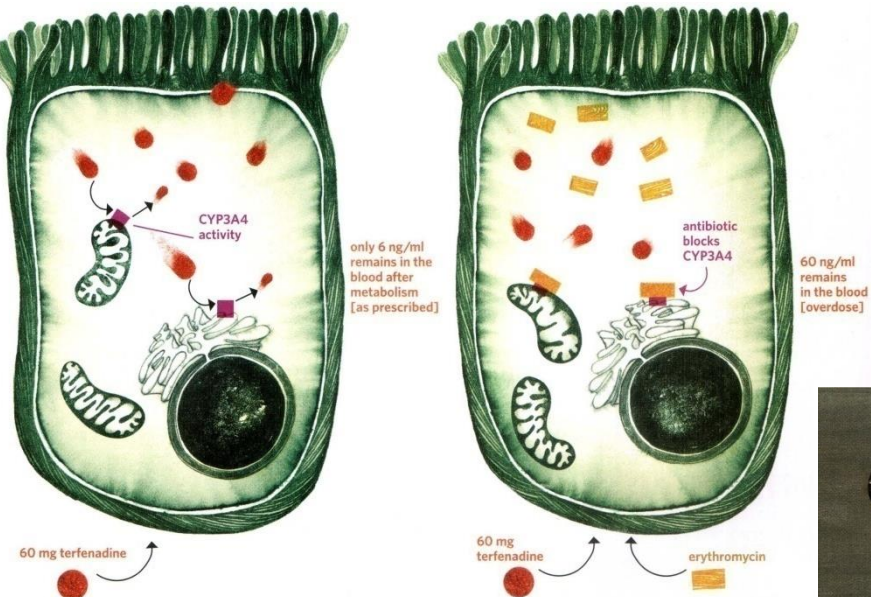


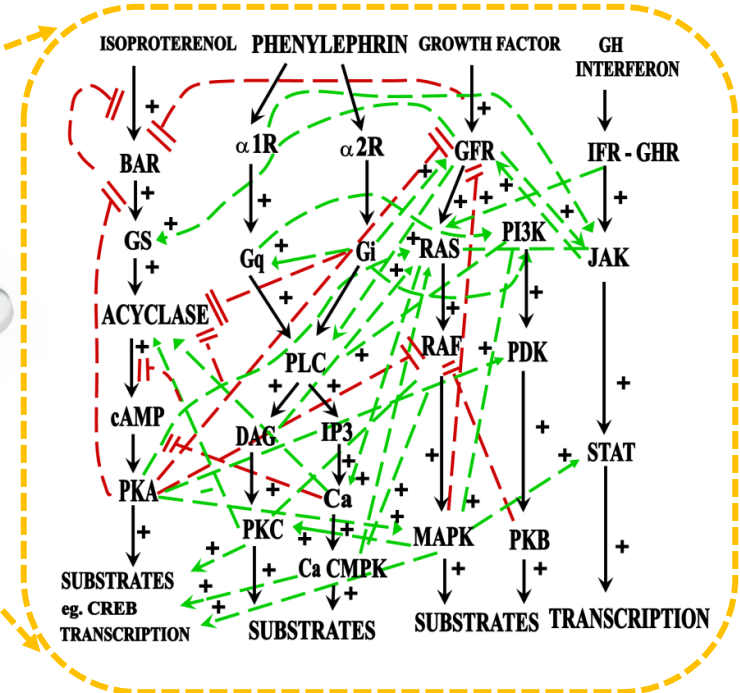
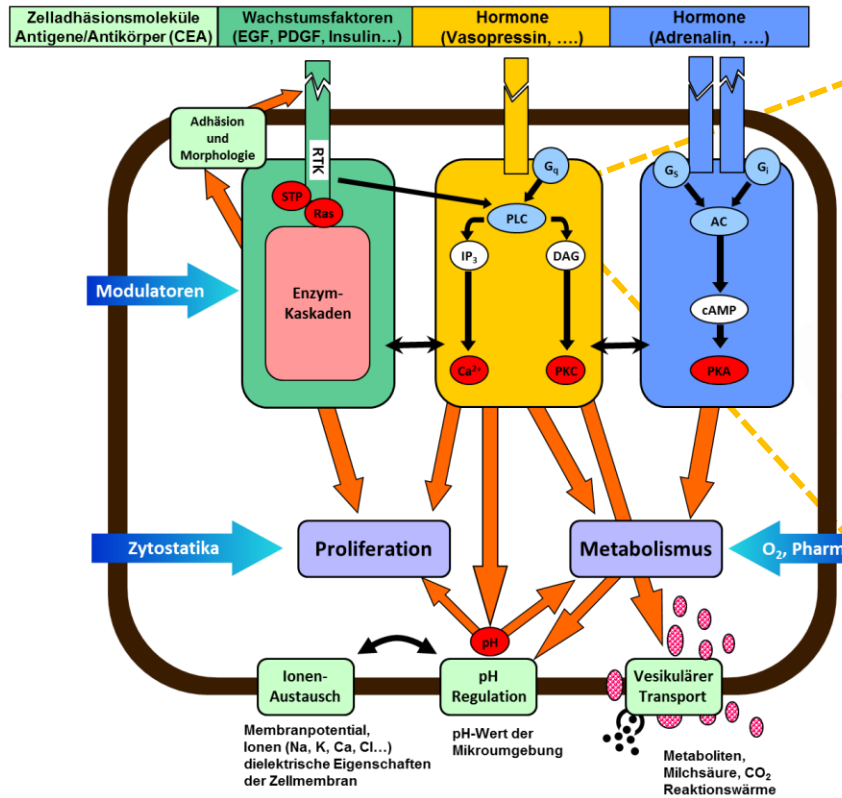
# „Medizin 4.0“ Vom Lab on Chip zur elektronischen Pille





