

# Breast Milk and Infection



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# Benefits

## ◆ Nutrition

## ◆ Digestion

- ◆ amylase, lipase, esterase

## ◆ Immunological

- ◆ sIgA, IgG, C', IF, lysozyme, lactoferrin

## ◆ Decreased disease rates

- ◆ Necrotizing enterocolitis (NEC), obesity, coeliac, arteriosclerosis, allergy



# Infectious agents in breast milk



# Infectious agents in breast milk

## ◆ Viruses

- HIV 1 & 2
- HTLV I & II
- CMV
- Hepatitis B, C, E
- Rubella
- HSV 1 & 2
- VZV, EBV, HHV 7
- TT virus

## ◆ Protozoa

- *Toxoplasma gondii*
- *Trichinella spiralis*

## ◆ Bacteria

- Group B streptococcus
- *S. aureus*
- *M. tuberculosis*
- *T. pallidum*
- *L. monocytogenes*
- *Coxiella burnetii*
- *Salmonella* spp.
- *Vibrio cholerae*

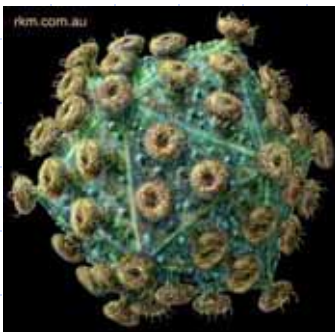
# Human Immunodeficiency Virus

## ◆ Neonatal infection

- ◆ prenatal, intrapartum, postnatal
- ◆ contribution of each stage?

## ◆ Breastmilk

- ◆ transfused mother \*
- ◆ macrophages / epithelial cells
- ◆ cell-free component



\* Ziegler JB, et al. Postnatal transmission of AIDS-associated retrovirus from mother to infant. *Lancet* 1985;1:896-7.

# Human Immunodeficiency Virus

## ◆ Nairobi study

- ◆ 16.2% transmission due to breast feeding
- ◆ Formula feeding prevented 44% of cases

Nduati R, et al. Effects of breastfeeding and formula feeding on transmission of HIV-1: a randomized clinical trial. *JAMA* 2000;283:1167-74

## ◆ Meta-analysis (10 studies) - additional risk

- ◆ existing HIV positive: 14%
- ◆ [post-partum acquired HIV: 29%]

Dunn DT, et al. Risk of HIV-1 transmission through breast-feeding. *Lancet* 1992;340:585-8

# Human Immunodeficiency Virus

## ◆ Factors influencing transmission:

- ◆ Nipple/breast abnormalities (bleeding)
- ◆ Poor nutrition (vitamin A deficiency)
- ◆ Duration of breastfeeding
- ◆ Viral load
- ◆ Antiretroviral agents
- ◆ Drug-resistant strains
- ◆ Colostrum
  - cellular content
  - glycosaminoglycans



Credit: NIAID

# HIV - Conclusions

## ◆ Developed countries

- ◆ Clean water
- ◆ Commercial formulas
- ◆ AVOID breast feeding

## ◆ Developing countries

- ◆ Pasteurisation
- ◆ Vitamin A supplementation
- ◆ Anti-retrovirals
- ◆ Duration of breast feeding

