

# Scientific basis of Kangaroo mother care and the use of a novel stimulator for APNEA of prematurity and SIDS



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“The child grows daily more when  
in the body of its mother than  
when it is outside of the body, and  
this teaches us…”



*Leonardo da Vinci (1452–1519)*

# Economic Consequences of Preterm Delivery

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Five million hospital days per year in the care of preterm offspring

Neonatal intensive care costs exceed \$5 billion

Average cost to graduate a sick infant from the newborn intensive care unit is between \$20,000-\$100,000 per infant

Infants weighing <1000 g cost an average of \$140,000 per patient

40% of very low birth weight infants (<1500 g) will have two rehospitalizations, for an average of 16 days during the first year

Cost for special education and long-term care is estimated to be over \$100,000 for infants with severe physical and neurologic handicap

Lifetime custodial care may run as high as \$450,000 per child

Morrison, Obstet Gynecol, 76:5S, 1990

# Most common complications encountered in preterm and/or small-for-date babies

- Asphyxia
- Hypoglycemia
- Hyperkalemia
- Hypocalcemia
- Hypomagnesemia
- Hypothermia
- Apnea
- NRDS
- Hyperbilirubinemia
- Polycythemia
- Hypovolemia
- Peripheral vasoconstriction
- Cerebral and pulmonary hemorrhage

## TRUE APNEA

- NO THORACIC OR ABDOMINAL BREATHING MOVEMENTS FOR MORE THAN 10 SECONDS
- BRADYCARDIA
- HYPOXIA

## FALSE APNEA

- NO THORACIC BREATHING MOVEMENTS BUT ABDOMINAL BREATHING MOVEMENTS
- NO BRADYCARDIA
- NO HYPOXIA

## PERIODIC BREATHING

- NO THORACIC AND ABDOMINAL BREATHING MOVEMENTS FOR LESS THAN 10 SECONDS
- NO BRADYCARDIA
- NO HYPOXIA

SIDS is defined as the sudden death of an infant that is unexpected by history and unexplained by postmortem examination. An extensive literature, including prospective studies of infants who later died of SIDS and retrospective studies of infants who were resuscitated after a near fatal instance of SIDS, has related SIDS to cardiorespiratory irregularities, particularly increased apnea and severe bradycardia during sleep.

Developmental abnormalities in the sympathetic nervous system has also been postulated.

A decreased FHR variability has been reported in apnea of infancy.

Stewart et al. put forward the hypothesis that neural input is important to maintain respiratory function during diencephalically mediated sleep in a critical period of infant development, and that attenuation of these stimuli due to sleep practices, sleep environment, or auditory system dysfunction may contribute to the development of SIDS.

In 1978 Dr Edgar Rey and Dr Hector Martinez of the Maternal and Child Institute of Bogotá, Colombia, developed a new method of ambulatory care of LBW infants: the Kangaroo Mother Care (KMC).

Rey ES and Martinez HG, 1983

Reduction of neonatal mortality  
from 70% to 30% in LBW  
infants (1,000-1,500 g).

## Bergman NJ, Jurisoo IA, 1994

Reduction of neonatal mortality from 90% to 50% in newborns weighing less than 1,500 g and from 30% to 10% in newborns weighing between 1,500 and 2,000 g.

Charpak et al. in a randomized, controlled trial of a Colombian population of newborns <2,000 g randomized to receive KMC (No.=364) and "traditional" care (No.=364) have found that the mortality was lower among KMC infants; the growth index of head circumference was significantly greater in the KMC group. Infants weighing  $\leq 1,500$  g at birth and undergoing KMC spent less time in the hospital.

