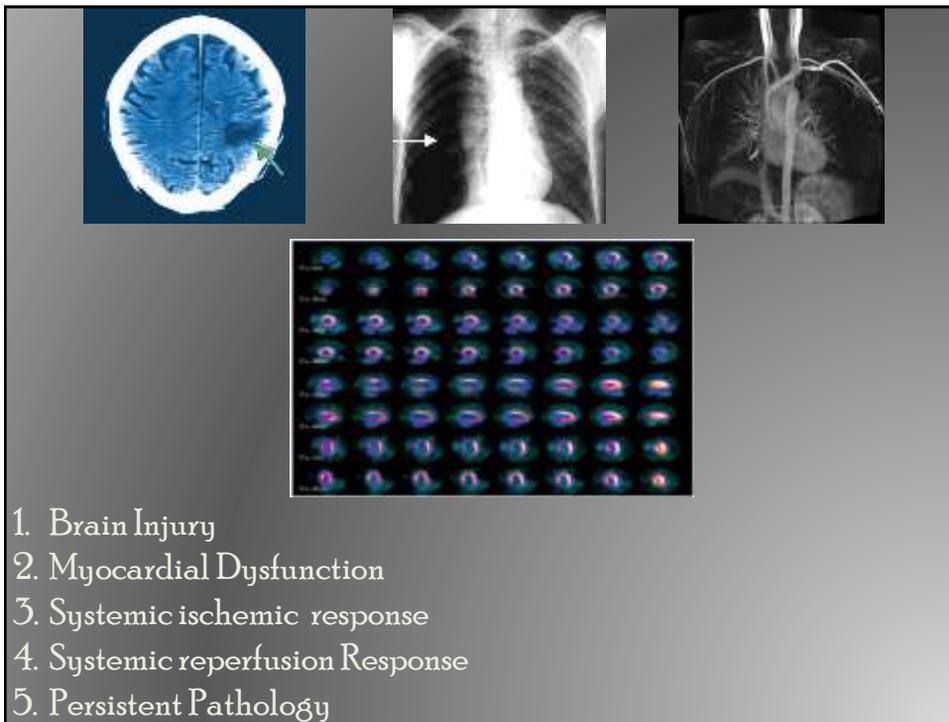


## Post “ROSC”

Mona Youssef  
 Consultant Cardiologist, NHI  
 Egyptian CPR League Board Member  
 & CME Director EgSC







## *Inhospital Deaths*



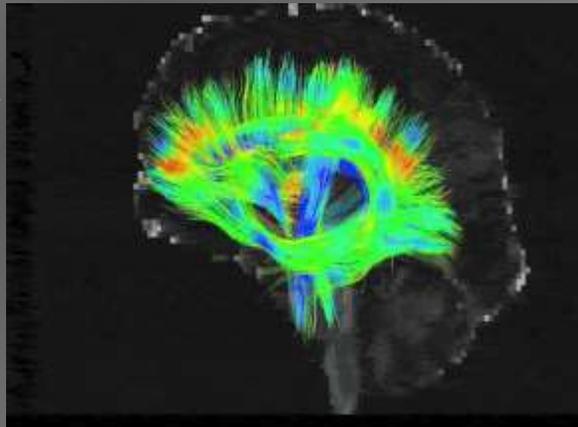
➤ 1<sup>st</sup> 3 days most deaths will result from Cardiovascular failure



Brain injury will kill  $\frac{2}{3}$  of out of hospital arrests  
&  $\frac{1}{4}$  of in-hospital arrests.

#### Brain injury

- starts within 4-6 minutes
- continues from hours to days
- can be re-triggered by new ischemia
- may be exacerbated by metabolic turmoil:
  - Microcirculatory failure,
  - Impaired autoregulation,
  - Hypotension,
  - Hypercarbia,
  - Hypoxemia,
  - Hyperoxemia,
  - Pyrexia,
  - Hypoglycemia,
  - Hyperglycemia
  - Seizures

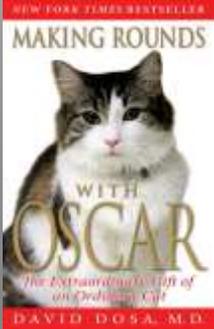




The most frequent cause of death:  
Withdrawal of life-sustaining therapy (WLST)



- 80% mortality rate
- 50% leaving the hospital have neurological injury.



