



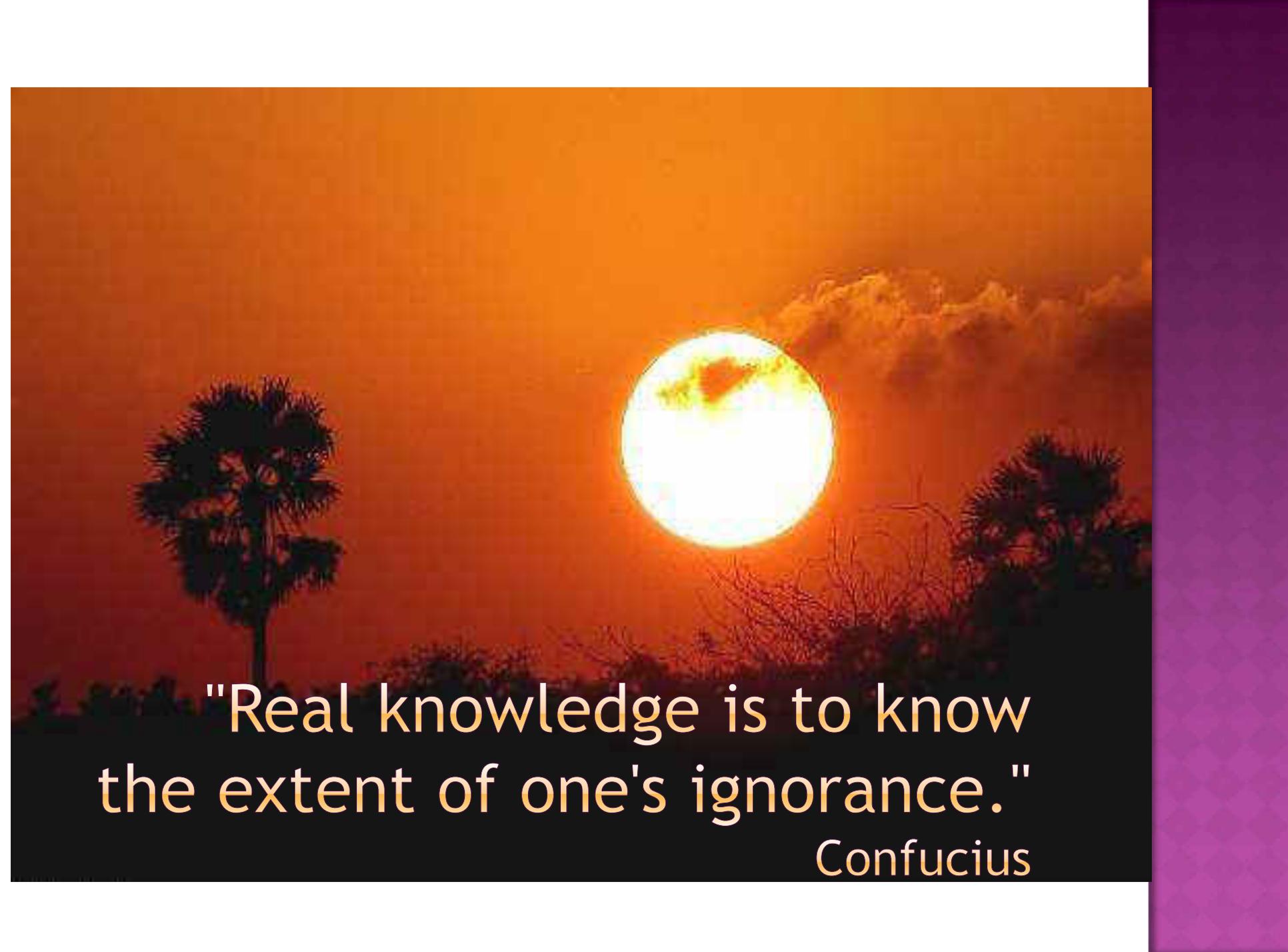
# VITAMIN D IN THE PERINATAL PERIOD- MYTHS AND REALITIES

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"Real knowledge is to know  
the extent of one's ignorance."