Charpak N et al. Pediatrics 2001; 108: 1072-9

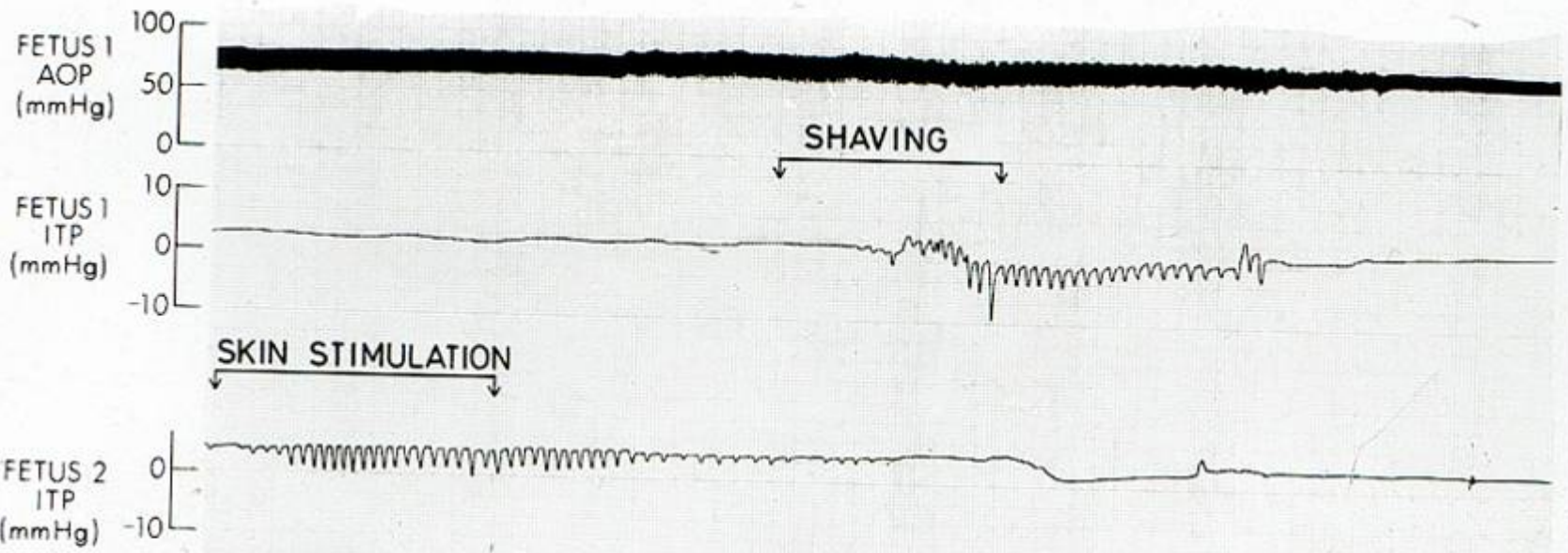
# Characteristics of KMC

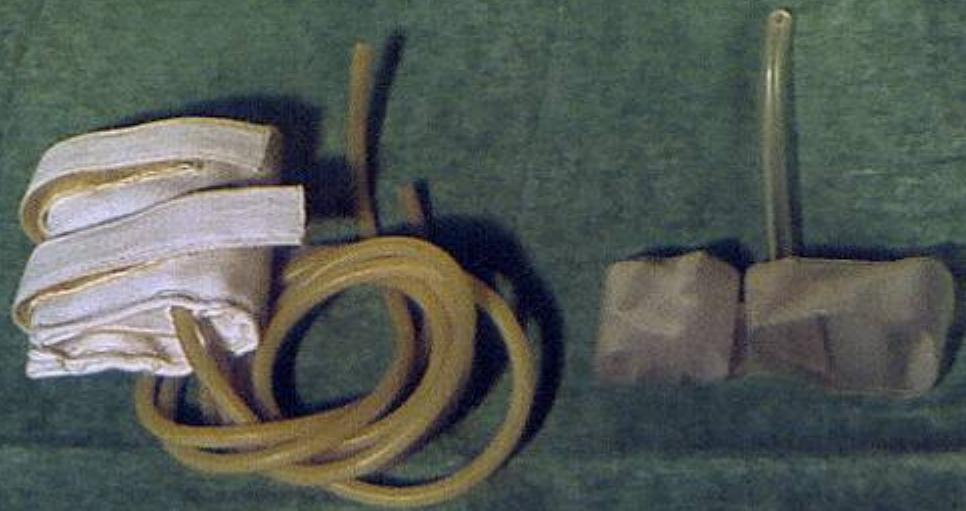
- ✓ **Mother is employed as incubator for thermal control and as the main source of food.**
- ✓ **Newborns are discharged as soon as they are stabilised**