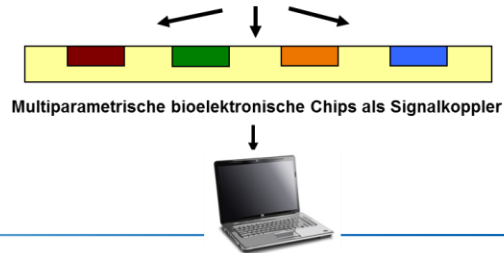
Leicht modifizierte Grafiken von:  
Chris Bode, *Dangerous Liaisons*, *The Scientist*, May 2010

## Eingangssignale

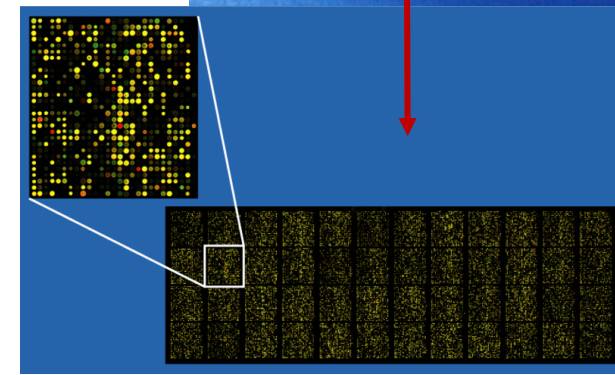
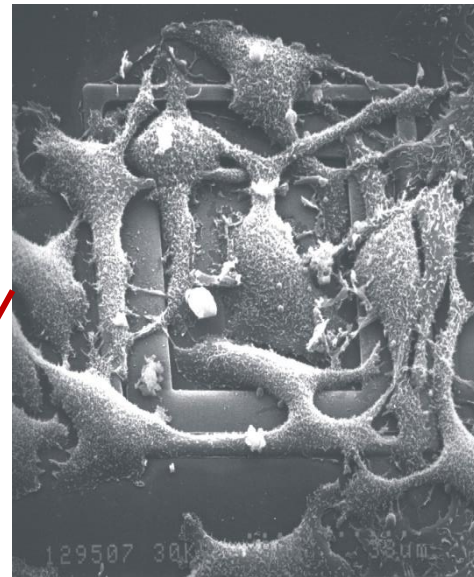
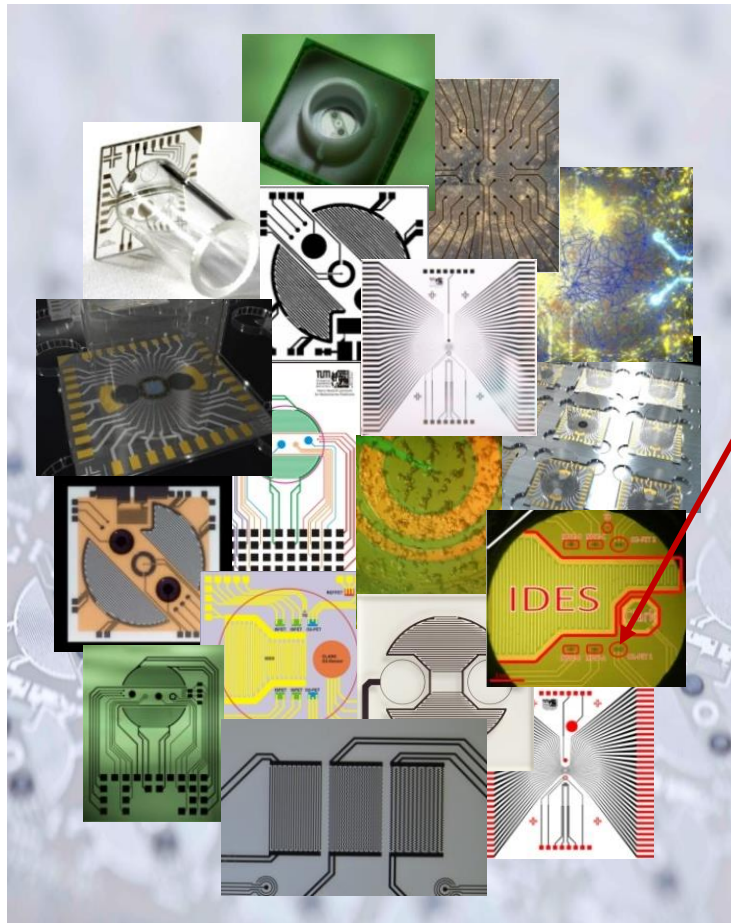


Quelle: J. E. Dumont et. al., Cellular Signalling 13, 2001

## Ausgangssignale







microelectronic meets medicine:  $m^3$

■■■■ O M I C S ■■■■

# Vom egoistischen Gen zum egoistischen Stoffwechsel

Überdenken des Zentralen Dogmas Victor de Lorenzo, Bioforum 1/2014

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ANTICANCER RESEARCH 14: 1573-1584 (1994)

## Relevance of Microenvironmental pH for Self-Organized Tumor Growth and Invasion

MICHAEL KRAUS, THOMAS SEVERIN and BERNHARD WOLF

*AG Medizinische Physik und Elektronenmikroskopie, Institut für Immunbiologie, Albert-Ludwigs-Universität Freiburg, Germany*

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Endocytobiosis & Cell Res. 12, 133-156 (1998)

