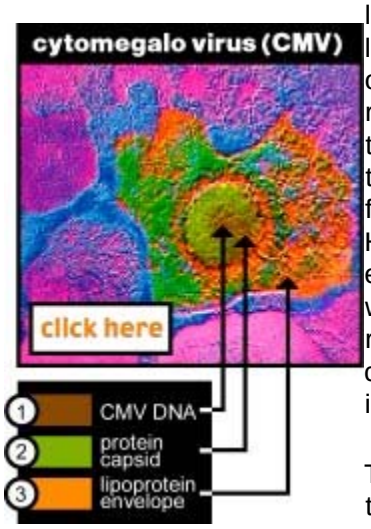
LIPID COATED VIRUS and BACTERIA

(LCVs) and Bacteria (LCBs) - Some of the microorganisms inactivated by the lauric acid monoglycerides are listed in the table below. Many of the pathogenic organisms reported to be inactivated by these antimicrobial lipids are those known to be responsible for opportunistic infections in HIV-positive individuals. For example, concurrent infection with cytomegalovirus is recognized as a serious complication for HIV+ individuals.



The properties that determine the anti-infective action of these lipids are related to their structure; e.g., monoglycerides, free fatty acids. The monoglycerides are active, diglycerides and triglycerides are inactive. Of the saturated fatty acids, lauric acid has greater antiviral activity than either caprylic acid (C-8), capric acid (C-10) or myristic acid (C-14) for these viruses.

The antiviral action attributed to monolaurin is that of solubilizing the lipids and phospholipids in the envelope of the virus causing the disintegration of the virus envelope. In effect, it is reported that the fatty acids and monoglycerides produce their killing/inactivating effect by lysing the (lipid bilayer) plasma membrane. However, there is evidence from some recent studies that one antimicrobial effect of monolaurin is related to its interference with signal transduction in cell replication.

Table 1a Lipid Coated Viruses (LCVs)	
type	**description**
virus	Human immunodeficiency virus HIV-1 or HIV+
virus	Measles virus
virus	Herpes simplex virus-1 (HSV-1)
virus	Herpes simplex virus-2 (HSV-2)
virus	Herpes viridae (all)
virus	Human lymphotropic viruses (type 1)
virus	Vesicular stomatitis virus (VSV)
virus	Visna virus
virus	Cytomegalovirus
virus	Epstein-Barr virus
virus	Influenza virus
virus	Leukemia virus
virus	Pneumonovirus
virus	Sarcoma virus
virus	Syncytial virus
virus	Rubeola virus

Table 1b Lipid Coated Bacteria (LCBs)	
type	**description**
bacterium	Listeria monocytogenes
bacterium	Helicobacter pylori (gram negative)
bacterium	Hemophilus influenzae (gram negative)
bacterium	Staphylococcus aureus
bacterium	Streptococcus agalactiae
bacterium	Groups A,B,F & G streptococci
bacterium	Gram-positive organisms
bacterium	Gram-negative organisms if pretreated with chelator

Table 1 References

1. Isaacs, C.E., Kim, K.S, Thormar, H. Inactivation of enveloped viruses in human bodily fluids by purified lipids. *Annals of the New York Academy of Sciences* 1994;724:457-464.

2. Kabara, J.J. Fatty acids and derivatives as antimicrobial agents -- A review, in *The Pharmacological Effect of Lipids* (JJ Kabara, ed) American Oil Chemists' Society, Champaign IL, 1978, pp.1-14.

3. Kabara, J.J. Antimicrobial agents derived from fatty acids. *Journal of the American Oil Chemists Society* 1984;61:397-403.

4. Kabara, J.J. Inhibition of *staphylococcus aureus* in *The Pharmacological Effect of Lipids II* (J.J. Kabara, ed) American Oil Chemists' Society, Champaign IL, 1985, pp.71-75.

5. Fletcher, R.D., Albers, A.C., Albertson, J.N., Kabara, J.J. Effects of monoglycerides on *mycoplasma pneumoniae* growth, in *The Pharmacological Effect of Lipids II* (JJ Kabara, ed) American Oil Chemists' Society, Champaign IL, 1985, pp.59-63.

6. Hierholzer, J.C. and Kabara, J.J. In vitro effects of monolaurin compounds on enveloped RNA and DNA viruses. *Journal of Food Safety* 1982;4:1-12.

7. Boddie, R.L. and Nickerson, S.C. Evaluation of postmilking teat germicides containing Lauricidin, saturated fatty acids, and lactic acid. *Journal of Dairy Science* 1992;75:1725-1730.

8. Wang, L.L. and Johnson, E.A. Inhibition of Listeria monocytogenes by fatty acids and monoglycerides. *Appli Environ Microbiol* 1992; 58:624-629.

9. Isaacs, C.E., Thormar, H. The role of milk-derived antimicrobial lipids as antiviral and antibacterial agents. in *Immunology of Milk and the Neonate* (Mestecky J, et al, eds) Plenum Press, New York, 1991.

10. Isaacs, C.E., Litov, R.E., Marie, P., Thormar, H. Addition of lipases to infant formulas produces antiviral and antibacterial activity. *Journal of Nutritional Biochemistry* 1992;3:304-308.