**NEW YORK TIMES BESTSELLER**  
**MAKING ROUNDS**  
 WITH  
**OSCAR**  
*The Extraordinary Gift of an Ordinary Cat*  
 DAVID DOSA, M.D.

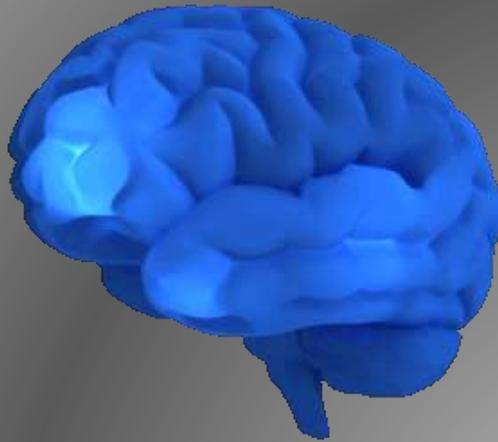
**This is Oscar the therapy cat who lives in a nursing home in Rhode Island. He has predicted the death of over 50 patients, and is so accurate nurses notify patients families when Oscar has been sleeping in their room. Scientists believe he can smell biochemicals released by dying cells.**



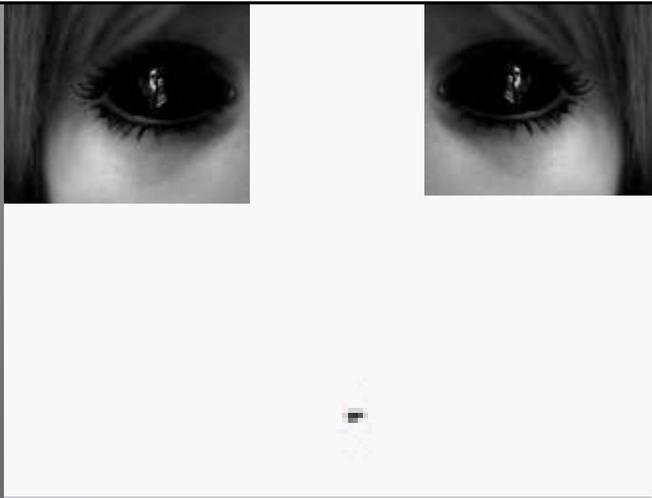

A couple of days before death, our body starts secreting chemicals like putrescine & cadaverine . Our subconscious picks up these subliminal smells & it knows that it's time.



Just before “Death”



➤ An unexplained electric surge runs through the brain.  
Our brains are stimulated like never before in our whole  
life...



2-20 seconds after the heart and lung have stopped, the cerebral cortex still has perception of the outside world

For about 10 minutes after the heart stops and just before shutting down, the memory center sends out electroencephalographic recordings that are different & unique for each & every one of us.

TABLE 10  
SURVIVAL TIME OF DIFFERENT NERVE TISSUES  
COMPLETELY DEPRIVED OF BLOOD\*

Tissue	Survival Time (Minutes)
Cerebrum, small pyramidal cells . . . . .	8
Cerebellum, Purkinje's cells . . . . .	13
Medullary centers . . . . .	20-30
Spinal cord . . . . .	45-60
Sympathetic ganglia . . . . .	60
Myenteric plexus . . . . .	180

\* From W. P. Drinker, *Carbon Monoxide Asphyxia* (New York: Oxford University Press, 1938), p. 133.

[Nat Rev Neurosci](#): Author manuscript; available in PMC 2013 Dec 2.  
Published in final edited form as:  
[Nat Rev Neurosci](#). 2011 Jul 13; 12(7): 30-1000/nrn2071.  
Published online 2011 Jul 13; doi: 10.1038/nrn2071

PMCID: PMC3845678  
NIDMSID: NIDMS23424

## Gut feelings: the emerging biology of gut-brain communication

Emeran A. Mayer

[Author information](#) | [Copyright and License information](#)

The publisher's final edited version of this article is available at [Nat Rev Neurosci](#).  
See other articles in PMC that cite the published article.

### Abstract

Go to:

The concept that the gut and the brain are closely connected, and that this interaction plays an important part not only in gastrointestinal function but also in certain feeling states and in intuitive decision making, is deeply rooted in our language. Recent neurobiological insights into this gut-brain crosstalk have revealed a complex, bidirectional communication system that not only ensures the proper maintenance of gastrointestinal homeostasis and digestion but is likely to have multiple effects on affect, motivation and higher cognitive functions, including intuitive decision making. Moreover, disturbances of this system have been implicated in a wide range of disorders, including functional and inflammatory gastrointestinal disorders, obesity and eating disorders.