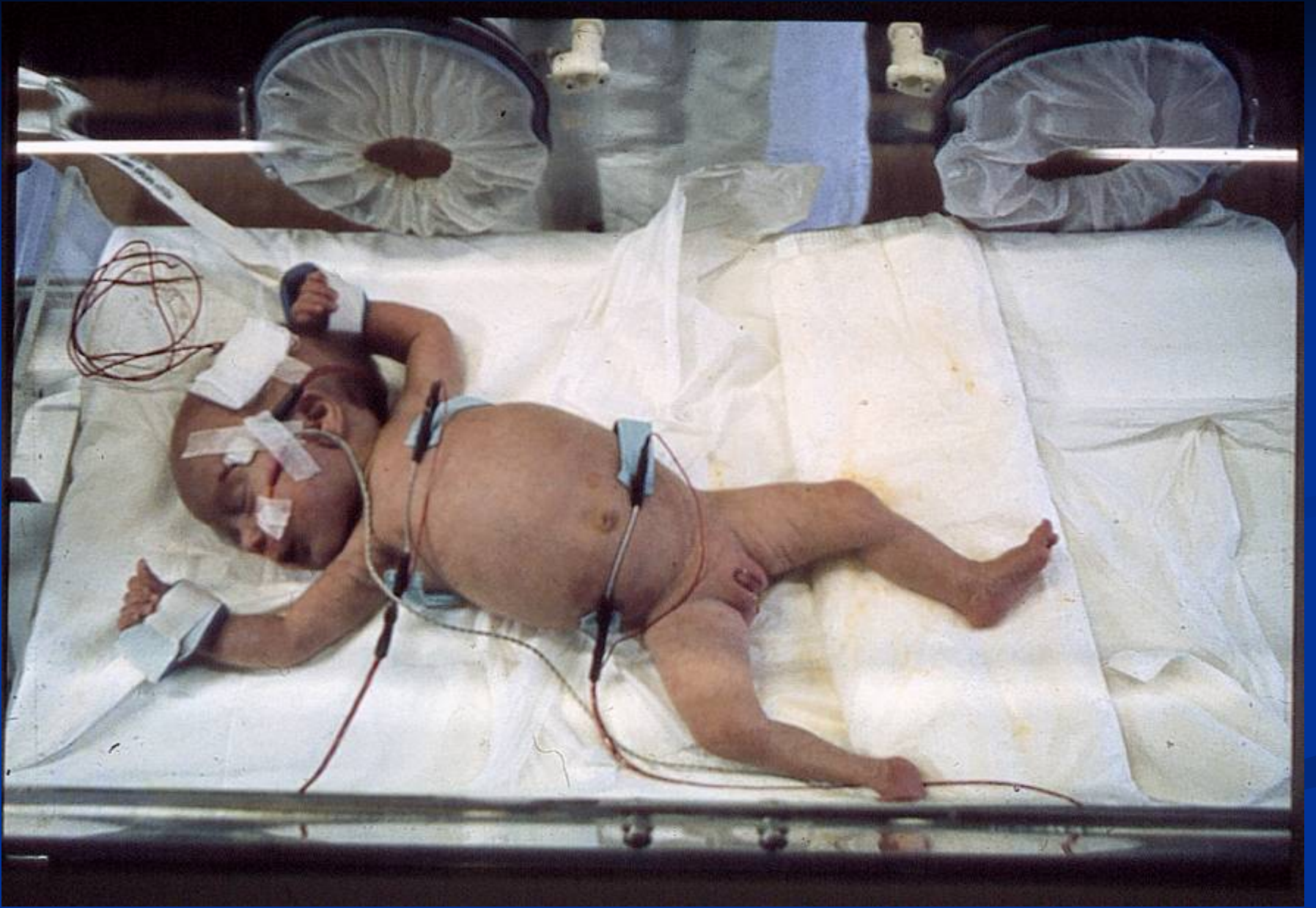
# Advantages of KMC

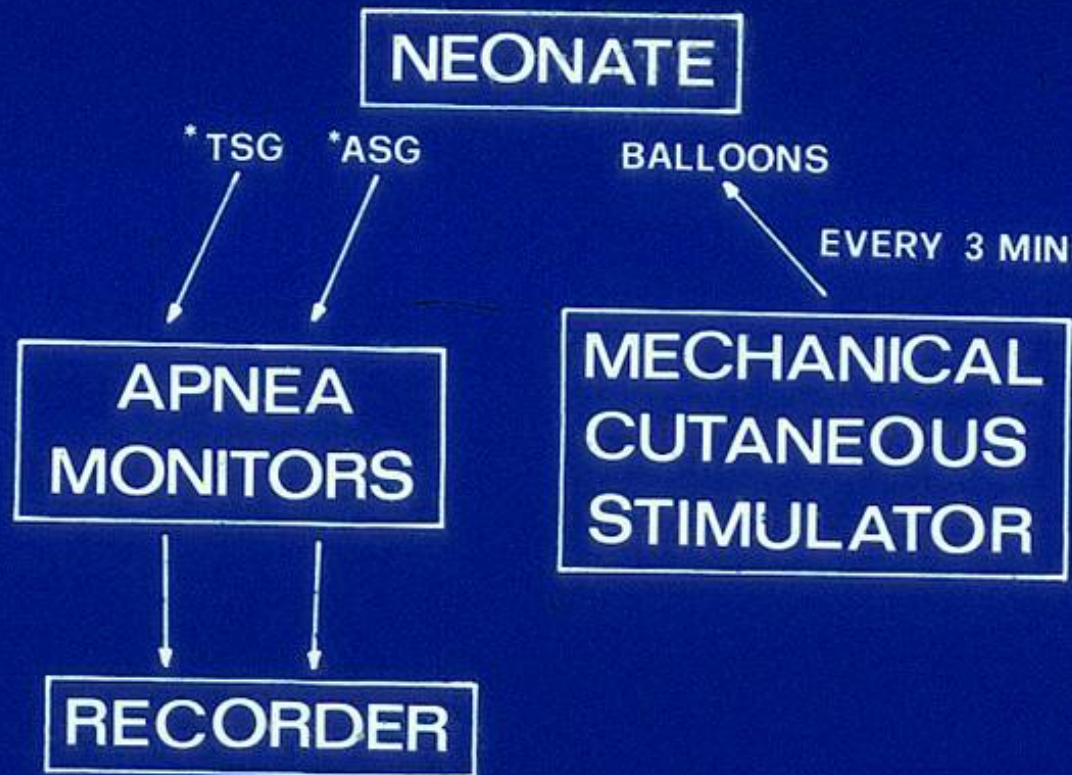
- ✓ Lower cost
- ✓ Breast feeding at any time
- ✓ Control and maintenance of infant's temperature
- ✓ Better parent-child bonding
- ✓ Humanization of neonatal care