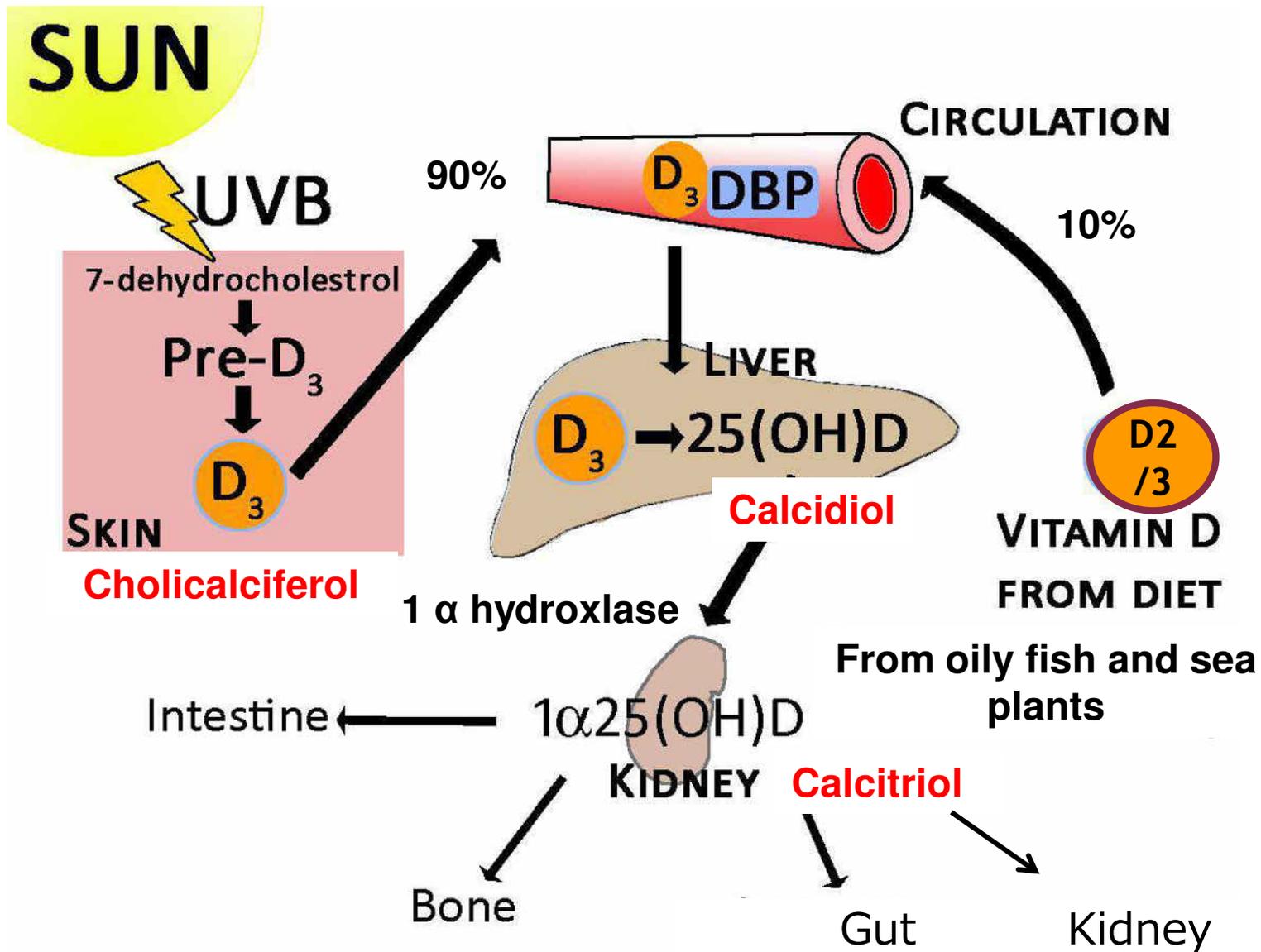
Confucius

# WIDESPREAD RENEWED INTEREST

- Peer reviewed articles on vitamin D in PubMed have increased from about 100 articles per year in 1975 to >3000 in 2015
- Time magazine has reported the newly realized importance of Vitamin D as one of the top 10 medical breakthroughs in 2007



Sir Edward Mellanby discovered Vitamin D in the late 1890s



Alpha calcidiol  
 (1 OH cholecalciferol):synthetic form

# MYTHS

1. In sunny countries like ours we easily get our daily requirement of Vit D
2. Vit D is mainly important for bone health
3. Vit D deficiency is a nutritional problem seen in malnourished children with rickets
4. Normal neonates get enough Vit D from the maternal stores and breastmilk
5. Requirements of Vit D are the same for all ages
6. The hype about Vit D is just a passing fad...

Myth No1 : We easily get our daily requirement of Vit D  
from sunlight in countries like ours

REALITY NO1.....

# SUNLIGHT VS ORAL INTAKE

- ◉ Just **10 minutes of >70% body exposure to mid-afternoon sunlight in a fair-skinned adult** produces about 2000 units of vitamin D over the next 24 hours
- ◉ This is equivalent to drinking **20 glasses of fortified milk** (at 100 IU per glass) or taking **8 standard calcium tablets** (250 IU per tablet) in one day