# Two Days After Death

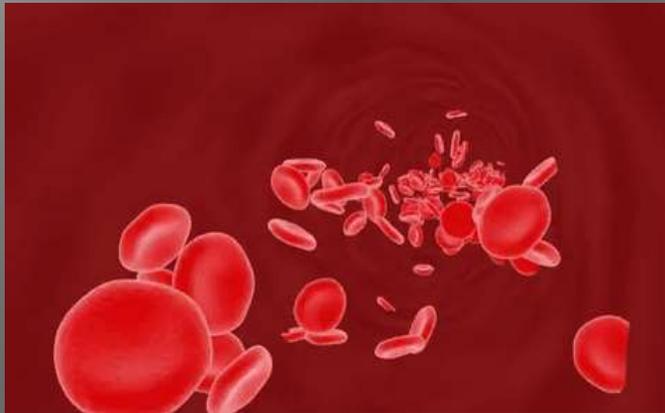


Resurrection of > 2000 embryonic genes involved with the stimulation of inflammation & the immune system; counteracting stress.

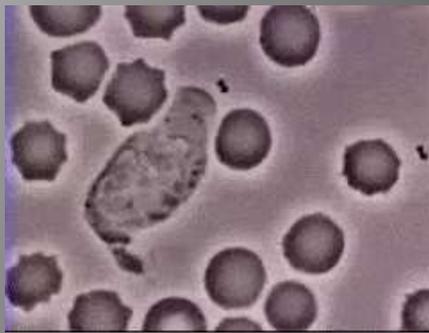
Some of these genes promote cancer growth...



## Reperfusion Injury & Inflammatory



- Increased vascular permeability: edema
- Activation of coagulation
- Cellular hyperactivity
- Disruption of Blood-brain barrier
- Microthrombi formation
- Increased temperature in the brain

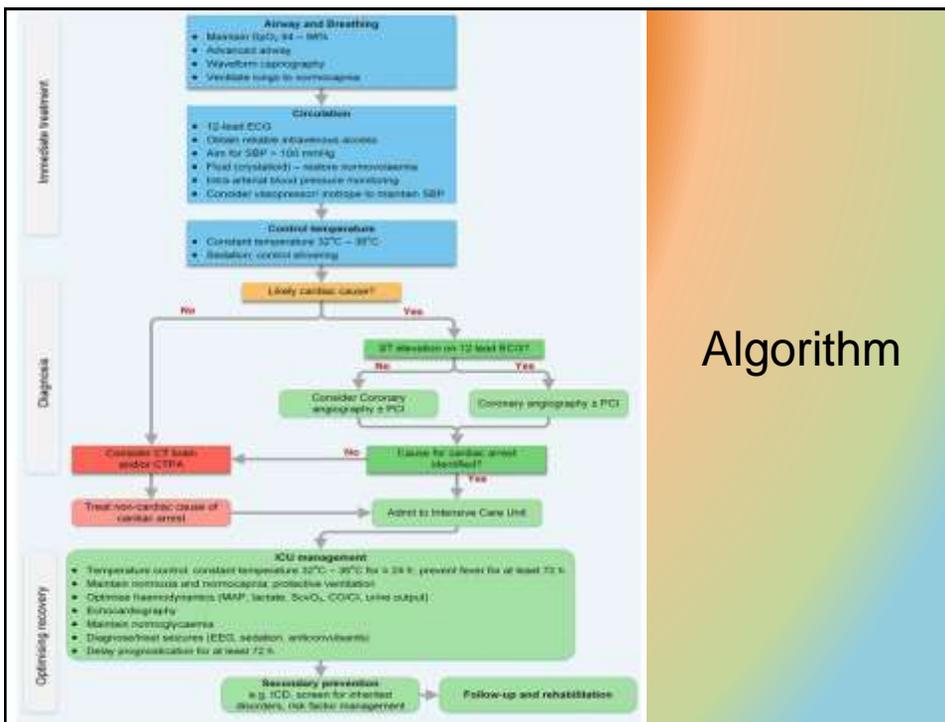


The post-cardiac arrest syndrome has many common features with sepsis, including:

- intravascular volume depletion,
- vasodilation,
- endothelial injury
- microcirculation abnormalities

### HYPOVOLEMIA

- Small hyperdynamic heart
- E/A < 1
- Small (< 20mm) IVC with exaggerated collapse with deep inspiration



# Unconscious patient?



Doesn't follow commands?