- ✓ Lower risk of apnea of prematurity





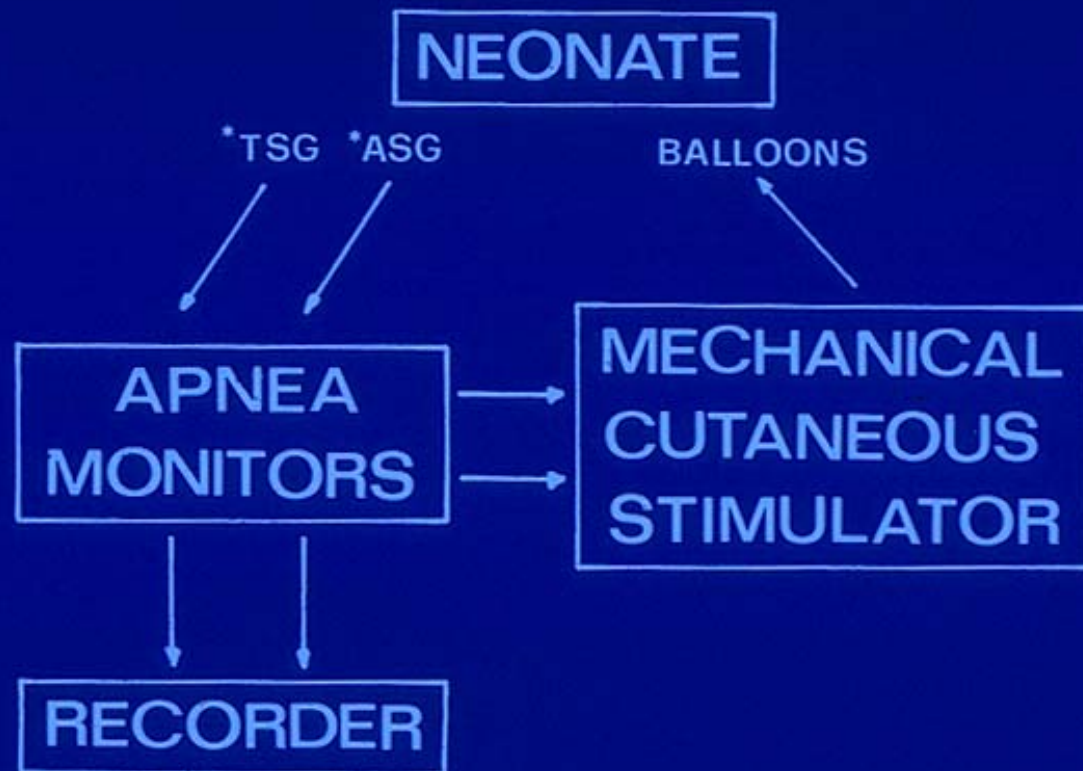






## INTERMITTENT STIMULATION

\*TSG : THORACIC STRAIN GAUGE  
\*ASG : ABDOMINAL " "



## DEMAND STIMULATION

\*TSG : THORACIC STRAIN GAUGE

\*ASG : ABDOMINAL " "

ECG

HR  
(beats/min)