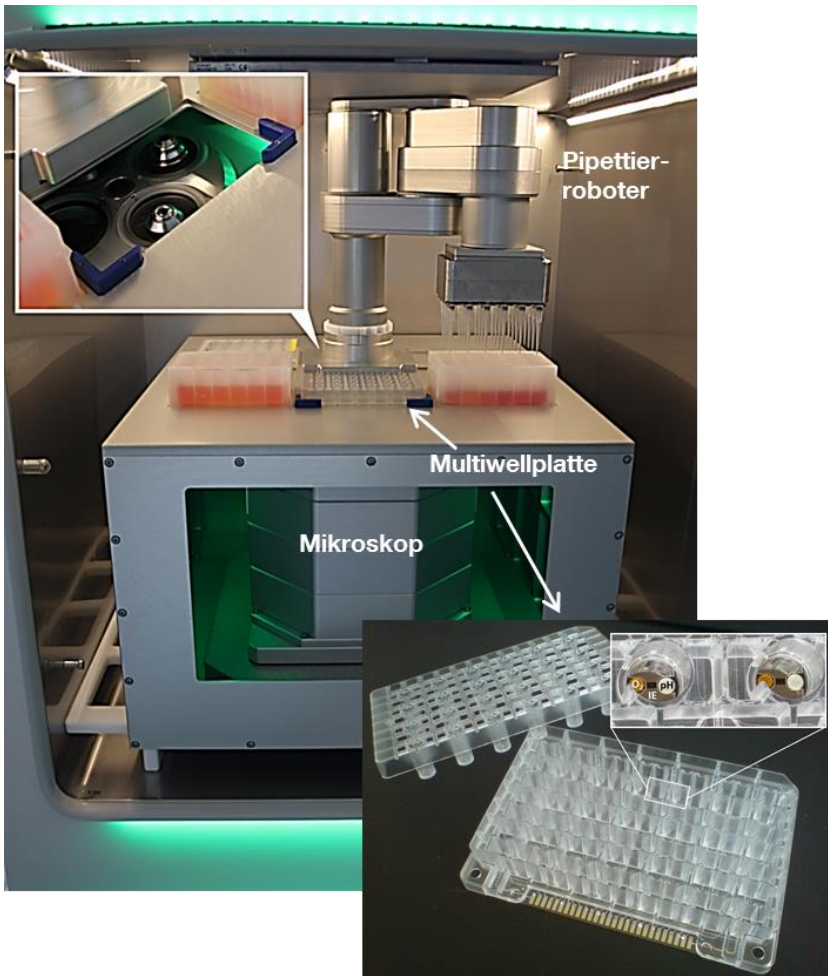
133

## PHYSICOCHEMICAL MICROENVIRONMENT AS KEY REGULATOR FOR TUMOR MICROEVOLUTION, INVASION, AND IMMUNE RESPONSE: TARGETS FOR ENDOCYTOTECNOLOGICAL APPROACHES IN CANCER TREATMENT

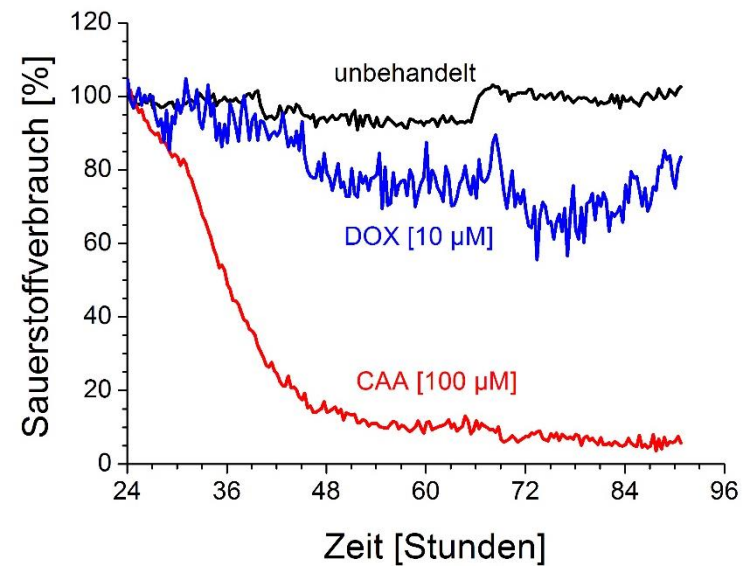
MICHAEL KRAUS AND BERNHARD WOLF\*

AG Medizinische Physik und Elektronenmikroskopie, Institut für Immunbiologie der Albert-Ludwigs-Universität Freiburg, Stefan-Meier-Straße 8, D-79104 Freiburg, Germany

# pCST - personalisierte Chemo-Sensitivitäts-Tests

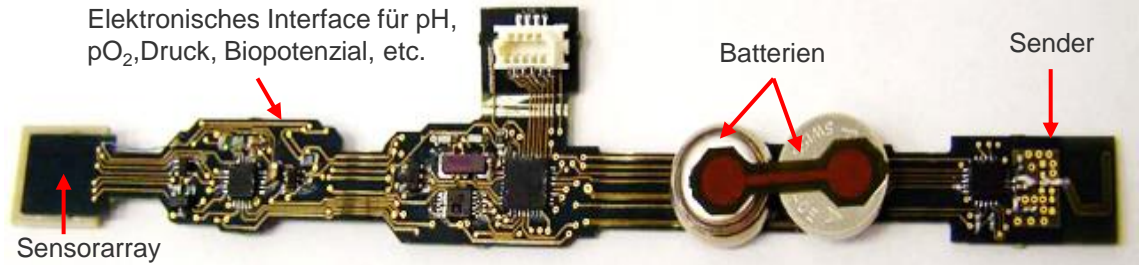


Intelligent Microplate Reader (IMR)