# Intubate



- \* pharyngeal
- \* nasogastric also serves to decompress the stomach from bag-mask

## Sedate

\***Common practice:** for at least 24 hours post-ROSC<sup>1</sup>

- decrease O<sub>2</sub> consumption
- reduce patient/ventilator dysynchrony & barotrauma
- prevent shivering & pain

\*Opioids & short-acting hypnotics are used e.g. propofol, alfentanil, remifentanyl  
to allow for more reliable & earlier neurological assessment & prognostication

\*Followed up by sedation scales eg Ramsay scale

(1-patient is anxious and agitated ± restless, 2-patient is co-operative & tranquil, 3-patient responds to commands only, 4-patient exhibits a brisk response to light glabellar tap, or loud auditory stimulus, 5-patient exhibits a sluggish response to light glabellar or loud auditory stimulus, 6-patient exhibits no response)



<sup>1</sup> no high level data available to support a defined period

## Ventilate



- \*Tidal volume 6-8 ml/kg ideal body weight
- \*PEEP 4-8cm H<sub>2</sub>O



## Blood Pressure

\*Target **unknown**

\*Aim from **observational studies** : achieve an adequate urinary output of 1 ml/kg/hr & a normal or decreasing plasma lactate values

## Potassium

\*Hyperkalemia, followed by hypokalemia

## Glucose

\*Increased mortality & poor neurological outcome with

- Post-ROSC hyperglycemia,
- intensive glucose control, & hypoglycemia
- glucose variability, irrespective of value

\***Observational data** : optimal level ~10mmol/L (180mg/dl)

## Temperature



\*Hyperthermia

-maybe a sign of severe brain injury & **destroys quantum features**.  
 -It could be immediate, in the 1<sup>st</sup> 24 hours post-ROSC ,  
 or rebound after a period of induced hypothermia

\*Targeted Temperature Management (TTM)

-**Observational data on comatose patients**: mild induced hypothermia at 36 ° C  
 is neuroprotective



\*Methods

-Induction:

30 ml/kg of 4°C saline will decrease core temperature by 1.0-1.5°C

**observational studies:** Do not recommend pre-hospital TTM, increases risk of pulmonary edema & re-arrest during transport.

-Other cooling methods: non prove superiority

>simple ice packs/wet towels: more time consuming, greater temperature fluctuations

>cooling blankets / pads

>water/air circulating blankets

>water circulating gel-coated pads

>transnasal evaporative cooling even before ROSC: **under investigation** in a large multicenter randomised controlled trial

>intravascular heat exchanger: usually in the femoral or subclavian veins

>extracorporeal circulation eg cardiopulmonary bypass, ECMO

QuickCool nasal balloons  
QuickCool unit

**RhinoChill Non-Invasive Head Cooling System**

WellCool Device  
(Wardlaw et al. Ann Emerg Med 2009;53:488-92)

**Cooling Blanket**

The pad contains coils that circulate a chilled solution.

(Lippert & Williams & Wilkins (2010) Emergency Critical Care Handbook)

Forced convective device - soft, fabric helmet  
(Ward et al. J Cardiothorac Vasc Anesth 2013;27:286-293)

Sovika head and neck cooling device (Sovika GmbH)  
(Pohl et al. Stroke 2011;42:106-11)



Thermistor Temperature Sensor Probe Adult Rectal Esophageal



Silicone Foley Catheter With Temperature Sensor

\*Monitoring: core thermistor placed in the bladder / esophagus / rectum

\*Rewarming: 0.25-0.5°C / hour to avoid rapid alterations in plasma electrolyte concentrations