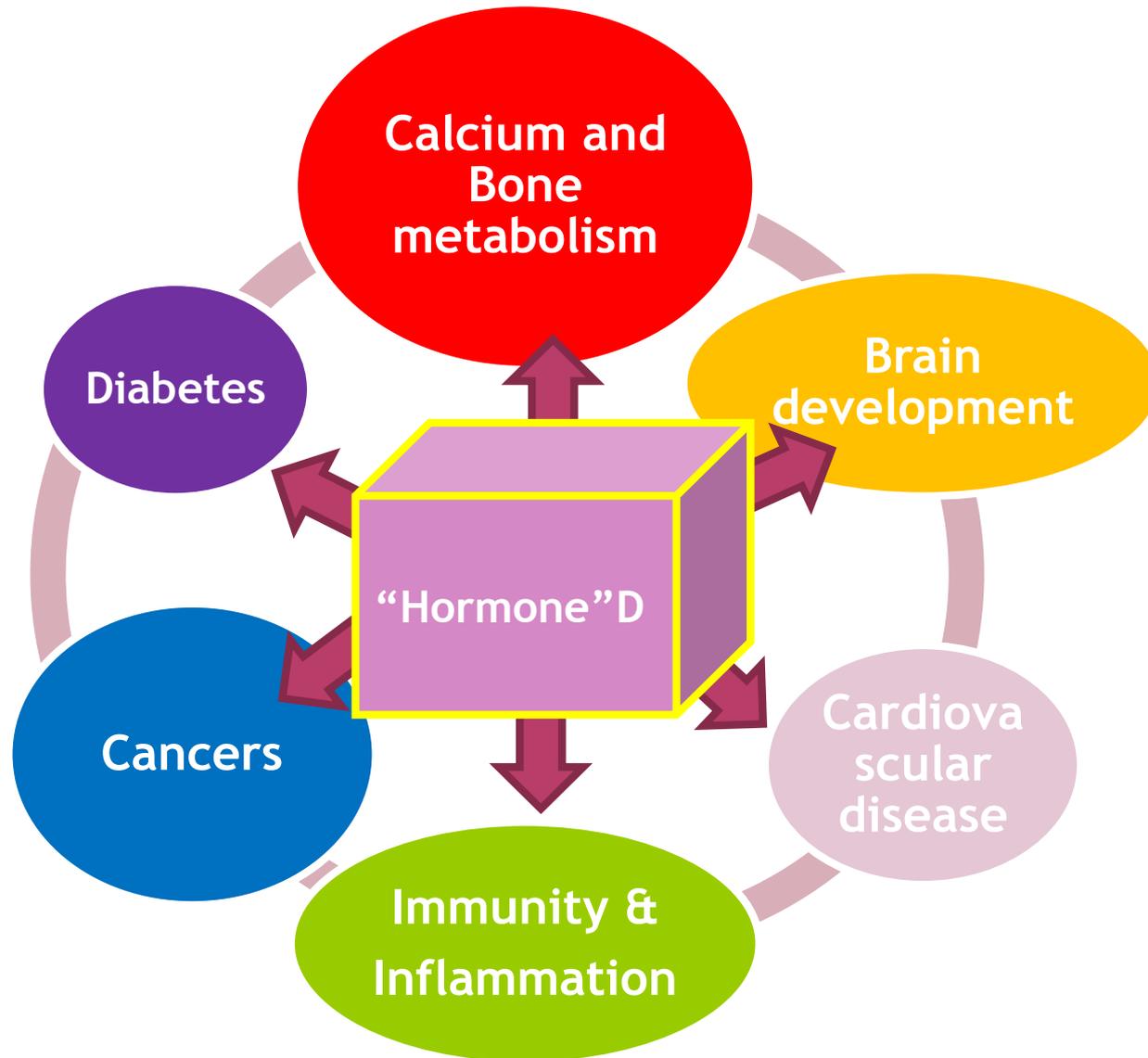
# CAVEATS OF SUN-INDUCED VITAMIN D

- Depends on
  - Amt of skin exposed
  - Skin type (brown and dark skin absorbs less UV rays)
  - UVB Index (maximum between 1200-1500 hrs)
  - Geographical location
- Vitamin D from sunlight can actually vary from <100 IU/day to >2000 IU/day