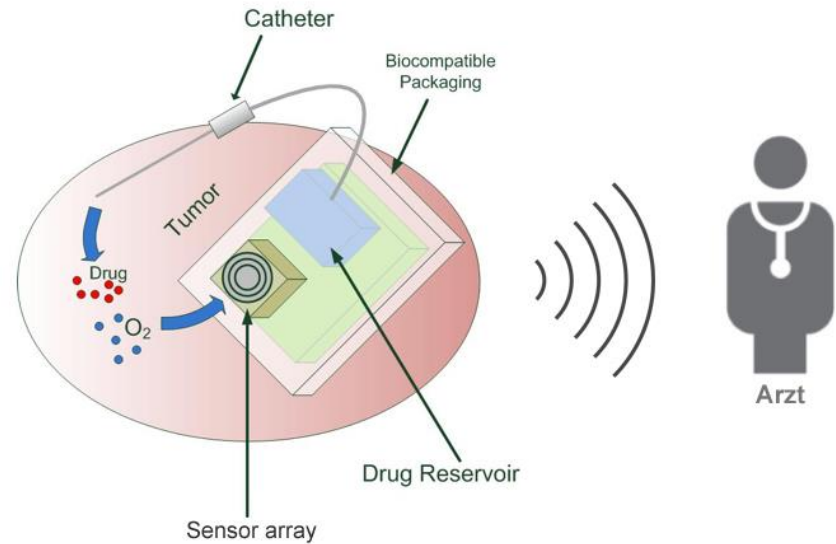
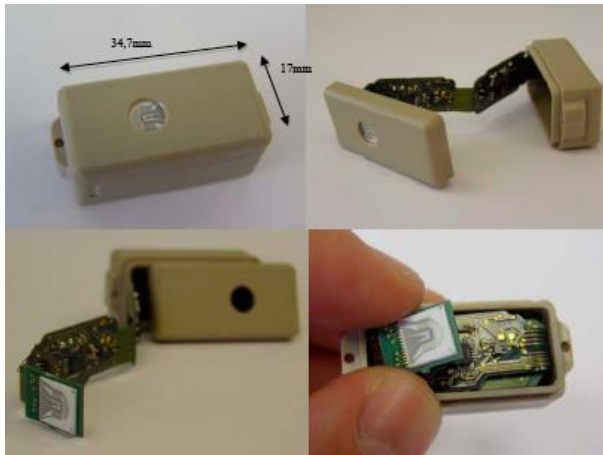


Brusttumor Biopsie im Chemosensitivitätstest





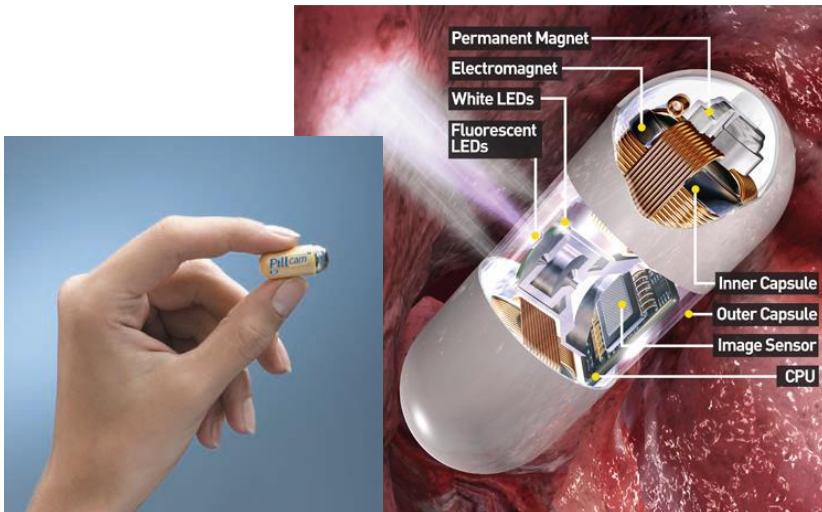
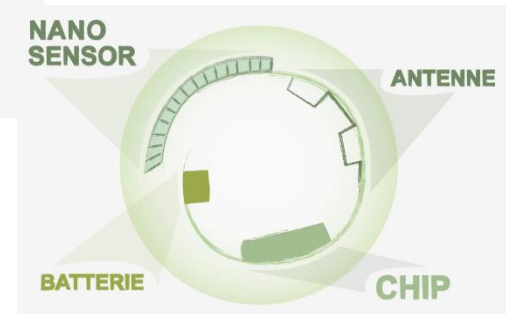
## Lokale Tumorthherapie