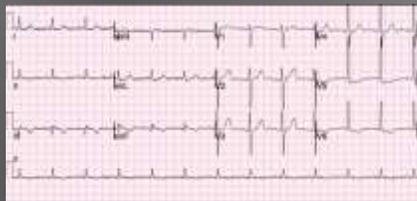
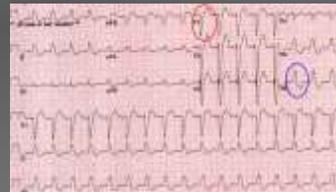
& rebound

hyperthermia

\*contraindications to TTM

- severe systemic infection
- pre-existing medical coagulopathy

\*\*However, fibrinolytic therapy is not a contraindication to mild hypothermia



ECG

\*STEMI/LBBB

-**Observational studies**: recommend a combination of TTM &

PCI

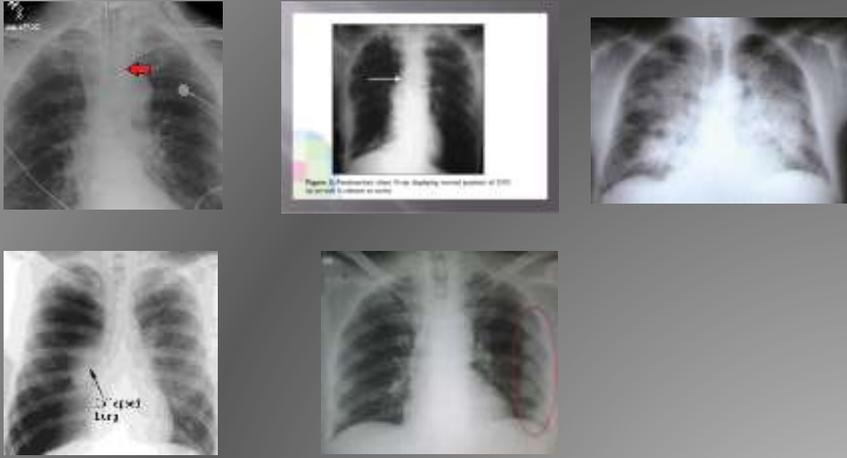
\*NON-STEMI

-**Observational studies**: suggest that even in the absence of

STEMI

there may be an ACS situation.

\*Bradycardia : **retrospective studies** found it beneficial. Even <40



CXR

- \*confirm position of tubings & CV line
- \*assess for pulmonary edema
- \*detect CPR complications: pneumothorax, fractured ribs...

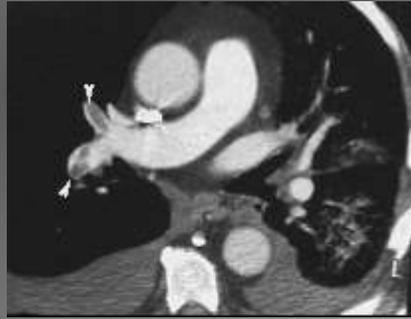
Echo

Early echo in ALL patients

- \* Detect & quantify degree of myocardial dysfunction & need for inotropic support:
  - Fluids
  - Epinephrine
  - Dobutamine
- \*Treatment maybe guided by:
  - Blood Pressure : arterial/intra-arterial
  - Heart Rate
  - Urinary output
  - Plasma lactate clearance rate
  - Central venous oxygen saturation
  - Serial echo especially in hemodynamic instability



N.B. IABP: IABP-SHOCK II Trial showed no improvement in 30 day



CT brain & chest :  
 Needed on hospital admission before or after coronary angio  
 according to presenting picture

## Seizures



May present

\*Clinically in 1/3 of post ROSC comatose patients

- valproate
- levetiracetam
- benzodiazepines
- propofol
- barbiturates
- phenytoin: often ineffective

\*Subclinically: there are no recommendations for routine prophylaxis .

## Prognostication



- \*involves multiple tests for brain injury & neuro consultation
- \*Obscured by TTM , sedatives, & neuromuscular blockers
- \*Do not prognosticate before 72 hours.... Results may translate into an unplug situation.

## Rehabilitation



- \* Long-term cognitive impairments are present in half of survivors.
  - \* Memory is most frequently affected, followed by problems in attention and executive functioning (planning and organisation)
  - \* Emotional problems, including depression, anxiety and post-traumatic stress

## Organ Donation



\*Non-randomised studies : 1 year organ survival ~ in post-CPR & non-CPR specimens.

\*Organ donation is currently considered after CIRCULATORY death occurs.

## Organ Donation Ethicality ?



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Chest. 2017 Jun;151(6):1229-1238. doi: 10.1016/j.chest.2016.11.036. Epub 2016 Dec 6.

### Hydrocortisone, Vitamin C, and Thiamine for the Treatment of Severe Sepsis and Septic Shock: A Retrospective Before-After Study.

