

Virus Name: Ebola		Abbreviation: EBOV
Status Probably not Arbovirus	Select Agent Yes	SALS Level 4
SALS Basis Results of SALS surveys and information from the Catalogue.		
Other Information DOC Permit Required		
Antigenic Group Marburg		

SECTION I - Full Virus Name and Prototype Number

Prototype Strain Number / Designation ME strain	Accession Number	Original Date Submitted 6/12/1984
Family Not listed	Genus Not listed	
Information From S.R. Pattyn (1), E.T.W. Bowen (2), P.A. Webb (3).	Address (1)Institut Voor Tropische, Geeneskunde, Antwerp, Belgium(2) M.R.E., Porton Down, Salisbury, Wilts., England(3) Virology Div.,CDC, Atlanta, GA,USA	
Information Footnote		

Section II - Original Source

Isolated By (name) S.R. Pattyn (1), E.T.W. Bowen (2), P.A. Webb (3)	Isolated at Institute	
Host Genus Man	Species	Host Age/Stage Adult
Sex Female		
<u>Isolated From</u> Serum/Plasma	<u>Isolation Details</u>	
Signs and Symptoms of Illness Severe, prostrating, febrile illness with hemorrhagic signs and rash	Arthropod	
Time Held Alive before Inoculation		
Collection Method unknown	Collection Date	
Place Collected (Minimum of City, State, Country) Yambuku and Kinshasa*, Zaire		
Latitude 2° 45' N	Longitude 22° 10' E	
Macrohabitat Undulating tropical rain forest, 400 meters altitude	Microhabitat	Method of Storage until Inoculated Frozen, -60dC
Footnotes		

Section III - Method of Isolation

Inoculation Date
10/2/1978

Animal (Details will be in Section 6)
GP (Tissue Culture)

Route Inoculated Intraperitoneal	Reisolation Yes
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Other Reasons

Homologous Antibody Formation by Source Animal

Test(s) Used

Footnotes

Section IV - Virus Properties

Physicochemical
RNA, Single Strand

Pieces (number of genome segments) 1	Infectivity No	Sedimentation Coefficients(s) 1300-1400(S)
Percentage wt, of Virion Protein 1.1%	Lipid in membrane	Carbohydrate
Virion Polypeptides: Number 4 major	Details 4 major and an L protein. Additional polypeptides may be present, but none unequivocally identified (9).	
Non-virion Polypeptides: Number	Details	
Virion Density 1.14 gm/ml in potassium tartrate	Sedimentation Coefficients(s) 46(S)	
Nucleocapsid Density 1.32 gm/ml in CsCl	Sedimentation Coefficients(s) (S)	

Stability of Infectivity (effects)

pH (infective range)

Lipid Solvent (ether - % used to test) 50%, 4dC, 1 hr	After Treatment Titer <1.7 dex	Control Titer 6.3 dex
Lipid Solvent (chloroform)	After Treatment Titer	Control Titer
Lipid Solvent (deoxycholate)	After Treatment Titer	Control Titer

Other (formalin, radiation)
60dC for 1 hr. ttr_aftr_ <1.7 dex. contrl_ttr 6.3 dex

Virion Morphology

Shape Filamentous with some branching	Dimensions 130-14000 x ± 80 nm
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Mean nm	Range 300-1500nm
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Measurement Method Negative contrast electron microscopy	Surface Projections/Envelope Regular 7-10 nm long, envelope present	Nucleocapsid Dimensions, Symmetry
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MorphogenesisSite of Constituent Formation in Cell
CytoplasmSite of Virion Assembly
Plasma membraneSite of Virion Accumulation
Extracellular spaceInclusion Bodies
Yes; characteristic masses of nucleocapsids in cytoplasm

Other

HemagglutinationHemagglutination
Not tried

Antigen Source

Erythrocytes (species used)

pH Range

pH Optimum

Temperature Range

Temperature Optimum

Remarks

***Disease originally contracted in Yambuku. Transported to mission hospital in Kinshasa.**

Serologic Methods Recommended

IFA

Footnotes

Disease originally contracted in Yambuku. Transported to mission hospital in Kinshasa.*Section V - Antigenic Relationship and Lack of Relationship to Other Viruses**

Ebola virus is antigenically distinct by IFA test from 10 catalogued arenaviruses, CHF-Congo, yellow fever and RVF.