11. Isaacs, C.E., Schneidman, K. Enveloped Viruses in Human and Bovine Milk are Inactivated by Added Fatty Acids(FAs) and Monoglycerides(MGs). *FASEB Journal*. Abstract 5325, p.A1288, 1991.

12. Isaacs, C.E., Thormar, H. Membrane-disruptive effect of human milk: inactivation of enveloped viruses. *Journal of Infectious Diseases* 1986;154:966-971.

13. Thormar, H., Isaacs, E.C., Brown, H.R., Barshatzky, M.R., Pessolano, T. Inactivation of enveloped viruses and killing of cells by fatty acids and monoglycerides. *Antimicrobial Agents and Chemotherapy* 1987;31:27-31.

14. Isaacs, C.E., Kashyap, S., Heird, W.C., Thormar, H. Antiviral and antibacterial lipids in human milk and infant formula feeds. *Archives of Disease in Childhood* 1990;65:861-864.

15. Isaacs, E.C., Thormar, H. Human milk lipids inactivated enveloped viruses. in *Breastfeeding, Nutrition, Infection and Infant Growth in Developed and Emerging Countries* (Atkinson SA, Hanson LA, Chandra RK, eds) Arts Biomedical Publishers and Distributors, St. John's NF, Canada, 1990.

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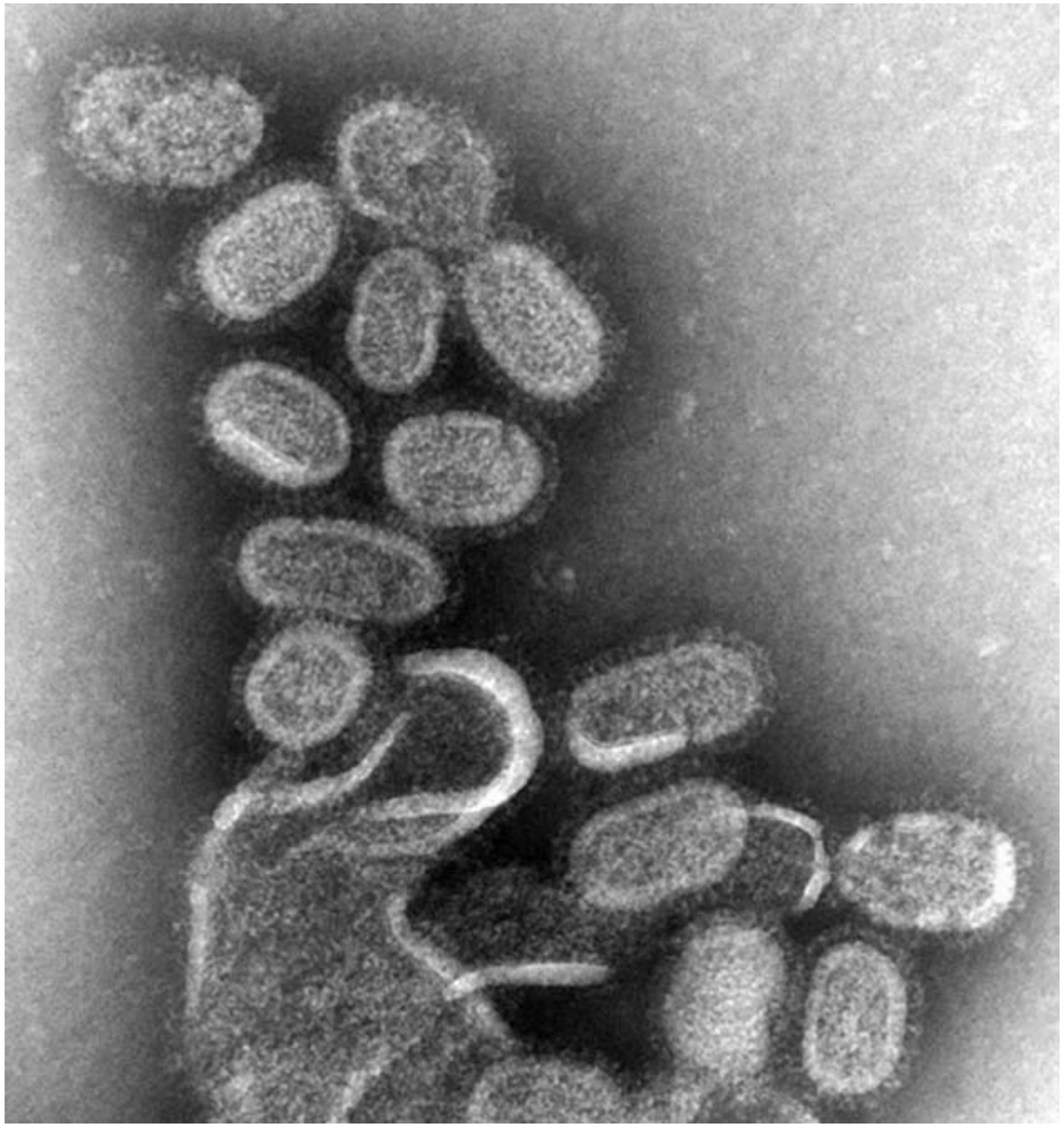

Recreated influenza virions from the 1918 flu that killed an estimated 50 million people. Credit: CDC/Terrence Tumpey