Maki PE<sup>1</sup>, Kharoozian L<sup>2</sup>, Rivera R<sup>3</sup>, Hooper MB<sup>4</sup>, Caravita J<sup>4</sup>.

Author information

**Abstract**

**BACKGROUND:** The global burden of sepsis is estimated as 15 to 19 million cases annually, with a mortality rate approaching 60% in low-income countries.

**METHODS:** In this retrospective before-after clinical study, we compared the outcome and clinical course of consecutive septic patients treated with intravenous vitamin C, hydrocortisone, and thiamine during a 7-month period (treatment group) with a control group treated in our ICU during the preceding 7 months. The primary outcome was hospital survival. A propensity score was generated to adjust the primary outcome.

**RESULTS:** There were 47 patients in both treatment and control groups, with no significant differences in baseline characteristics between the two groups. The hospital mortality was 8.5% (4 of 47) in the treatment group compared with 40.4% (19 of 47) in the control group ( $P < .001$ ). The propensity adjusted odds of mortality in the patients treated with the vitamin C protocol was 0.13 (95% CI, 0.04-0.45;  $P = .002$ ). The Sepsis-Related Organ Failure Assessment score decreased in all patients in the treatment group, with none developing progressive organ failure. All patients in the treatment group were weaned off vasopressors, a mean of 16.3  $\pm$  9.8 h after starting treatment with the vitamin C protocol. The mean duration of vasopressor use was 54.9  $\pm$  28.4 h in the control group ( $P < .001$ ).

**CONCLUSIONS:** Our results suggest that the early use of intravenous vitamin C, together with corticosteroids and thiamine, are effective in preventing progressive organ dysfunction, including acute kidney injury, and in reducing the mortality of patients with severe sepsis and septic shock. Additional studies are required to confirm these preliminary findings.

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Global utilization of low-dose corticosteroids in sepsis [Crit Care. 2010]  
Review Corticosteroids for treating sepsis [Cochrane Database Syst Rev. 2015]  
Review Hydrocortisone and the reduction of mortality in sepsis [Intensive Care Med. 2000]

Cited by 11 PubMed Central articles

Medscape Wednesday, February 14, 2018

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News & Neurology

## Zolpidem Paradox: Why Sleep Med Wakes Brain-Injured Patients

Pauline Anderson  
November 27, 2013

The observation that zolpidem can have a paradoxical arousal effect on patients with a severe brain injury dates back about 6 years and has been reported by many different groups. For example, Dr. Schiff and his colleagues previously described the case of a 48-year-old woman who had been in a minimally conscious state for 2 years following a suicide attempt. She couldn't move, feed herself, or speak. When given zolpidem to treat insomnia, she could communicate, eat, and move unassisted within 20 minutes.

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## First in a series on hyperkalemia: hyperkalemia, the sodium potassium pump and the heart

Vol. 14, No. 1 | 24 May 2015

Dr. René Yusef

The sodium potassium ATPase pump on (prow) found in the sarcolemma membrane of cells keeps 90% of potassium intracellularly by actively pumping two potassium ions into the cell while ousting three sodium ions. Under normal conditions homeostasis is maintained between potassium intake, intracellular shifts and potassium excretion. A disturbance producing hyperkalemia has been recorded in up to 12% of hospitalized patients. The gravity of severe hyperkalemia lies in the direct consequences of its concentration on the action potential, resulting in dysrhythmias and cardiac arrest. Controlling the functionality of the sodium potassium pump could meet the guidelines for cardiopulmonary resuscitation (CPR) and cardiac arrest management.

\*Sodium-potassium enzyme is the “gate-keeper”. Controlling its functionality could rewrite the guidelines for cardiopulmonary resuscitation & cardiac arrest management.

\*Enzymes possess quantum tunneling capabilities.



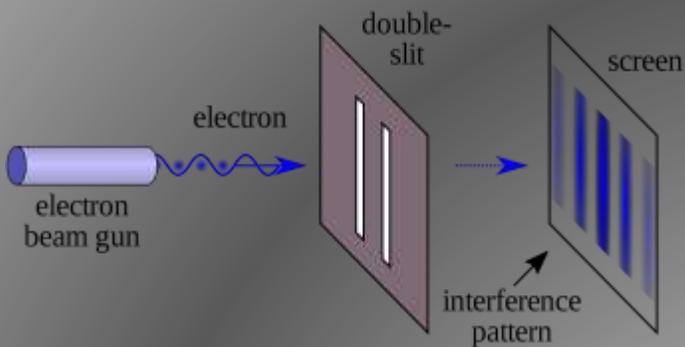
Quantum Mechanics, the branch of physics that describes the behavior of particles in the subatomic realm in which there is:

\*Superposition: where a particle can be in 2 places at once, while also occurring in 2 different states; as a particle & a wave

\*Quantum Coherence: states that all parts of a wave stick together, the exciton can, as a wave, feel out all possible pathways, find the most efficient one, and take it.