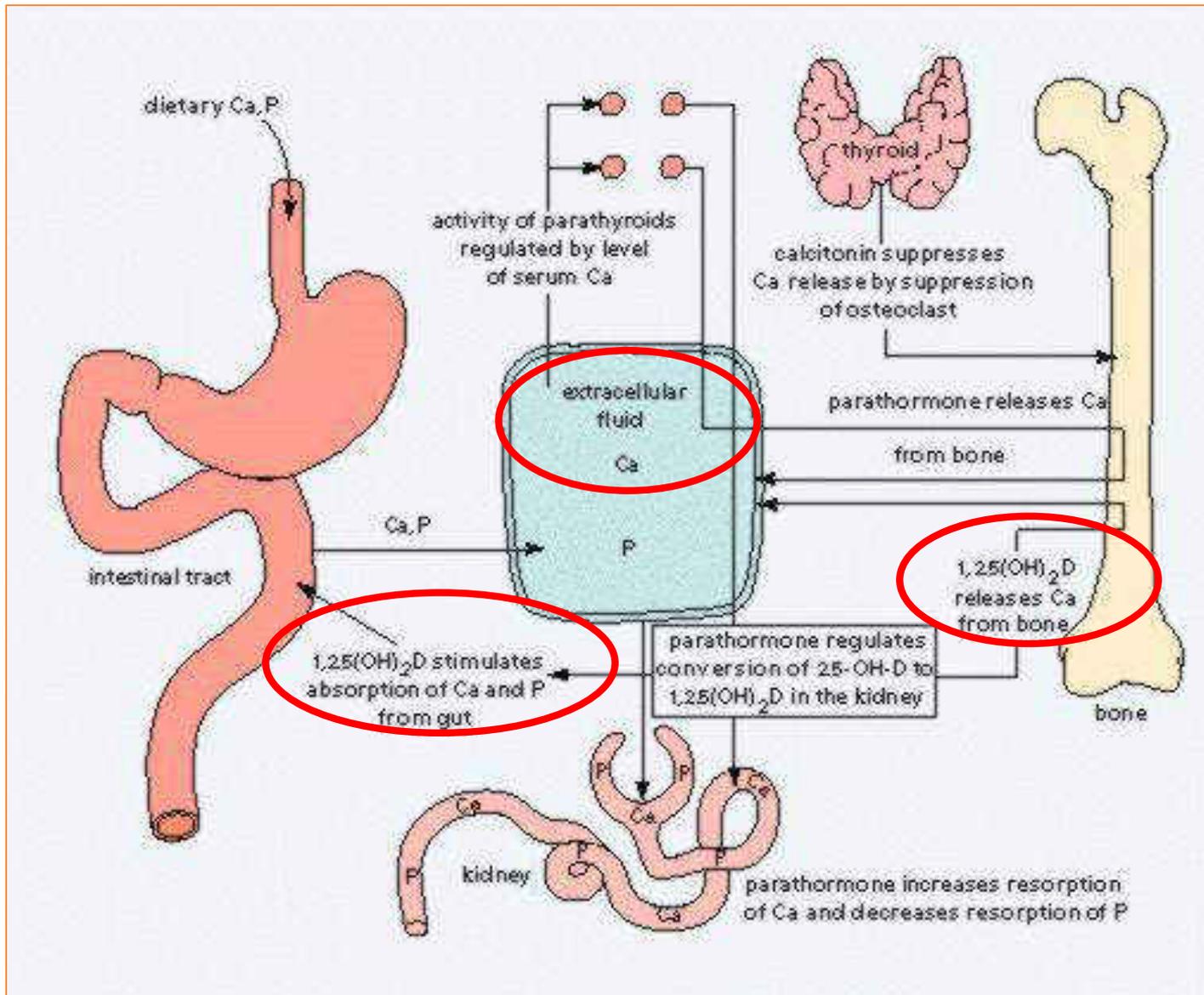
Myth No 2: Vitamin D is only important for bone health

REALITY NO 2

# VITAMIN D- MULTI-FACETED HORMONE



# VITAMIN D AND CALCIUM METABOLISM



# VITAMIN D AND CA ABSORPTION

- ◉ Normally 30% of dietary intake of calcium is actually absorbed from the gut
- ◉ This decreases to < 10% in Vit D deficient states

# VITAMIN D AND BRAIN DEVELOPMENT

- ⦿ Gestational vitamin D deficiency causes permanent changes in the developing rat brain
- ⦿ It disrupts the balance between cell proliferation and apoptosis
- ⦿ Results in epigenetic changes and has been implicated in autism

Levenson CW, Figueiroa SM **Gestational vitamin D deficiency: long-term effects on the brain.** Nutr Rev. 2008 Dec;66(12):726-9.

# ANTI-INFLAMMATORY AND IMMUNE-MODULATORY ROLE OF VIT D

- T and B lymphocytes, macrophages and Langerhans cells express the Vitamin D receptors through TLRs
- Regulates the production of the antimicrobial proteins cathelicidin and beta defensin
- Induces the generation of CD25<sup>+</sup>/CD4<sup>+</sup>

Liu PT, Stenger S, Li H, et al. Toll-like receptor triggering of a vitamin D-mediated human antimicrobial response. *Science* 2006;311:1770-3

# LONG-TERM EFFECTS ON CHILDREN

- Maternal intake reduces the risk of recurrent wheeze and allergies in children at 3 y of age
  - Camargo CA et al. Am J Clin Nutr 2007;85:788-95.
- Intake of vitamin D in pregnancy reduces risk of type 1 diabetes: a birth-cohort study
  - Hyppönen E, et al Lancet 2001;358:1500-3.

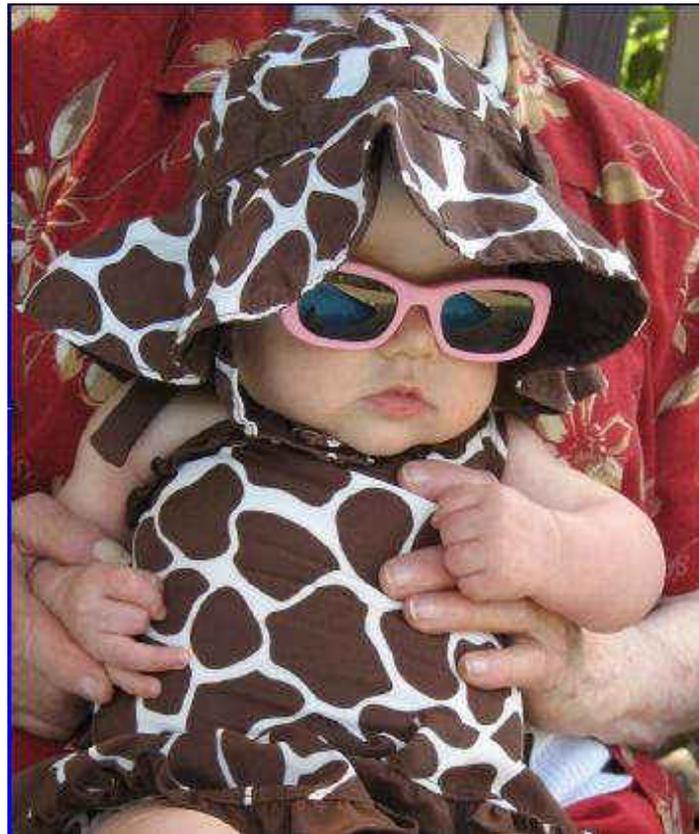
Myth No 3: Vitamin D Deficiency is a nutritional problem

