

Virus Name: Machupo		Abbreviation: MACV
Status 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 Tacaribe		

SECTION I - Full Virus Name and Prototype Number

Prototype Strain Number / Designation Strain Carvalho	Accession Number	Original Date Submitted 2/5/1985
Family Arenaviridae	Genus Arenavirus	
Information From Karl M. Johnson	Address Middle America Research Unit, Box 2011, Balboa Heights, Canal Zone	
Information Footnote Reviewed by editor		

Section II - Original Source

Isolated By (name) K.M. Johnson (1)	Isolated at Institute San Joaquin, Bolivia	
Host Genus Man	Species	Host Age/Stage 2 years
Sex Male		
<u>Isolated From</u>	<u>Isolation Details</u>	
Organs/Tissues	Spleen	
Signs and Symptoms of Illness Fatal case of Bolivian hemorrhagic fever	Arthropod	
Time Held Alive before Inoculation		
Collection Method Autopsy	Collection Date 5/18/1963	
Place Collected (Minimum of City, State, Country) San Joaquin, Bolivia		
Latitude 13° S	Longitude 64° 30' W	
Macrohabitat	Microhabitat	Method of Storage until Inoculated None
Footnotes		

Section III - Method of Isolation

Inoculation Date
5/18/1963

Animal (Details will be in Section 6)
nb hamster

Route Inoculated
ic and ip

Reisolation
Yes

Other Reasons

Homologous Antibody Formation by Source Animal
Not tested

Test(s) Used

Footnotes

Section IV - Virus Properties

Physicochemical
RNA, Single Strand

Pieces (number of genome segments) 2 viral	Infectivity	Sedimentation Coefficients(s) 30-31S;22-24 3 host RNAs in virion (12)(S)
Percentage wt, of Virion Protein	Lipid	Carbohydrate
Virion Polypeptides: Number	Details	
Non-virion Polypeptides: Number	Details	
Virion Density	Sedimentation Coefficients(s) (S)	
Nucleocapsid Density	Sedimentation Coefficients(s) (S)	

Stability of Infectivity (effects)

pH (infective range)

Lipid Solvent (ether - % used to test)	After Treatment Titer	Control Titer
Lipid Solvent (chloroform)	After Treatment Titer <5.0 dex	Control Titer 5.3 dex
Lipid Solvent (deoxycholate)	After Treatment Titer	Control Titer

Other (formalin, radiation)
Rapidly inactivated at 25 C and higher (5).

Virion Morphology

Shape Resembles LCM, Tacaribe (8)	Dimensions Approximately 150 nm	
Mean nm	Range nm	
Measurement Method	Surface Projections/Envelope	Nucleocapsid Dimensions,

Gradocol membrane (results provisional)

Symmetry

Morphogenesis

Site of Constituent Formation in Cell	Site of Virion Assembly	Site of Virion Accumulation
Inclusion Bodies	Other	

Hemagglutination

Hemagglutination No	Antigen Source SHB, spleen, liver several passage levels; crude alkaline, sucrose-acetone extracts.	Erythrocytes (species used) Several*
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pH Range 5.5-7.5	pH Optimum
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Temperature Range 4dC, 37dC	Temperature Optimum
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Remarks

*** Goose, wet chick, human, sheep, pigeon, Geoffrey's marmoset, hamster, mouse.**

Serologic Methods Recommended
CF, NT

Footnotes

*** Goose, wet chick, human, sheep, pigeon, Geoffrey's marmoset, hamster, mouse.**

Antigen	CF Test		
	Machupo	Antibody Junin	Tacaribe
Machupo	128	64	128
Junin	64	256	256
Tacaribe	64	128	512

Antigens: Sucrose-acetone extracted infected hamster (Machupo), or mouse (Junin, Tacaribe) brains. 2-4 units in test, as determined by homologous box titrations. Hamster antiserum (Machupo) obtained after 4 weekly IP injections 0.1 ml SHB virus; Ascitic fluid produced in mice (Junin, Tacaribe) by repeated IP injections SHB virus with equal parts Freund's complete adjuvant.

Virus	Neutralization Test		
	Machupo	Antibody Junin	Tacaribe
Machupo	3.0	0	0
Junin	0	4.0	1.0
Tacaribe	0	0	3.5

Dex virus neutralized, rounded off to nearest 0.5 dex. Test in continuous rabbit kidney cells (MA-111) and viruses estimated by plaques production [3].