200

150

100

100

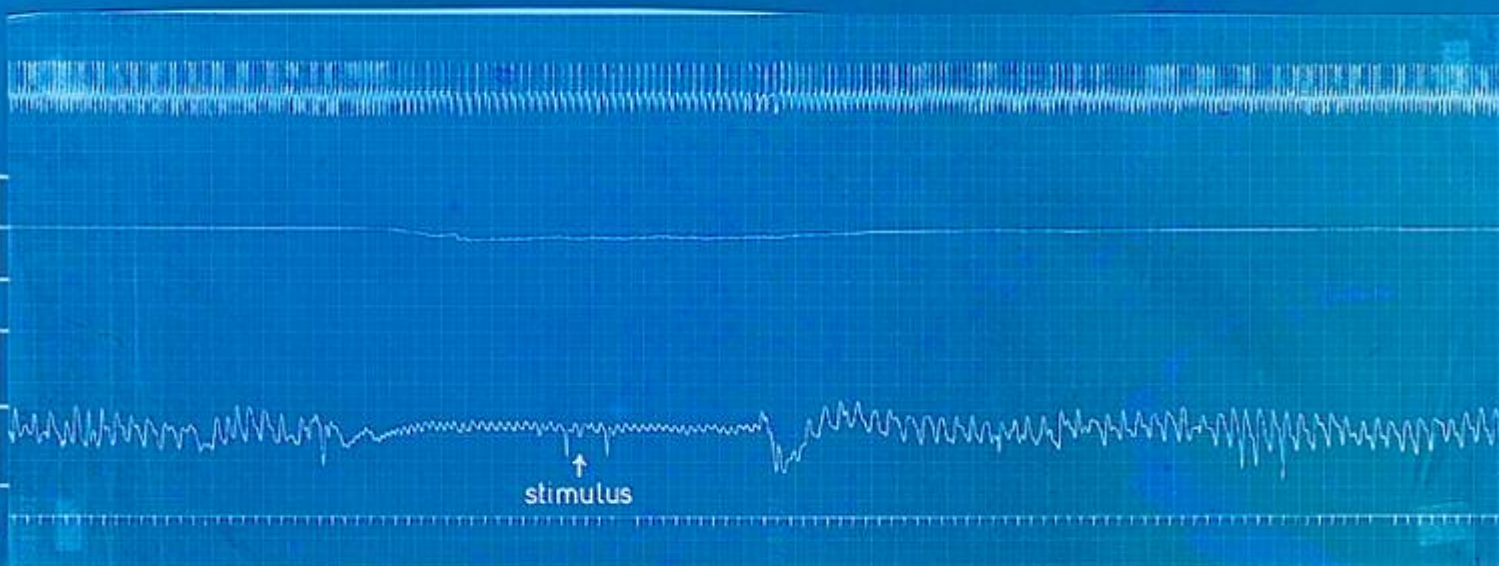
RW  
(thoracic)