The weak cross-reactions between Ebola and Marburg by IFA are shown below:

Serums	Time after onset	Antigen	
		Marburg	Ebola
Convalescent human Zaire (S.M.)	1 month	4	160
Single injection GP Marburg	12 days	>640	5
Single injection GP Ebola	10 days	2	256

Virus isolates from two discrete outbreaks of Ebola hemorrhagic fever were shown to be antigenically distinct serotypes by a sensitive radioimmunoassay [17].

Section VI - Biologic Characteristics

Virus Source (all VERTEBRATE isolates)
 Blood (M), liver (M), serum/plasma (M), semen (M)

Lab Methods of Virus Recovery (ALL ISOLATIONS)
 Guinea pig (200-250 gms), newborn mice, Vero cell cultures

Cell system (a)	Virus passage history (b)	Evidence of Infection						
		CPE			PLAQUES			Growth Without CPE +/- (g)
		Day (c)	Extent (d)	Titer TCD50/ml (e)	Day (c)	Size (f)	Titer PFU/ml (e)	
Vero (CL)	Patient's serum,	3	1+	5.5**				
Vero (CL)	Vero 1	9	4+					
Vero (CL)	GP3 Vero1	11-13	4+		10-12	2-3 mm		
Vero (CL)	Zaire, GP3 Vero2 Patient's serum,				5-7	2-5 mm	6.4**(12)	
PtK 1 (CL)	Vero 2	3-7	CPE (7)					
TB-1Lu (CL)		3-10	CPE (7)					
MDCK (CL)		7-10	CPE (7)					
Indian muntjac		10-11	CPE (7)					
RD (CL)		8-13	CPE (7)					

** Expressed in dex

Vertebrate (species and organ) and arthropod	No. isolations/No. tested	No. with antibody/No. tested Test used	Country and region
Man		2/2,245 HI	California, USA
Man		0/62 CF	
Lepus californicus	7/1,066	386/1,278 HI	Kern Co., California; NV; Utah; AZ, USA
Sylvilagus auduboni	3/601	75/597 HI	Kern Co., California; WI; AZ, USA
Lepus americanus		40/216 HI	Montana, USA;, Canada
Ammospermophilus nelsoni	0/1,308	16/956 HI	Kern Co., California, USA
Citellus beecheyi	0/230	1/194 HI	Kern, Mendocino Cos., California, USA
Other rodentia, chiroptera, carnivora chiroptera,	0/4,489	6/3,238 HI	
Domestic mammals (cattle, horses, pigs, goats, dogs, sheep)		2/1537 HI	Kern, Mendocino Cos., California; Hawaii, USA
Odocoileus hemionus		2/242(sheep)	
Mosquitoes: Culex, Anopheles, Aedes Culiseta, spp.	0/236,755	0/105 HI	California, USA
Ticks: from leporids;	0/8,731		Kern Co., California, USA
from other animals	0/18,911		
Fleas: from leporids;	0/2,912		
from other animals	0/6,360		
Midges and gnats:			
Culicoides variipennis;	61/122,089		
Other Culicoides spp. Leptoconops, Phlebotomus and Simulium spp.	0/11,689		
See References 5, 6.			