Antisera to influenza A and B, parainfluenza types 1-4, mumps, Newcastle and LCM viruses failed to react in CF test with Machupo antigen. LCM CF antigen did not fix complement in presence of Machupo antiserum. Junin virus has been exhaustively tested by CF test against other known and suspected arboviruses with negative results [2].

Human sera collected following infection with Machupo virus give positive CF with Junin antigen [3]. Serologically related to LCM and other members of Tacaribe serogroup [9].

Section VI - Biologic Characteristics

Virus Source (all VERTEBRATE isolates)

Lab Methods of Virus Recovery (ALL ISOLATIONS)
Newborn mice

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)	
WI-26 (CL)	Carvallo	8-12	CPE, granular nondescript	+/- 5.0**				
MA-111 (CL)	Diff. P				6-10	Plaques		

** Expressed in dex

Section VII - Natural Host Range (Additional text can be added below table)

Vertebrate (species and organ) and arthropod	No. isolations/No. tested	No. with antibody/No. tested	Test used	Country and region
Man	5			San Joaquin, Bolivia
Calomys callosus	2/6			
Calomys callosus	9			Bolivia; 1963 (7)
Mollosus and Myotis sp.	0/65			San Joaquin, Bolivia
Proechimys and Oryzomys	0/33			Bolivia (7)

Experimental host and age	Passage history and strain	Inoculation Route-Dose	Evidence of infection	AST (days)	Titer log ₁₀ /ml
Mice (nb)	Carvallo SHB 2	ic 0.02	Neurological illness, death	16	6.7
Mice (nb)		ip 0.03	Neurological illness	17	3.7
Mice (nb)		sc			
Mice (wn)		ic			
Mice (wn)		ip			
mice (5-6 day)		ic,ip 0.02	CF antibodies		4.5
hamster (nb)		ic,ip 0.02	Neurological illness, death	12-14	6.9
hamster (5-6 wk)		ic 0.2	CF antibodies, virus excretion in urine		6.5
Calomys callosus (infant)			Chronic viremia, immune tolerance (6)		
Geoffrey's marmoset (ad)			Non-specific illness, death (5)	12-15	6.2
cat (ad)	Carvallo SHB 3	sc 0.2	No illness		
chicken (1-3 day)		sc 0.2	No illness		
horse (ad)		sc 0.2	No illness		
pig (ad)		sc 0.2	No illness; CF antibody prod.		
rhesus monkeys (ad)	SHB 3	sc 0.5	Viremia and death(11)	14.3-19.5	

Section IX - Experimental Arthropod Infection and Transmission

Arthropod species & virus source(a)	Method of Infection log ₁₀ /ml (b)		Incubation period (c)		Transmission by bite (d)		Assay of arthropod, log ₁₀ /ml (e)		
	Feeding	Injected	Days	°C	Host	Ratio	Whole	Organ	System

Section X - Histopathology

Character of lesions (specify host)

Newborn mice, ic: choroiditis, gliosis, vasculitis, perivasculitis with lymphocytic infiltration. Thymectomy abolished response (10).

Inclusion Bodies

Intranuclear

Organs/Tissues Affected

Category of tropism

Section XI - Human Disease

In Nature
Significant

Residual

Death
Significant

Subclinical

Overt Disease
Reported

Clinical Manifestations

Fever (S), headache(S), prostration (S), conjunctival inflammation (S), myalgia(S), arthralgia (R), CNS signs (including encephalitis) (S), hemorrhagic signs (S), leukopenia (S), rash (S), lymphadenopathy (S), vomiting (S)

Number of Cases
More than 300 (4)

Category (i.e. febrile illness, etc.)
Hemorrhagic fever

Section XII - Geographic Distribution

Known (Virus detected)
San Joaquin, Bolivia

Suspected (Antibody only detected)

Section XIII - References

1. Johnson, K.M., et al. 1965. *Proc. Soc. Exp. Biol. Med.* 118:113-118.
2. Mettler, N.E., et al. 1963. *Am. J. Trop. Med. and Hyg.* 12:647-652.
3. Wiebenga, N.H., et al. 1964. *Am. J. Trop. Med. and Hyg.* 13:626-628.
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Remarks