REALITY NO 3

# VITAMIN D FROM DIETARY SOURCES

- ◉ Fish oil
- ◉ Alfafa (seaweed)
- ◉ Mushrooms
- ◉ Spinach
- ◉ Small amts from egg yolk

# VITAMIN D DEFICIENCY IS A LIFESTYLE DISEASE



**Because we shun the sun....**

# VIT D DEFICIENCY WITH 'NORMAL' NUTRITION

- ◉ 40-50 % of inner city children have been found to be deficient
  - Marwaha RK, Tandon N, Reddy D, et al. Vitamin D and bone mineral density status of healthy schoolchildren in northern India. *Am J Clin Nutr* 2005;82:477-82
- ◉ Maternal Vitamin D deficiency at or near term has ranged from 5-20% in light-skinned populations to 30-70% amongst dark-skinned people
  - CS Kovac. Maternal Vitamin D deficiency: Fetal and neonatal implication. *Seminars in Fetal & Neonatal Med* Feb 2013

# DEFICIENCY OF VIT D IN 'HEALTHY' BABIES

Vandana Jain, Nandita Gupta, et al. Vitamin D deficiency in healthy breastfed infants. Seasonal variation & determinants. Indian J Med Res 133, March 2011, pp 267-273

- 98 infants aged 2.5 to 3.5 months, born at term with appropriate weight and their mothers were enrolled
- Vitamin D deficiency was found in 66.7 per cent of infants and 81.1 per cent of mothers; and insufficiency in an additional 19.8 per cent of infants and 11.6 per cent of mothers.
- Radiological rickets was present in 30.3 per cent of infants with 25OHD < 10 ng/ml.

Myth No 4: Normal neonates get enough Vit D from breastmilk and Vit D deficiency is not a big problem

REALITY NO 4

# VITAMIN D IN THE FETUS AND NEONATE

- ◉ The mother is the only source of Vitamin D
- ◉ Cholecalciferol and 25-OH Vit D cross the placenta
- ◉ Hydroxylation occurs in placenta and fetal kidney to 1-25 (OH)<sub>2</sub>D<sub>3</sub>
- ◉ Half life of Vitamin D is 3-4 weeks and stores get depleted by 6-8 weeks
- ◉ The Vitamin D content of breast milk is 20-40 IU/L
- ◉ Requirement for a term baby is 200- 400 IU/day in infancy which is equivalent to taking 4-8 L of breast milk/day!