# Nanopille

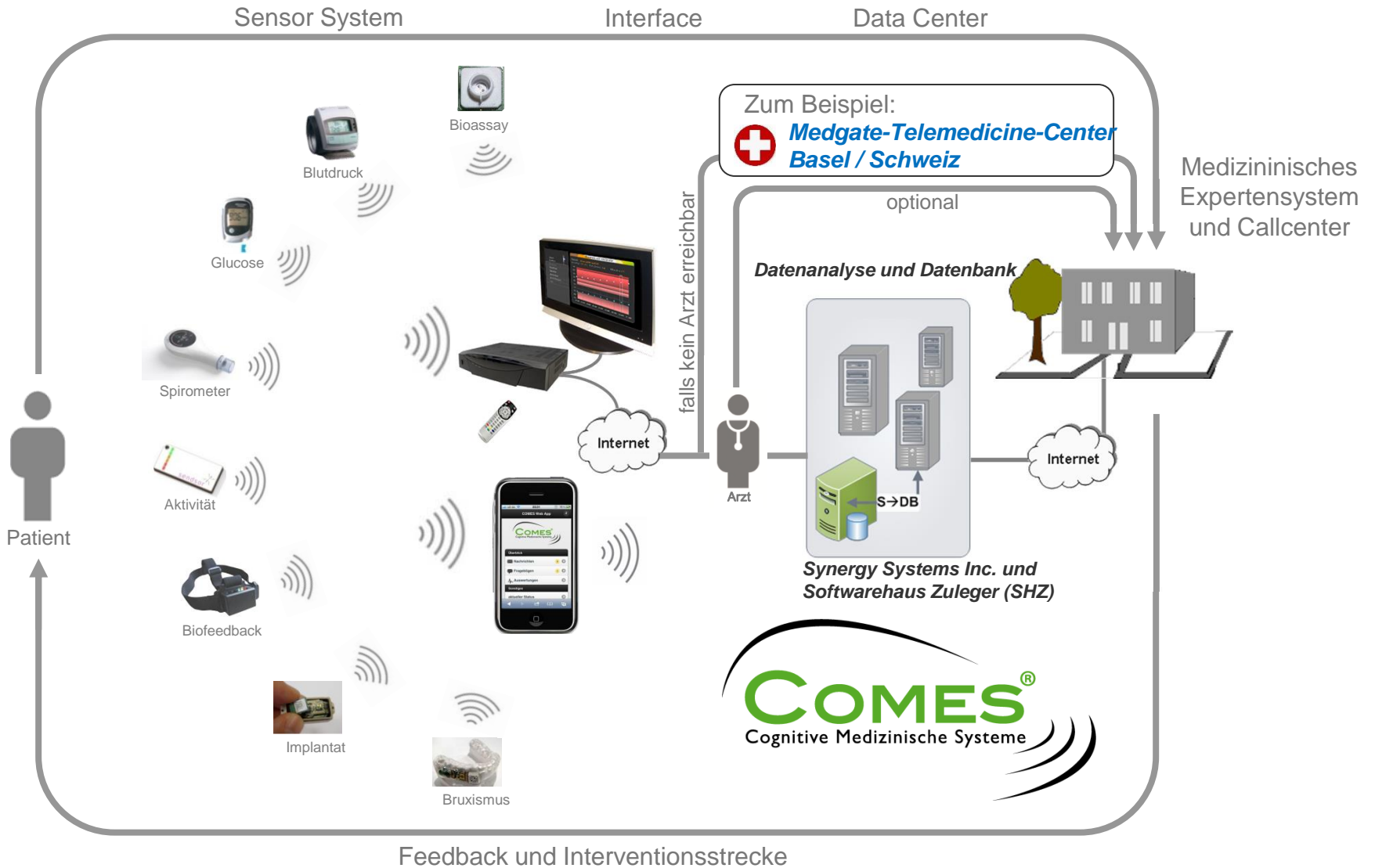


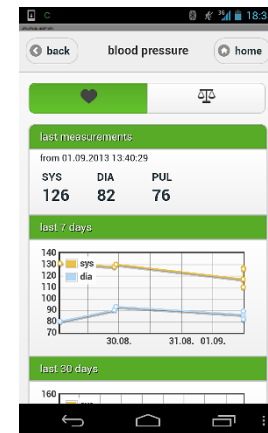
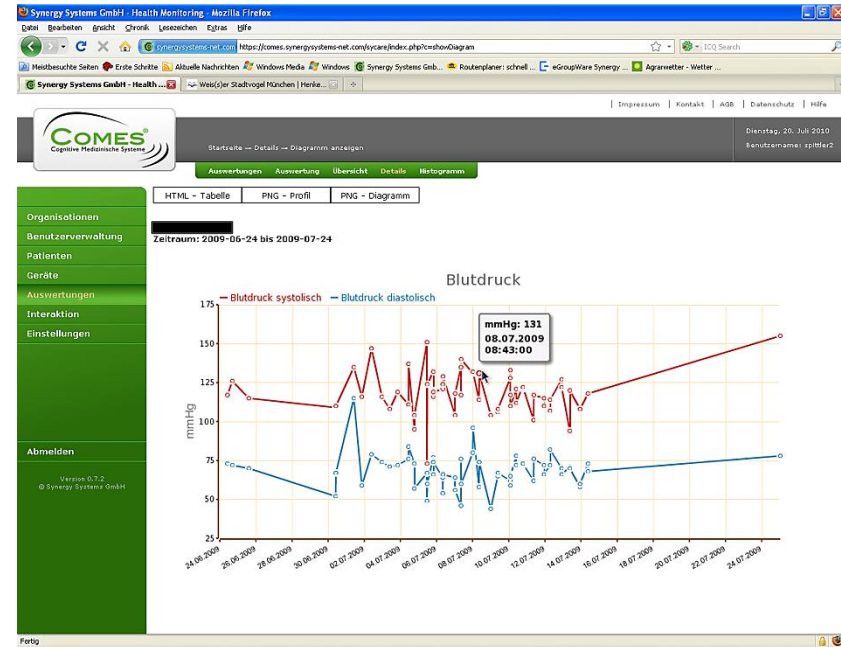
Quelle: <http://cdn.c.photoshelter.com>