## ◆ HIV-2

- ◆ Transmission uncommon
- ◆ Role of breastfeeding unknown

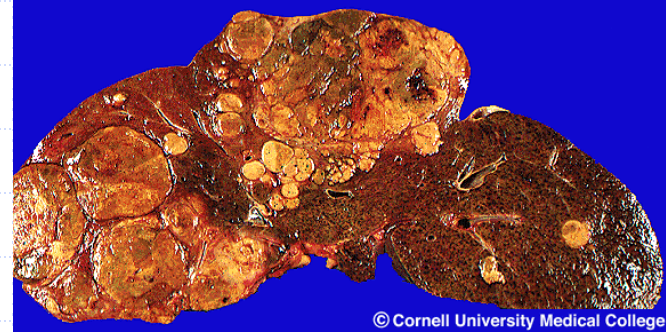




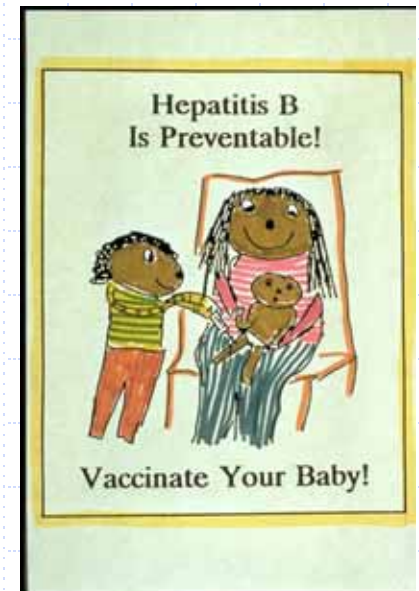


**YEAH, MY MOM IS ALWAYS NURSING MY BROTHER.  
HE'S ON "COMMAND FEEDING."**

# Hepatitis B Virus



- ◆ HBsAg and HBeAg present in breast milk
- ◆ No transmission described
- ◆ HBIG + vaccine further reduce any theoretical risk of transmission
  
- ◆ Recommendation:
  - Not a contraindication

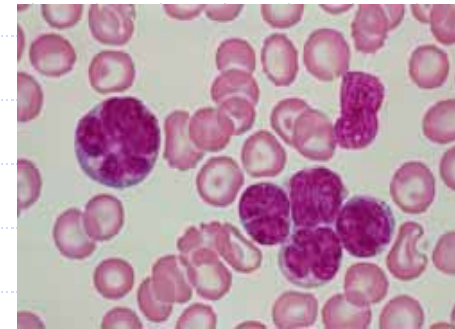
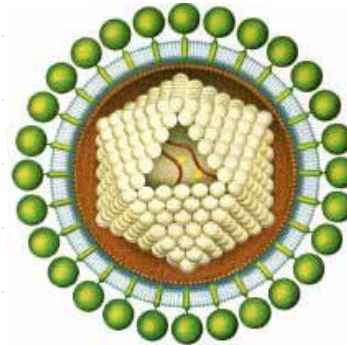
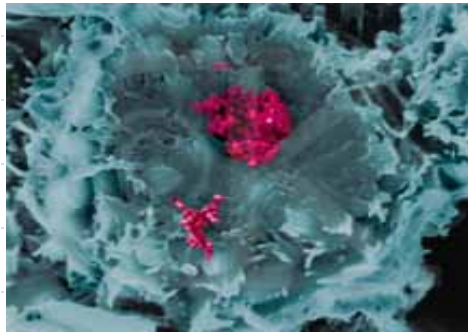


# Hepatitis C Virus

- ◆ HCV RNA present in breast milk
- ◆ No transmission described
  - ◆ Identical transmission rate in breast and bottle-fed
  
- ◆ Recommendation:
  - Transmission theoretically possible
  - Dependent on viral load (HIV co-infection)
  - Individual counselling



# Human T-Cell Lymphotropic Viruses I and II



# Human T-cell Lymphotropic Virus I

- ◆ Oncogenic retrovirus

  - ◆ family: *Oncovirinae*

- ◆ First isolated in 1980<sup>1</sup>

- ◆ 10-20 million infected



Dr Robert Gallo

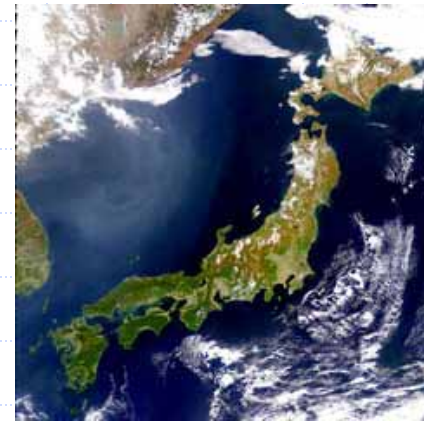
1. Poiesz BJ. *Proc Natl Acad Sci* 1980;77:7415-9

# Endemic Areas

- ◆ Japan
- ◆ Caribbean
- ◆ Africa (central & south)
- ◆ South America (Brazil)
- ◆ Iran
- ◆ Iraq
- ◆ PNG
- ◆ India
- ◆ China
- ◆ Malanesia

seroprevalence

3-5 (-30)%



# Non-Endemic Areas

	<u>seroprevalence</u>
◆ Europe	0.6%
◆ United Kingdom	0.2%
◆ USA	0.1%
◆ Australia	0.001%
■ Aboriginal	
Alice Springs	13.9%
Darwin	0.5%



# HTLV-I Transmission

## ◆ Mother → child

- ◆ Breast milk
- ◆ Intra-uterine – cord blood proviral DNA
- ◆ Horizontal – saliva (unconfirmed)