50

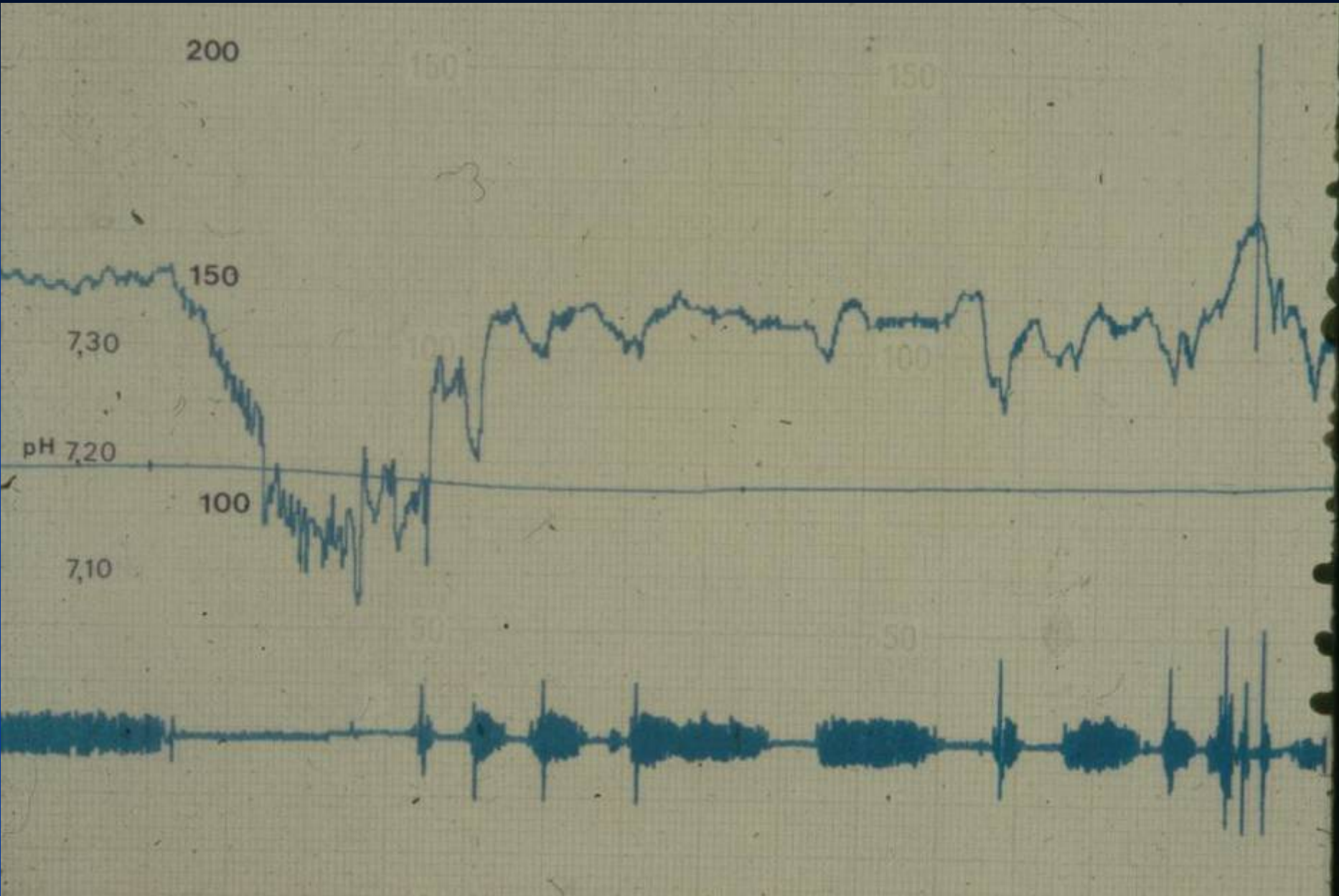
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TIME(sec)