Quelle: <http://drawingin.blogspot.de>







## All-in-One-Gerät

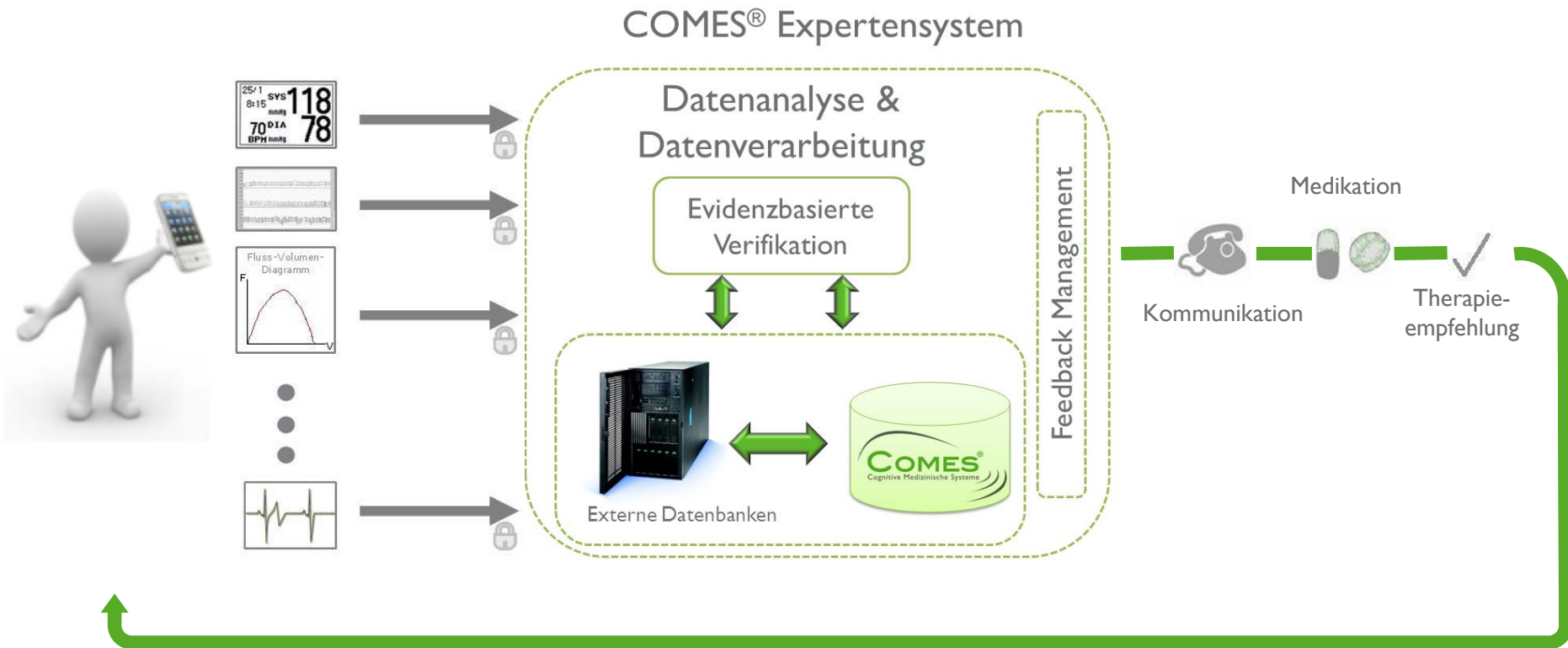


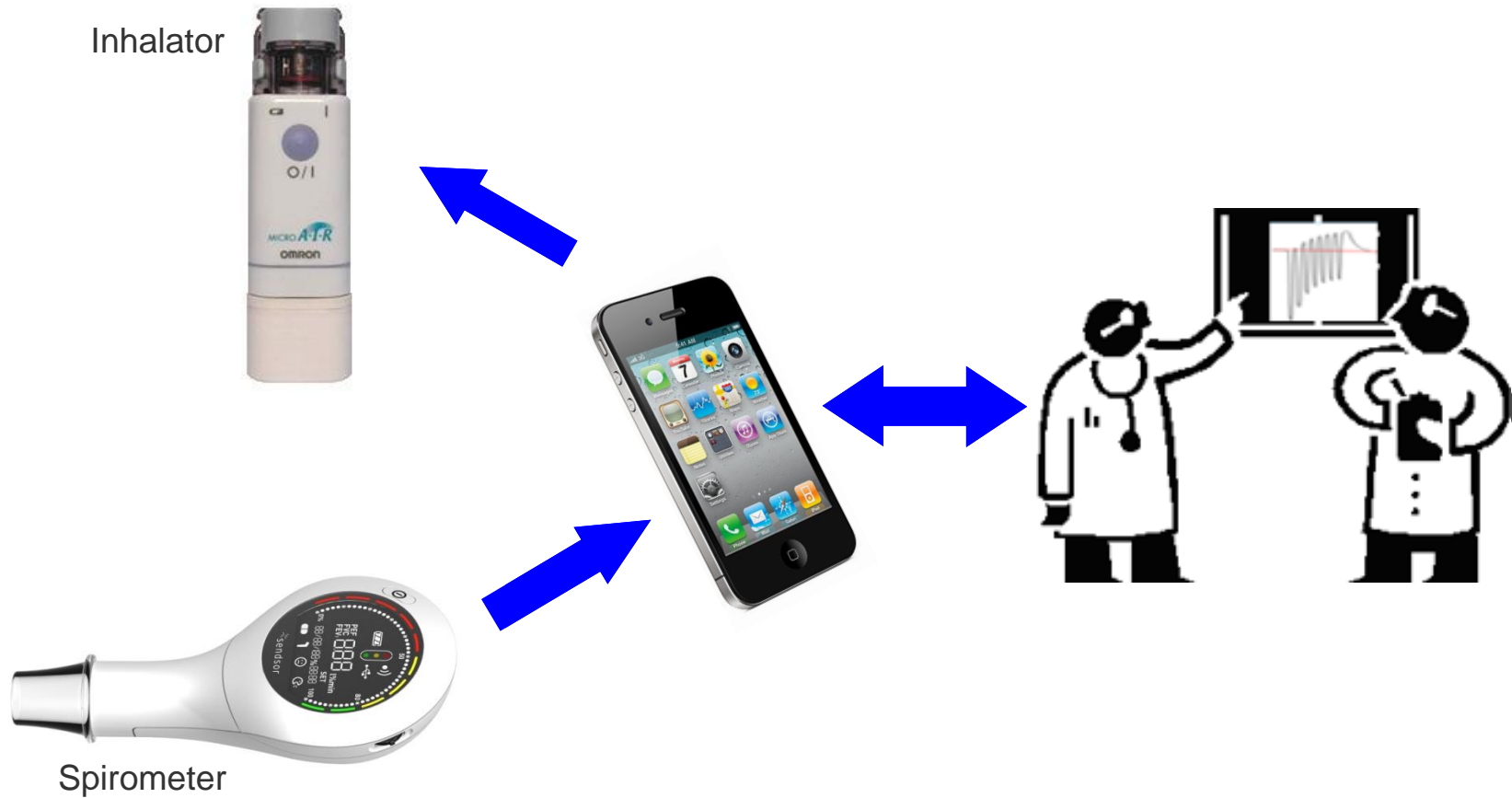
- Blutdruck
- Puls
- Sauerstoffsättigung
- Blutzucker