Experimental host and age	Passage history and strain	Inoculation Route-Dose	Evidence of infection	AST (days)	Titer log ₁₀ /ml
Mice (nb)	M.E. serum	ic	Sickness and death	5-7	
Mice (nb)	M.E. serum	ip	Sickness and death	5-9	
Mice (nb)		sc			
Mice (wn)	M.E. serum	ic	Sickness and death	4-5	
Mice (wn)	M.E. serum	ip	Sickness and death	4-5	
guinea pig	M.E. serum	ip	Fever, lethargy, sporadic deaths	12	
guinea pig	M.E. serum, GP3 Vero 1	ip	Death	9	6.5 (liver)
monkeys(vervet)	M.E. serum, GP2	ip	Fever, death	6	6.0 (serum)
monkeys(rhesus)	M.E. serum, GP3	ip	Fever, death	5-8	6.5 (blood)
monkeys (cynomolgus)	M.E. serum, GP3	ip	Fever, death	5-8	7.5 (liver) 7.5 (spleen)

Section IX - Experimental Arthropod Infection and Transmission

Arthropod species & virus source(a)	Method of Infection log10/ml (b)		Incubation period (c)		Transmission by bite (d)		Assay of arthropod, log10/ml (e)		
	Feeding	Injected	Days	°C	Host	Ratio	Whole	Organ	System

Section X - Histopathology

Character of lesions (specify host)
In man (3); in guinea pigs (2); in monkeys (5,6): Liver shows focal eosinophilic hepatocellular necrosis with modest inflammatory infiltration (M)(LV)

Inclusion Bodies Intranuclear
Man, Lower Vertabrates

Organs/Tissues Affected
Liver (M)(LV) Spleen and lymph nodes (LV)

Category of tropism
In man and monkey: lymphoid tissues, many visceral organs, particularly liver

Section XI - Human Disease

In Nature Significant	Residual	Death Significant
Subclinical	Overt Disease Significant	
Clinical Manifestations Fever (S), headache (S), arthralgia (S), myalgia (S), diarrhea(S), dry cough (R) conjunctivitis (S), rash (S), prostration (S), hemorrhagic signs (S)		
Number of Cases 651 (452 deaths) Sudan,Zaire 1976, Sudan 1979	Category (i.e. febrile illness, etc.) Hemorrhagic fever with rash	

Section XII - Geographic Distribution

Known (Virus detected)
N. Zaire (1,2,3) Maridi and Juba, Sudan (2)

Suspected (Antibody only detected)

1. Pattyn, S.R., et al. 1977. *Lancet* 1:573-574.
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3. Johnson, K.M., et al. 1977. *Lancet* 1:569-571.
4. Emond, R.T.D., et al. 1977. *Brit. Med. J.* 2:541-544.
5. Bowen, E.T.W., et al. 1978. *Trans. Roy. Soc. Trop. Med. Hyg.* 72:188-191.
6. Baskerville, A., et al. 1978. *J. Path.* 125:131-138.
7. Van der Groen, G., et al. In: *Ebola virus haemorrhagic fever*. S.R. Pattyn, editor. Elsevier Amsterdam, New York. 1978. pp. 255-260.
8. *Morbidity and Mortality Weekly Report* 1979. 28:557-559.
9. Kiley, M.P., et al. 1980. *J. Gen. Virol.* 49:333-342.
10. Regnery, R.L., et al. 1980. *J. Virol.* 36:465-469.
11. Saluzzo, J.F., et al. 1980. *Bull. Soc. Pathol. Exot.* 73:238-241.
12. Moe, J.B., et al. 1981. *J. Clin. Microbiol.* 13:791-793.
13. Johnson, B.K., et al. 1981. *Lancet* i:1420-1421.
14. Johnson, K.M., et al. 1981. *J. Inf. Dis.* 143:749-751.
15. Knobloch, J., et al. 1982. *Annales de Virologie* 133E:125-128.
16. Stansfield, S.K., et al. 1982. *J. Inf. Dis.* 146:483-486.
17. Richman, D.D., et al. 1983. *J. Inf. Dis.* 147:768-771.

Remarks

Cases listed above include several nosocomial hospital personnel infections in all three outbreaks. In addition, there were about 90 cases by syringe needle transmission in Yambuku, Zaire; 1976.