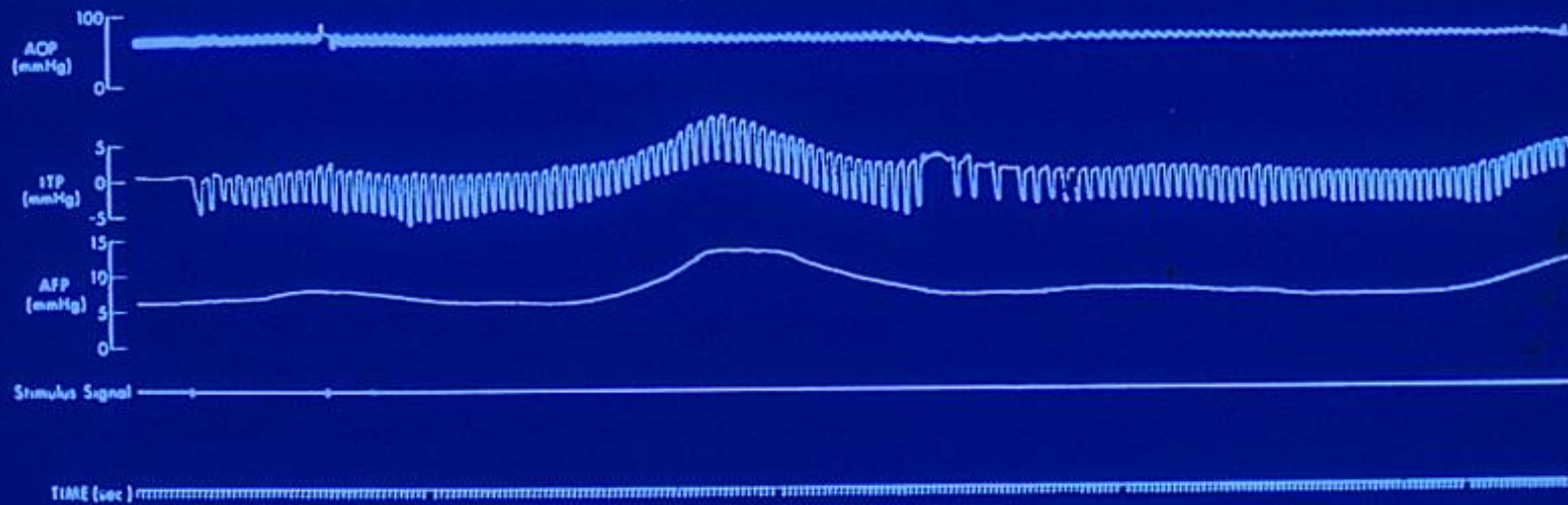
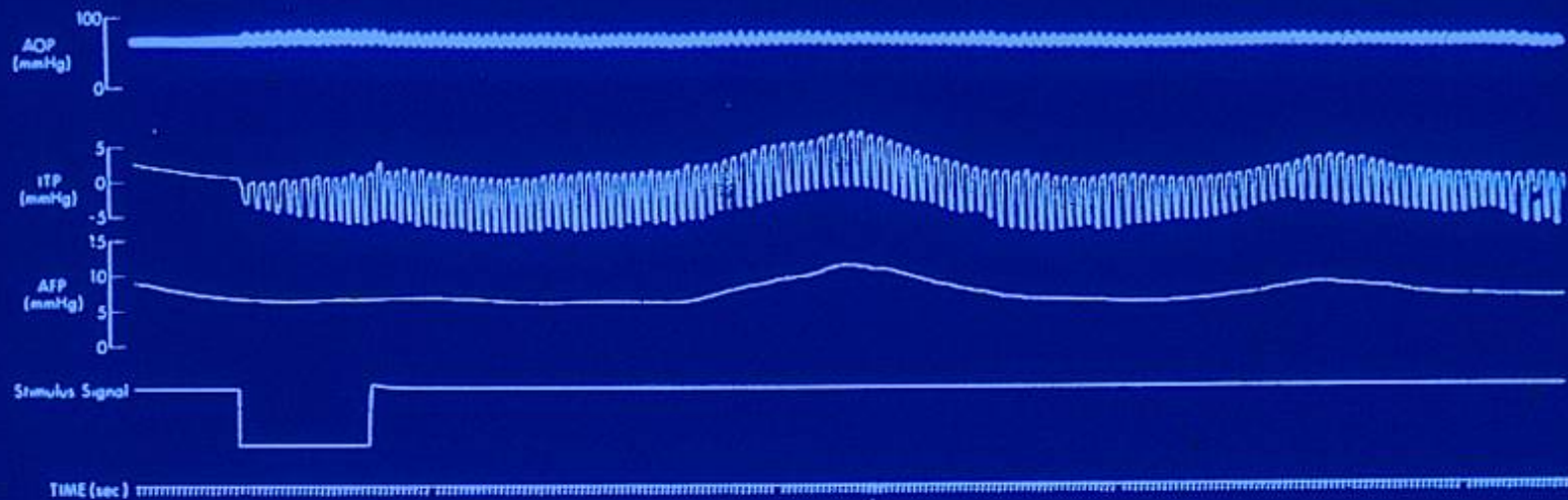
stimulus







**We have also shown that the electrical stimulation of the skin of the lamb fetus (66 cps, 4.0 msec, 6V, 0.77 mA) can be as effective as direct stimulation of the sciatic nerve (66cps, 4.0 msec, 1.5V, 0.08 mA) when the higher voltage and current are used. Mechanical and vibratile cutaneous stimulation also produced spontaneous breathing which, however, was short lived compared with that produced by electrical stimuli.**



# Project description

- A neonatal monitor;
- An acoustic stimulator;
- An electric stimulator;
- A remote unit (collecting, evaluating and transmitting data);
- A cellular (GSM) data link;
- A receiveing station.

# Data Link:

Via cellular GSM or Internet Protocol

- Automatically activated by the monitor (dangerous pattern recognition);
- On request, by operator of the receiving center.
- Local area network
- Internet

# Newborn parameters:

- Heart Rate;
- ECG;
- Breathing rate;
- Pulsed-oximetry
- Oximetry (SO<sub>2</sub>)