# CALCIUM AND VIT D METABOLISM

## NORMAL

CALCIUM INTAKE



## PREGNANCY

CALCIUM INTAKE

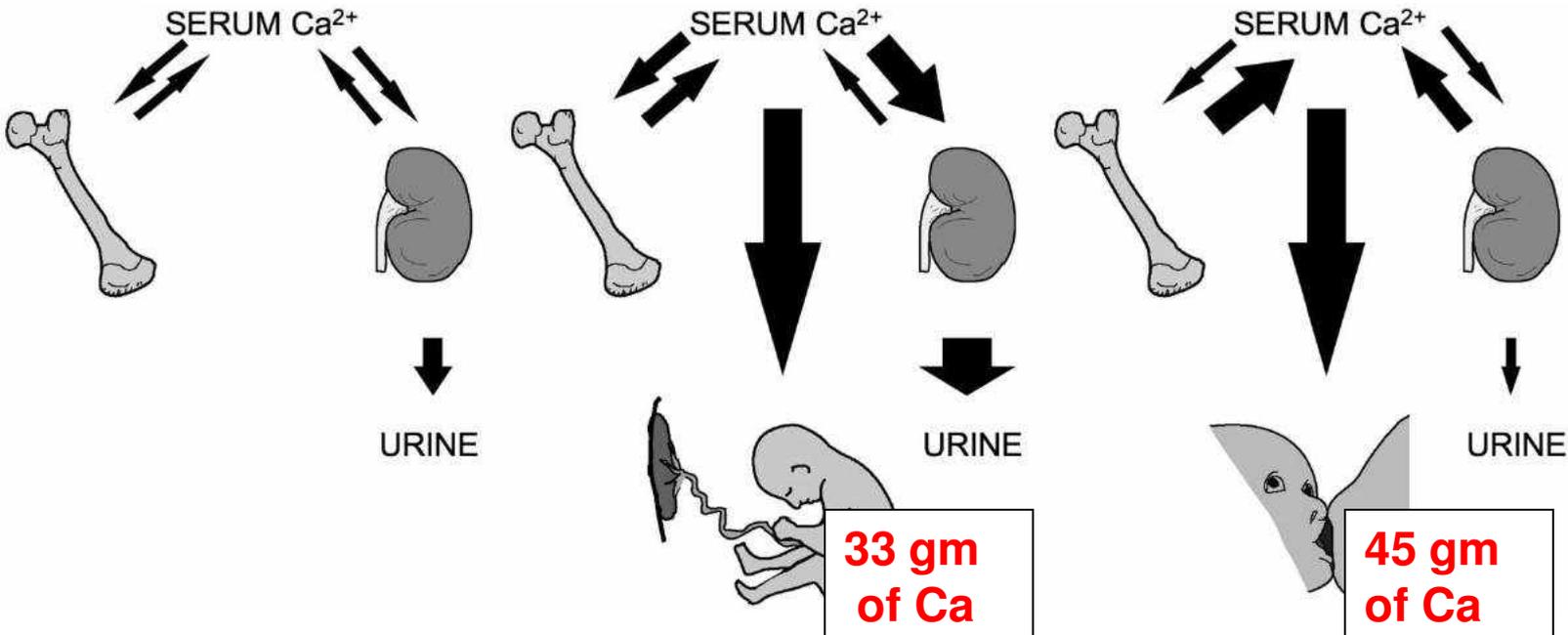


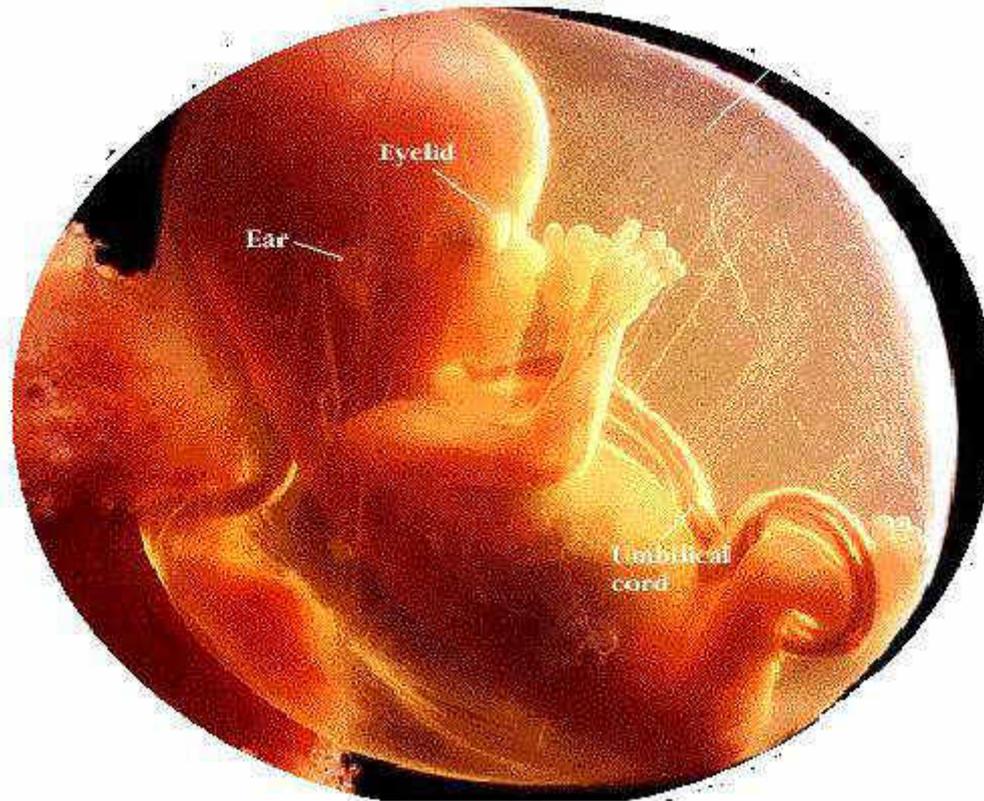
## LACTATION

CALCIUM INTAKE



Only 10-20% of Ca is absorbed without Vitamin D





Fetal serum Ca is always higher than  
mother's but  
Vit D level is always lower.....

## CASE ....

- 2<sup>nd</sup> twin born to a primi after ART at 36+ weeks POG by Em LSCS (Ind IUD of first twin)
- BW 1.9 Kg, Cried Immediately and started on feeds on D1
- On D2 developed jerky movements of upper limbs with normal sensorium
- During USG cranium had excessive crying followed by tetanic, opisthotonic spasms with laryngospasm requiring intubation
- Baby's SCa was 6.5mg with ionic Ca of 0.6mmol/L
- Vit D was 10ng/ml; mother's 12ng/ml, mother's Ca was 6mg%!)