## ◆ Sexual contact

- ◆ Male → female (4x more common)

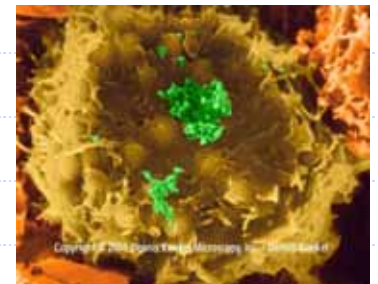
## ◆ Blood transfusion

- ◆ Cellular products – 15-80%
- ◆ Screening programs



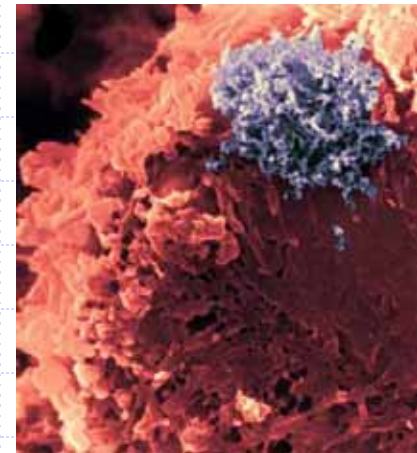
# Human T-cell Lymphotropic Virus I

- ◆ Derived from Simian T-cell Lymphotropic Virus I
- ◆ Infect CD4 T-Helper cells
- ◆ Chronic T-cell proliferation → enhanced transcription of cellular genes → accumulation of mutations → oncogenesis



# HTLV-I Disease Associations

- ◆ Adult T-cell Leukaemia/Lymphoma
- ◆ Tropical Spastic Paraparesis / HTLV-I Associated Myelopathy
- ◆ Dermatitis (children)
- ◆ Bronchopneumopathy
- ◆ Cryoglobulinaemia
- ◆ Polymyositis
- ◆ Arthropathy
- ◆ Uveitis



# Adult T-cell Leukaemia/Lymphoma

- ◆ Median age 55 years
- ◆ Prolonged 'incubation period'
- ◆ M:F 1.5 : 1
- ◆ 5% lifetime risk
  - ◆ 0.1% per annum

# ATL – Clinical Types

	% Total	Survival (months)	5-year survival
Acute	55%	6.2	5%
Lymphomatous	20%	10.2	6%
Chronic	20%	24.3	27%
Smouldering	5%	-	63%

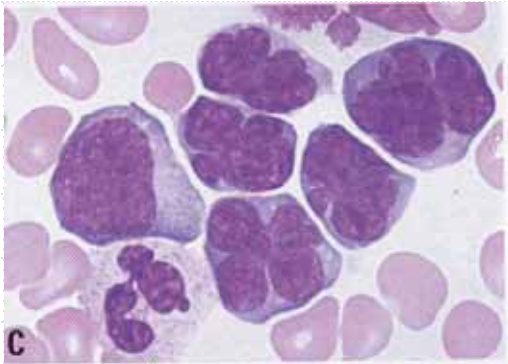
# Adult T-cell Leukaemia/Lymphoma

## ◆ Presentation

- ◆ Lymphadenopathy
- ◆ Hepato-splenomegaly
- ◆ Skin lesions
- ◆ Thirst

## ◆ Treatment

- ◆ Anti-retrovirals
- ◆ Alpha-interferon
- ◆ Bone marrow transplantation



Flower cell



Skin nodule



Skull: lytic lesions

# HTLV-1-Associated Myelopathy

◆ Jamaican neuropathy, 1955

◆ M:F 1:3

◆ Onset ~40 years

◆ Presentation

- ◆ Progressive spastic paraparesis
- ◆ Parasthesias
- ◆ Urinary incontinence

◆ Lifetime risk 1-2%

◆ Post transfusion – incubation 18 weeks



# Mother-to-Child Transmission

- ◆ 1984: HTLV-I in breast milk
- ◆ hEBM → marmoset → infection
- ◆ Source:
  - ◆ Lymphocytes
  - ◆ Basal mammary epithelial cells
- ◆ Risk<sup>1</sup>:
  - ◆ Breast (12 mo) 15.7%
  - ◆ Formula (12 mo) 3.6%  $p < 0.001$