- Temperatur
- Gewicht (über Bluetooth)
- (EKG)
- (Lungenfunktion)



# Das COMES<sup>®</sup> Expertensystem analysiert, regelt und gibt ein individualisiertes Feedback



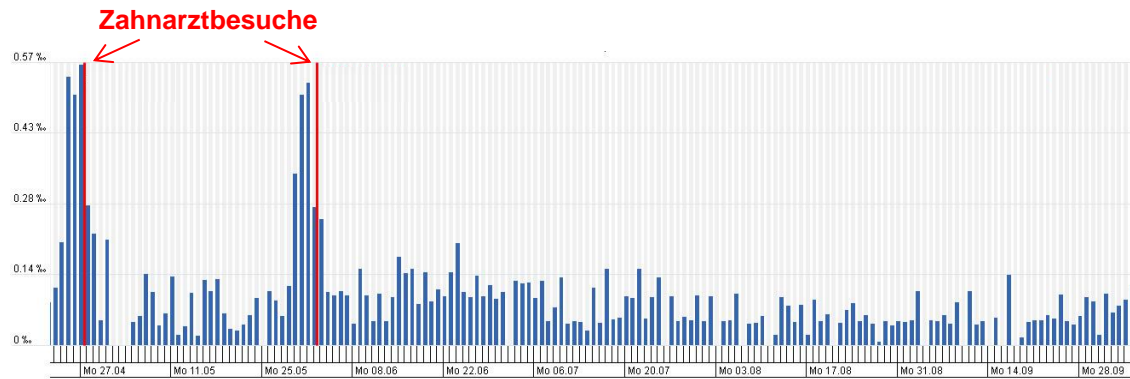


Kooperation mit der ausgegründeten Firma Sendor GmbH

# Das SensoBite System



Diagnose und Therapie von Bruxismus (Zähneknirschen): Das SensoBite System

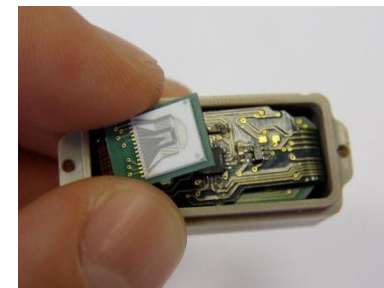
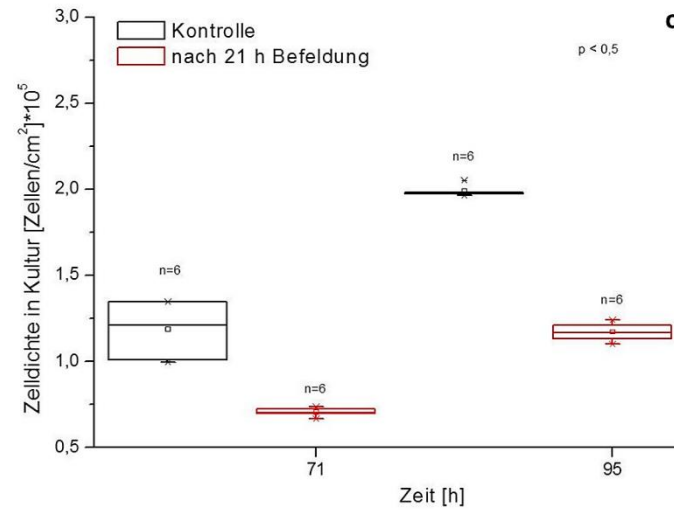
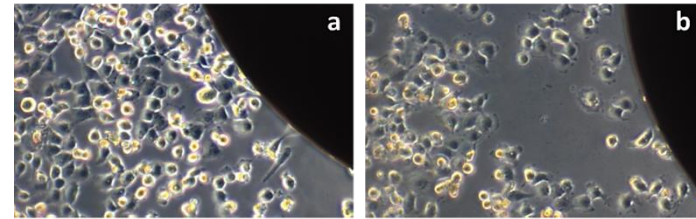
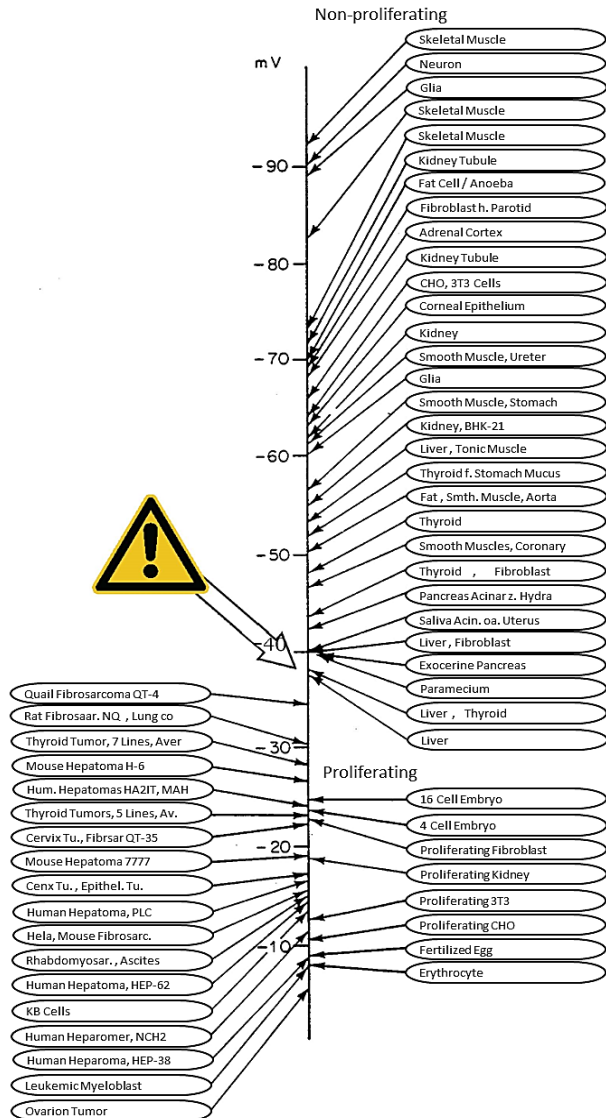