# FACT...

Breast fed babies born to mothers with Vit D deficiency are **very likely** to develop both calcium and Vit D deficiency in early infancy **unless supplemented from birth or exposed daily to sunlight**

# VITAMIN D DEFICIENCY AND HYPOCALCAEMIA IN INFANCY

**Mehrotra P, Marwaha RK et al.  
Hypovitaminosis D and Hypocalcemic Seizures  
in Infancy. Indian Pediatrics 2010;47:581-586**

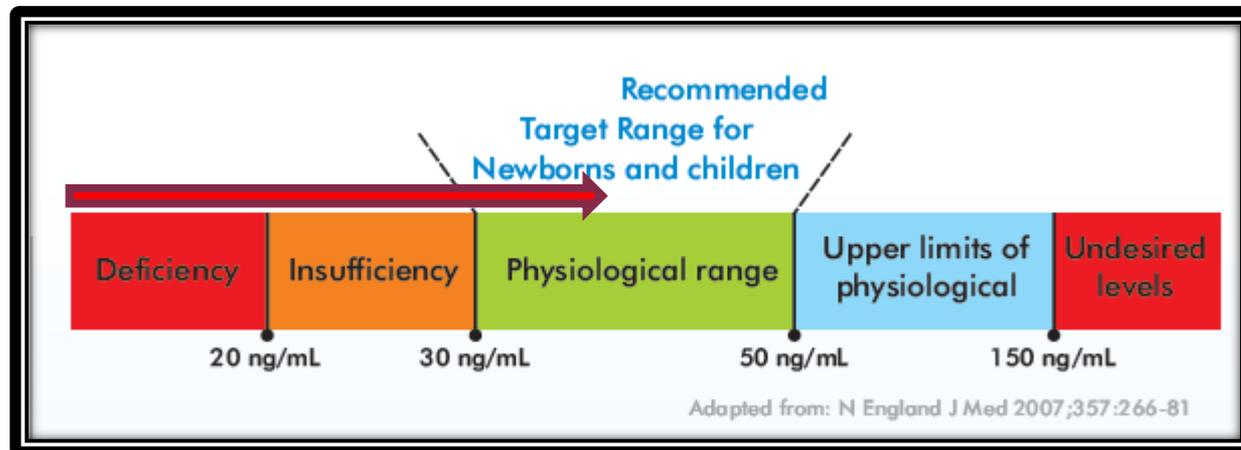
- 60 infants with hypocalcaemic seizures and their mothers were compared with apparently healthy controls
- Hypovitaminosis D (25(OH)D levels  $<10$  ng/mL) was observed in 85% of study mothers ( $6.54 \pm 5.32$  ng/mL ) and 90% of study infants ( $4.92 \pm 4.62$  ng/mL)

Myth No 5: Requirements of Vit D are the same for all

REALITY NO 5

# WHAT ARE NORMAL LEVELS ...

What is considered normal is controversial....



$$1 \text{ ng/ml} = 2.5 \text{ nmol/L}$$

# REQUIREMENT OF VITAMIN D IN INFANCY

- Old recommendations: : 200 IU/day (1  $\mu\text{g}$  = 40 IU)
- 2008 recommendations of AAP: 400 IU of Vit D to be started in all breast fed babies from the first few days of life till on full complementary feeds to ensure a minimal serum level of 50 nmol/L
  - **Madhusmita Misra, et al. Vitamin D Deficiency in Children and Its Management: Review of Current Knowledge and Recommendations. *Pediatrics* 2008;122;398**

# RECOMMENDATIONS FOR PRETERMS

- The ESPGAN recommendation of 800 to 1,600 IU/day vitamin D for preterm infants is promoted by at least three randomized, controlled trials.
  - Sarah N. Taylor, Bruce W. Hollis and Carol L. Wagner. **Vitamin D Needs of Preterm Infants.** *NeoReviews* 2009;10:e590-e599

# INDIAN STUDY (AIIMS)

- Daily vitamin D supplementation to babies born at 28-34 weeks at a dose of 800 IU compared with 400 IU significantly reduces the prevalence of vitamin D deficiency in preterm infants
- Primary outcome was VDD (serum 25-hydroxyvitamin D levels ,20 ng/mL) at 40 weeks' PMA. Secondary outcomes were VDD, bone mineral content, and bone mineral density at 3 months' corrected age (CA)
  - Pediatrics 2014;133:e628-e634

# RECOMMENDATIONS FOR SUPPLEMENTATION OF MOTHERS

- A randomized, controlled trial with mothers who were supplemented with 6000 IU (study) or 400 IU/day (controls).
- The vitamin D levels in the breast milk of study group and in the exclusively breastfed infants themselves were found to be equivalent to the infants who received 300 IU per day with no toxic effects
  - Hollis et al. *Am J Clin Nutr* 2004; 80(suppl): 1752S-85.