Common marmoset

1. Hino S. *J Acquir Immune Defic Syndr Hum Retrovirol* 1996;13:S15-9

# Mother-to-Child Transmission

## ◆ Maternal antibody protective<sup>1</sup>

■ $\geq 7$ months	14.4%	RR 3.7, p=0.02
■ $\leq 6$ months	4.4%	
■ Formula	5.7%	RR 0.77, p=0.47

## ◆ Short-term breast feeding<sup>2</sup>

■ $< 12$ months	9%	RR 3.4 (1.7-6.9)
■ $> 12$ months	32%	

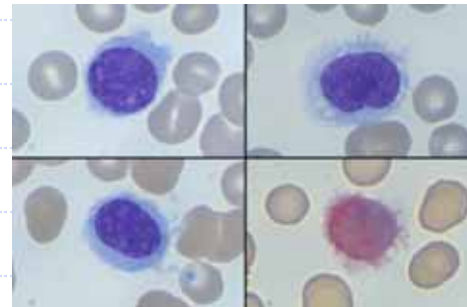
1. Takahashi K. *Int J Cancer* 1991;49:673-7

2. Wiktor SD. *J Hum Virol* 1997;1:37-44



# Human T-cell Lymphotropic Virus II

- ◆ Endemic groups – Africa, South America
- ◆ Intravenous drug use
  - ◆ United States 5%
  - ◆ ? Tropical spastic paraparesis / neuropathy
  - ◆ ? T-cell hairy cell leukaemia
  - ◆ 14% of breast-fed infants infected



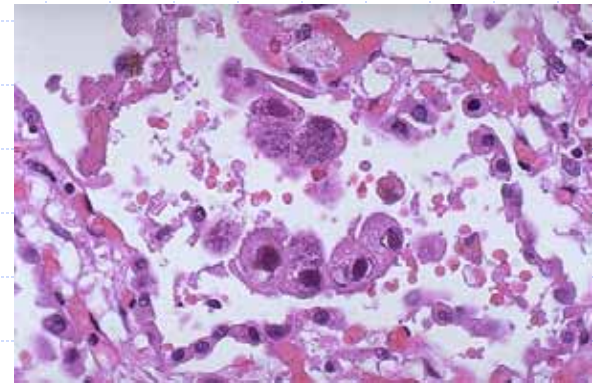
# Recommendations

- ◆ Screen high-risk groups
- ◆ Avoid breast feeding
  - ◆ 80% reduction in Japan
- ◆ If breast-fed:
  - ◆ Duration < 6 months



# Cytomegalovirus

- ◆ Cellular + cell-free components
- ◆ Most infected infants asymptomatic
- ◆ At risk babies:
  - Premature
  - Immunocompromised
  - Seronegative mother



# Cytomegalovirus

## ◆ Presentation:

- Rash, hepatitis, pneumonitis
- Thrombocytopenia, neutropenia

## ◆ Recommendation:

- Benefits may outweigh dangers
- Individual counselling



Rash



Hepatosplenomegaly

# Herpes Simplex Virus 1

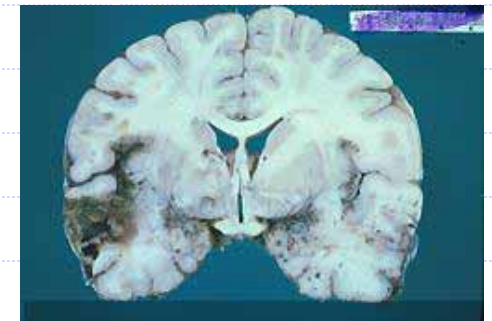
- ◆ Primary infection

- ◆ Shed in breast milk

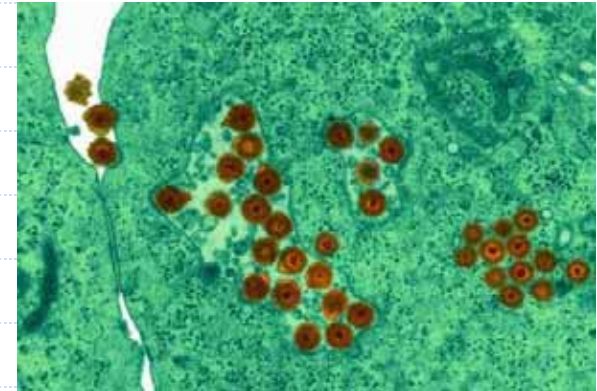
- ◆ Recurrent lesions on breast

- ◆ Recommendation:

- Primary: avoid breast feeding
  - Recurrent: avoid contact with lesions



# Other Herpesviridae



## ◆ Varicella Zoster Virus

- ◆ DNA in milk but no transmission

## ◆ Epstein-Barr Virus

- ◆ DNA in milk but no transmission

## ◆ Human Herpes Virus 7

- ◆ DNA in milk but no significant transmission



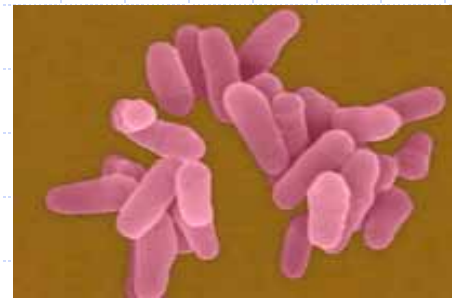
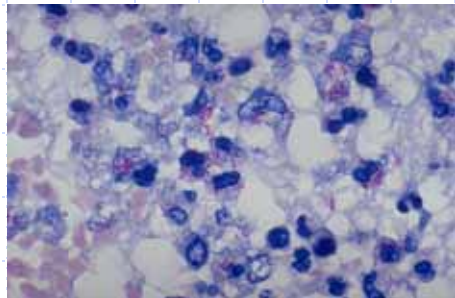
# *Mycobacterium tuberculosis*

## ◆ Tuberculous breast abscess

- ◆ Rare
- ◆ Avoid breast feeding until treated

## ◆ Open pulmonary tuberculosis

- ◆ Separate baby and mother until treated (2/52)
- ◆ Expressed breast milk OK





# Rubella Virus



- ◆ Wild-type and vaccine strains isolated from breast milk

- ◆ Single case report\*



- ◆ Breast feeding *not* contraindicated after vaccination or wild-type infection

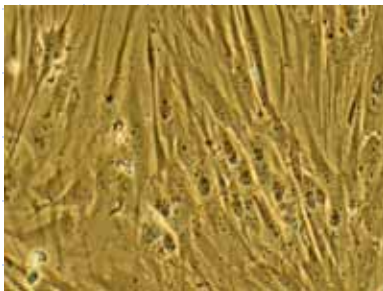
\* Klein EB, et al. Neonatal rubella in a breast-fed infant after postpartum maternal infection. *J Pediatr* 1980;97:774-5



# *Toxoplasma gondii*



- ◆ Acute post-natal toxoplasmosis<sup>1</sup>
- ◆ Breast feeding *not* contraindicated and may provide protective antibodies



1. Bonametti AM, et al. *J Trop Pediatr* 1997;43:116



# Expressed Breast Milk – incorrect administration

- ◆ Informed consent
- ◆ Serology – source and recipient mothers
  - ◆ HCV, HIV, HBsAg
  - ◆ Repeat at 3 months on source mother
  - ◆ [Consider CMV in specific circumstances]
  
- ◆ HBV – vaccine (+ HBIG)
- ◆ HIV – antiretrovirals
- ◆ HCV – peg-interferon + ribavirin
- ◆ CMV – ganciclovir

# Milk Banking

- ◆ Popular in USA and Europe
- ◆ Donor mothers screened:
  - ◆ HIV-1/2, HTLV-I/II, HBsAg, HCV, syphilis
  - ◆ Excluded if active HSV or VZV infections
- ◆ Milk screened for bacterial contamination
- ◆ Pasteurisation (62.5°C, 30 minutes)
- ◆ Frozen (-20°C)



YES, NURSING A TODDLER IS DIFFERENT AND VERY REWARDING. IT GIVES US SOME SPECIAL... UM... QUIET... UHH... MOMENTS TOGETHER. OW! WOULD YOU HOLD ON A MINUTE?

# Sterilising EBM Equipment

- ◆ Pump kits re-used by different mothers
  - ◆ semi-critical items
  - ◆ in contact with mucous membrane
- ◆ Maintenance by the mother
- ◆ Disinfection between mothers



# Sterilising EBM Equipment

## ◆ Maintenance by the mother

- ◆ rinse with warm soapy water between uses
- ◆ disinfect daily

Hypochlorite  
sanitation only



Avent steamer  
clinical disinfection





# Sterilising EBM Equipment

## ◆ Disinfection between mothers

- ◆ rinse with cold water
- ◆ wash in warm soapy water
- ◆ processing in CSSD - steam sterilisation or thermal disinfection

## ◆ Benefits

- ◆ central location
- ◆ visual checks for damage
- ◆ better quality control





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