\*Quantum Tunneling: where a particle can pass through a solid object like a ghost

\*Quantum Entanglement: where 2 particles form a relationship whether an inch apart or light years away



• each quantum entity has dual potential properties, which become an actual characteristic if and when it is observed

• quantum physics is a science of possibilities rather than exactness of Newtonian physics

• quantum objects and quantities becomes actual when observed

• key proof of quantum superpositions is the phenomenon of quantum tunneling

Double slit lamp experiment: They shot just ONE electron from the beam gun and to their surprise, it gave an interference pattern, so next they took their camera and placed it here and looked directly at the electron at which point it behaved like it was supposed to and it bombarded just one spot. Conclusion: deeds are by intention, we literally shape our reality as we go along. Medicine is not about drugs...

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[Curr Opin Cardiol](#) 2013 Jan 20(1):38-42. doi: 10.1097/HCO.0b013e3182835a079.

**Epinephrine for cardiac arrest.**

Gateway.CM<sup>1</sup>

Author information

**Abstract**

**PURPOSE OF REVIEW:** Epinephrine is the primary drug administered during cardiopulmonary resuscitation (CPR) to reverse cardiac arrest. Epinephrine increases arterial blood pressure and coronary perfusion during CPR via alpha-1-adrenoceptor agonist effects. However, the dose, timing and indications for epinephrine use are based on limited animal data. Recent studies question whether epinephrine provides any overall benefit for patients.

**RECENT FINDINGS:** A randomized controlled trial indicates that epinephrine for out-of-hospital cardiac arrest increases return of pulses, but does not significantly alter longer-term survival. Very large, well-controlled, observational studies suggest that, despite increases in return of pulses, epinephrine reduces long-term survival and functional recovery after CPR. Detrimental effects were greatest in patients found in ventricular fibrillation. Laboratory data suggest that harmful epinephrine-induced reductions in microvascular blood flow during and after CPR may offset the beneficial epinephrine-induced increase in arterial blood pressure during CPR.

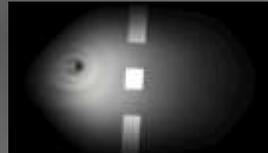
**SUMMARY:** The available clinical data confirm that epinephrine administration during CPR can increase short-term survival (return of pulses), but point towards either no benefit or even harm of this drug for more patient-centred outcomes (long-term survival or functional recovery). Prospective trials are needed to determine the correct dose, timing and patients for epinephrine in cardiac arrest.

PMID: 23196774 DOI: 10.1097/HCO.0b013e3182835a079

[Indexed for MEDLINE]

## Observational Study

All observational studies lack randomization, true assessment of efficacy is not possible. Furthermore, it is not possible to determine what biases may have influenced the results, both from the provider and the patient. Analytically, results from observational studies either cannot be pooled for a meta-analysis or can be done so only with caution.  
J Evid Base Dent Pract 2003;3:1-4