# TAKE HOME MESSAGES

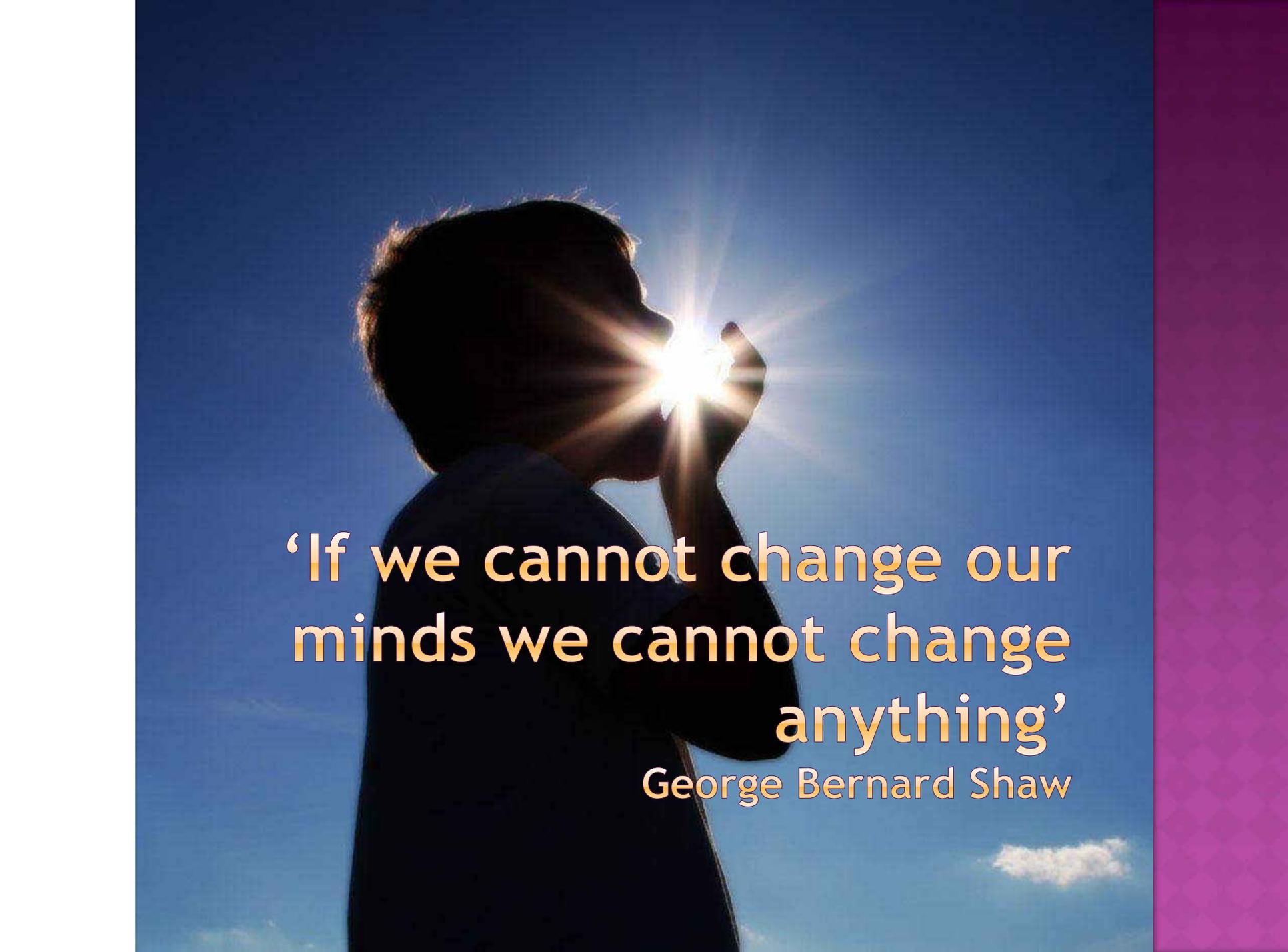
- ◉ Vitamin D deficiency is rampant in our country both in pregnant mothers and young infants
- ◉ It mostly remains subclinical and undetected but can manifest as frank hypocalcaemia in neonates
- ◉ Deficiency can have long term implications not only on bone health but on immune responses, allergies, neurodevelopment and incidence of diabetes, cancers and cardiovascular disease in adulthood

# TAKE HOME MESSAGES

- ◉ All pregnant and lactating women in our country **MUST** be supplemented with **ADEQUATE** amounts of Vit D (800-1000 IU/day should be considered along with 1000 mg Ca/day)
- ◉ Supplementation of all term, breast-fed neonates with Vit D **STARTING FROM THE FIRST FEW DAYS OF LIFE** with 400 IU/day should be considered
- ◉ Preterms will need higher doses (800-1000 U/day) of Vit D depending on GA along with calcium and phosphate

Myth No 6: The hype about Vit D is just a passing fad...

REALITY NO 6

A silhouette of a person shouting into a megaphone against a bright sun in a blue sky. The sun is positioned behind the megaphone, creating a lens flare effect. The person's head and hand are visible in silhouette against the bright light. The background is a clear blue sky with a few wispy clouds near the bottom right. A vertical purple bar is on the far right edge of the image.

**‘If we cannot change our  
minds we cannot change  
anything’**

**George Bernard Shaw**