Torten MD & MBA** - Dr. Dan Torten, MBA is a physician, pilot and former commander in the Israeli Air Force. As an athlete, he represented Israel in competitive sailing at the Seoul Olympics (1988). Dan joined the Pasher Group to replicate the success of the strategic process he led with Edna`s assistance while commander of Hatzor Air Force Base. Together, they help organizations develop and implement the competence of innovation and constant renewal as an emergent process – a platform called **Living Labs**.

**Prof Eve Mitleton-Kelly** was founder and Director of the Complexity Research Group at the London School of Economics; is CEM Fellow at Cambridge University; Advisor to organisations in the private and public sector, the European Commission, UN and ECOWAS; and was a member of the Complex Systems Global Agenda

Council of the World Economic Forum. Advisor to the Rabin Medical Centre and will be leading a workshop in March to help co-create an enabling environment to address some fundamental challenges.

**Dr. Michael Sagner MD** - Dr. Sagner is a medical doctor specializing in sports medicine and preventive medicine. After being head of the department for preventive medicine at a university medical center he became medical director of a clinic and institute for preventive medicine. He works on the convergence of systems biology, the digital revolution and consumer-driven healthcare which is transforming medicine from its current reactive mode, focused on treating disease, to a P4 Medicine mode, which is medicine that is *predictive, preventive, personalized* and *participatory*. His focus is interdisciplinary research, looking at the systems of the human body as part of an integrated whole, incorporating biochemical, physiological, and environment interactions and translating these systems biology principles into clinical practice. He has spearheaded several international initiatives in the field of systems medicine, such as with CERN OpenLab, at the European Organization for Nuclear Research. Dr. Sagner is a Chairman of the European Society of Preventive Medicine, Member of the European Union Platform for Action on Diet, Physical Activity and Health. Partner of the European Innovation Partnership on Active and Healthy Aging. He is also a Fellow of the Royal Society of Medicine and the European Society of Preventive Medicine.

*He is the Editor-in-Chief of Progress in Preventive Medicine*, a peer-reviewed journal for P4 medicine and systems medicine-based prevention. He co-authored a textbook on sports medicine and internal medicine and is the editor of several textbooks on preventive medicine.

His clinical work and scientific work now aims at closing the gap between clinical practice with a and public health to promote more effective and patient-oriented care and preventive measures. For that he has collaborated with many NGOs such as the World Heart Federation (WHF).

**Dr. Derek Yach**