# Lab test plant

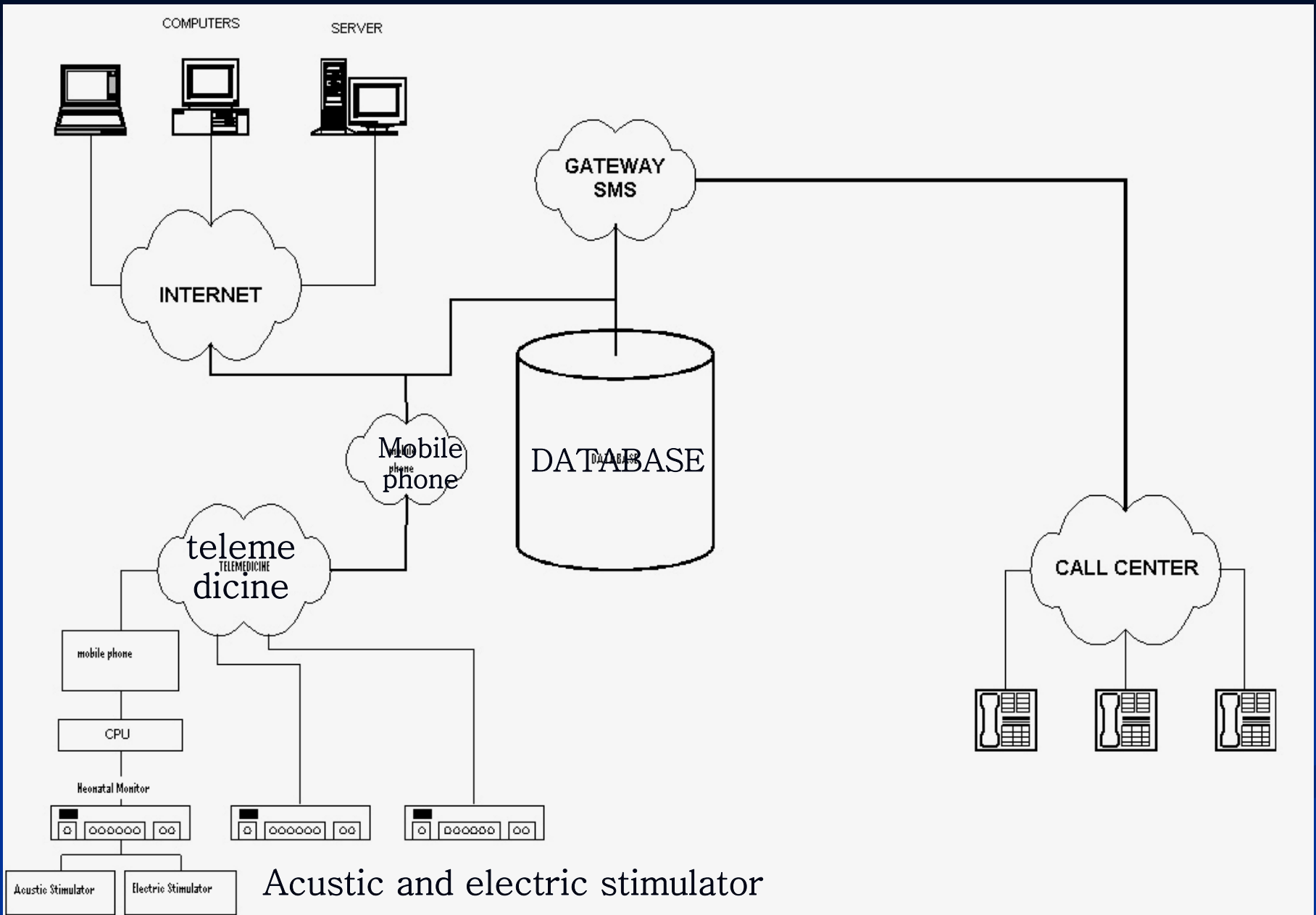


# Getemed Vitaguard



# Electrical stimulator





# KANGAROO MOTHER CARE

- 1.It facilitates the early mother and/or father preterm neonate contact, reducing the baby's necessity for NICU and promoting the recovery of the mother-father/premature baby bonding.
- 2.It replaces the mechanical heat of the incubator for the warmth transmitted by the skin to skin contact decreasing the risks of hypothermia and hyperthermia and of apneic episodes.

3.Promotes kinesthetic stimulation, e.g., tactile, vibration, thereby preventing apnea of prematurity and possibly SIDS.

4.Room-sharing and the presence of others in close proximity, which increase ambient acoustic stimulation, are protective against SIDS. Infants sleeping in the same room as parents have shown less sleep apnea. While other factors, such as increased exposure to parental CO<sub>2</sub>, may contribute to the protective effect of room sharing, auditory stimuli are amongst the most likely stimuli to be experienced by an infant.

5.It promotes the breastfeeding,  
decreasing the risks of early weaning.

6.It discharges the preterm-baby  
precociously, before it reaches the  
conventional weight of 2,000 g,  
decreasing the time the baby stay as an  
inpatient and the risks of infection.

7. It teaches and gives incentives to the premature baby's mother of how to care for the child.

8. It prevents and/or treats supraventricular tachycardia, by teaching the preterm newborn to suction from mother's breast by tactile stimulation of its perioral area (diving reflex).