Biology can't explain: our dependence on light for survival

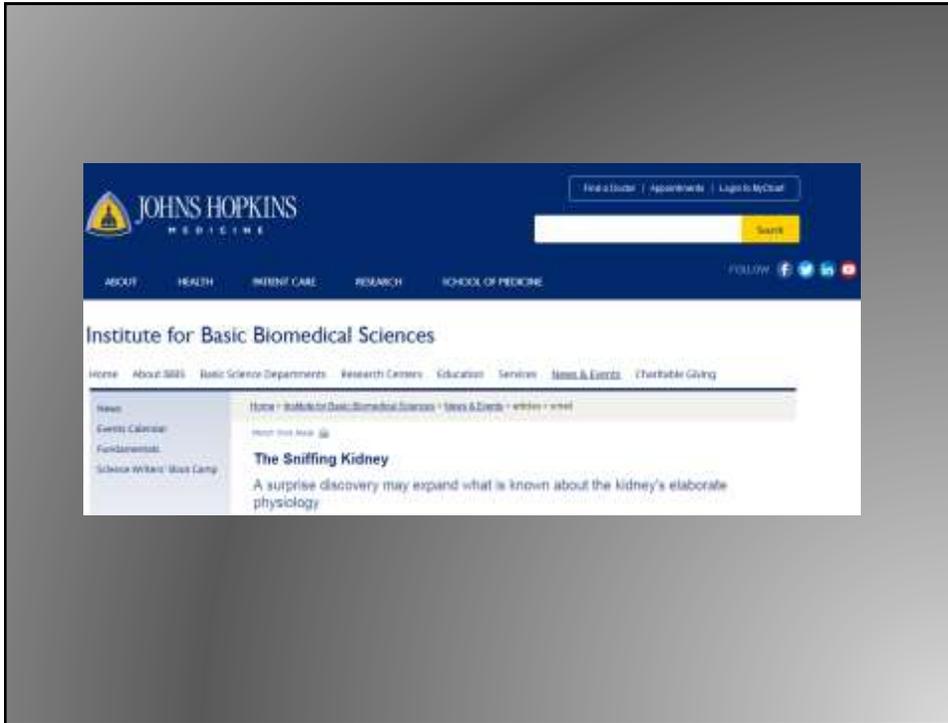
- \*"light" from the sun is necessary for
  - photosynthesis in plants
  - sulfated vitamin D3 in humans

- \*Smell
- \*Vision



Quantum Biology can

Recently alongside arteries, veins & lymph channels; "light Channels" were discovered. Every living cell emits light. Light receptors have been identified in the spinal cord of rats & in the human kidney. Diphotons have been directly seen in our brains...



The screenshot shows the Johns Hopkins Medicine website. At the top, there is a dark blue header with the Johns Hopkins Medicine logo on the left and navigation links for 'Find a Doctor', 'Appointments', and 'Login MyChart' on the right. Below the header is a search bar and a row of menu items: 'ABOUT', 'HEALTH', 'PATIENT CARE', 'RESEARCH', and 'SCHOOL OF MEDICINE'. The main content area is titled 'Institute for Basic Biomedical Sciences' and includes a secondary navigation bar with links for 'Home', 'About IBSB', 'Basic Science Departments', 'Research Centers', 'Education', 'Services', 'News & Events', and 'Charitable Giving'. A left sidebar contains links for 'News', 'Events Calendar', 'Fundamentals', and 'Schools Within: Blood Camp'. The main article is titled 'The Sniffing Kidney' and has a sub-headline: 'A surprise discovery may expand what is known about the kidney's elaborate physiology'.



The screenshot shows the University of California San Francisco (UCSF) website. At the top, there is a dark blue header with the text 'University of California San Francisco' on the left and the UCSF logo in the center. Below the header is a navigation bar with links for 'About', 'Patient Care', 'Research', and 'Education'. The main content area is titled 'Surprising New Role for Lungs: Making Blood' and has a sub-headline: 'Cells in Mouse Lungs Produce Most Blood Platelets and Can Replenish Blood-Making Cells in Bone Marrow, Study Shows'. The breadcrumb trail reads: 'Home > UCSF News Center > Surprising New Role for Lungs: Making Blood'.

**New Life Found That Lives Off Electricity**

Scientists have figured out how microbes can suck energy from rocks. Such life forms might be more widespread than anyone suspected.

### ELECTRICITY EATERS

Some microbes can survive solely on electricity.

**DIRECT UPTAKE**  
In some cases, the microbe can ingest an electron directly from an electrode.

**INDIRECT UPTAKE**  
Other microbes secrete enzymes that grab an electron from the electrode and pair it with a proton from water. The microbe eats the resulting hydrogen.

<https://www.quantamagazine.org/electron-eating-microbes-found-in-odd-places-20160621/>

**'Zeno effect' verified—atoms won't move while you watch**

October 23, 2015 by Bill Steele, Cornell University



The dawn of  
**quantum  
biology**

Article in *Nature* by Philip Ball (Nature 474 (2011) 272-274)



## Quantum Biology



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'We're only just learning how to control tunnelling'

PETER SCHREINER, UNIVERSITY OF GIESSEN

Call to bring quantum tunnelling to the table when trying to understand reactions

BY ANDREW VAUGHAN | 16 JANUARY 2018