Kooperation mit der ausgegründeten Firma Sense Inside GmbH



**Tumor cells**

**Normal cells**



Cancer Res 2009; 69: (6). March 15, 2009

Research Article

## Bicarbonate Increases Tumor pH and Inhibits Spontaneous Metastases

Ian F. Robey,<sup>1</sup> Brenda K. Baggett,<sup>1</sup> Nathaniel D. Kirkpatrick,<sup>1</sup> Denise J. Roe,<sup>1</sup> Julie Dosesco,<sup>2</sup> Bonnie F. Sloane,<sup>2</sup> Arig Ibrahim Hashim,<sup>3</sup> David L. Morse,<sup>3</sup> Natarajan Raghunand,<sup>1</sup> Robert A. Gatenby,<sup>3</sup> and Robert J. Gillies<sup>3</sup>

NATURE|Vol 441|25 May 2006|doi:10.1038/nature04871

INSIGHT REVIEW

## Hypoxia signalling in cancer and approaches to enforce tumour regression

Jacques Pouyssegur<sup>1</sup>, Frédéric Dayan<sup>1</sup> & Nathalie M. Mazure<sup>1</sup>

Cancer Res 2009; 69: (6). March 15, 2009

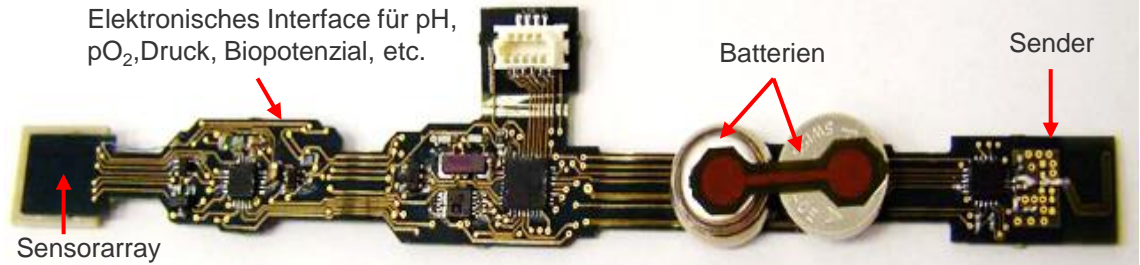
Research Article

## The Potential Role of Systemic Buffers in Reducing Intratumoral Extracellular pH and Acid-Mediated Invasion

Ariosto S. Silva,<sup>1</sup> Jose A. Yunes,<sup>1</sup> Robert J. Gillies,<sup>2</sup> and Robert A. Gatenby<sup>2</sup>

If intratumoral acidosis facilitates invasion, a reasonable extension of the acid-mediated invasion model leads to the hypothesis that reduction of intratumoral and peritumoral acid concentrations may inhibit malignant tumor growth. Sodium bicarbonate ( $\text{NaHCO}_3$ ) is one of the many physiologic buffers used to control the pH in blood and tissues. Excess  $\text{H}^+$  combines with bicarbonate and generates water and  $\text{CO}_2$ . Conversely, in environments wherein  $\text{CO}_2$  is produced in excess, there is production of bicarbonate and free protons (Fig. 1) from carbon dioxide hydration. Previous studies (32, 33) showed that the levels of  $\text{CO}_2$  are higher and concentrations of bicarbonate are lower in tumors than in blood or in healthy tissues.

The clinical feasibility of chronic ingestion of bicarbonate to reduce tumor invasion is an open question. Interestingly,  $\text{NaHCO}_3$  is readily available in grocery stores (as baking soda) and in over-the-counter preparations for clinical use as an antacid. The recommended daily dose is five teaspoons a day, which is 25 to 50 g (depending on how heaped the teaspoon is). This dose has been administered chronically (i.e., >1 year) in patients with renal tubular acidosis and sickle cell anemia without adverse affects (43, 44). Finally, in Supplementary data, we include the experience of a 79-year-old man with widely metastatic renal cancer at the Moffitt Cancer Center. After failing first-line treatment, he discontinued conventional therapy and began a self-administered course of vitamins, supplements, and 60 g of bicarbonate mixed in water daily. As of this submission, he has remained well with stable tumor for 10 months. Although little information can be gained from a single case report, we do note that he has tolerated the VHB administration used in our simulations without complication for nearly 1 year, suggesting that it is clinically feasible.



## Lokale Tumorthherapie

