

Virus Name: Lassa		Abbreviation: LASV
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 LP	Accession Number	Original Date Submitted 11/10/1984
Family Arenaviridae	Genus Arenavirus	
Information From YARU	Address 60 College Street, New Haven, Connecticut 06510 USA	
Information Footnote Reviewed by editor		

Section II - Original Source

Isolated By (name) Buckley and Casals (1)	Isolated at Institute YARU	
Host Genus Man	Species	Host Age/Stage Adult
Sex Female		
<u>Isolated From</u>	<u>Isolation Details</u>	
Serum/Plasma		
Signs and Symptoms of Illness Severe, prostrating, febrile illness; Lassa fever (2,3)	Arthropod	
Time Held Alive before Inoculation		
Collection Method Venipuncture	Collection Date 2/25/1969	
Place Collected (Minimum of City, State, Country) Jos, Nigeria		
Latitude 10° 0' N	Longitude 8° 30' E	
Macrohabitat Town in Nigerian plateau	Microhabitat Bingham Memorial Hospital Wards	Method of Storage until Inoculated Frozen part of time; at 2-4dC part of time
Footnotes		

Section III - Method of Isolation

Inoculation Date
3/10/1969

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

Route Inoculated Reisolation
Yes

Other Reasons
Isolation from other serum samples and from pleural exudate of patient.

Homologous Antibody Formation by Source Animal
Yes

Test(s) Used
CF, NT, IFA

Footnotes

Section IV - Virus Properties

Physicochemical
RNA, Single Strand

Pieces (number of genome segments) 2 (22)	Infectivity	Sedimentation Coefficients(s) 30-31S;22-24(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	Control Titer
Lipid Solvent (deoxycholate) 0.5% final	After Treatment Titer No virus	Control Titer 7.5 dex
Other (formalin, radiation) 0.1% BPL inactivates virus but not CF activity		

Virion Morphology

Shape Pleomorphic, variable size	Dimensions 70-90 nm	
Mean nm	Range nm	
Measurement Method Electron microscopy (4)	Surface Projections/Envelope Envelope observed; regularly spaced	Nucleocapsid Dimensions, Symmetry

Morphogenesis

Site of Constituent Formation in Cell Internal electron-dense granules resembling ribosomes	Site of Virion Assembly	Site of Virion Accumulation
Inclusion Bodies	Other	

Hemagglutination

Hemagglutination Not tried	Antigen Source	Erythrocytes (species used)
pH Range	pH Optimum	
Temperature Range	Temperature Optimum	

Remarks

3 host RNAs in virion (22) * RNA deduced from the fact that replication is not inhibited by BUDR

Serologic Methods Recommended

CF, PRNT, IFA

Footnotes

3 host RNAs in virion (22) * RNA deduced from the fact that replication is not inhibited by BUDR

Complement-fixation. No positive reaction between Lassa antigen in dilution 1:4 (homologous titer = 16) and the following polyvalent or individual immune ascitic fluids (homologous titers in parentheses): Group A (32-256), Group B (16-256), Group C (64-128), Congo (256), EHD-NJ (16), Marburg (64), Nairobi sheep disease (128), Piry (64), Rift Valley fever (256), simian hemorrhagic fever (256). No positive reaction between human convalescent sera, patient LP (homologous titer = 64 and 128) at dilution 1:8 and higher and the following antigens at dilutions 1:4 and 1:8: Acara, Akabane, Amapari, Anopheles A, Anopheles B, Aruac, Bahig, Agua Preta, Benfica, Belem, Bertioga, Bhanja, Boracea, Bunyamwera, Bushbush, Navarro, California, Capim, Chaco, Chandipura, Changuinola, Buenaventura, CoAr 3627, Cocal, CTF, Congo, Cotia, Matariya, EgAn 1825-61, Burg el Arab, Embu, EMC, EHD-NJ, EthAr 1846-64, Farallon, Flanders, Guajara, Guama, Guaroa, Germiston, Hart Park, mouse hepatoencephalitis, herpes, Hughes, Oyo, Gabek Forest (IbAn 10065), Arumowot (IbAn 15736), IbAn 17143, Jos, IbAn 20433, Orungo (IbH 11306), Ieri, Nyando, Irituia, J-19, J-134, Johnston Atoll, Junin, Jurona, Kamese, Kemerovo, Kern Canyon, Ketapang, Koongol Kwatta, LCM, Lagos bat, Lone Star, Lukuni, Machupo, Marburg, Marco, Klamath, Mirim, Mossuril, Mt. Elgon bat, NDV, Nyamaninni, Nyando, Omsk hem. fever, Oropouche, Piry, Naples SF, Sicilian SF, poliioencephalitis of mice, poxvirus, Pacui, Pichinde, Punta Toro, rabies, Lebombo, Sathuperi, Sawgrass, Silverwater, simian hemorrhagic fever, Soldado, SudAr 1169-64, SudAr 1275-64, SudAr 1225-64, Tacaribe, Tacaiuma, Tamiami, Tataguine, Tembe, Thogoto, Trinita, Turlock VSI, VSNJ, Wad Medani, Witwatersrand, yellow fever and Nkolbisson.

Using mouse hyperimmune sera and ascitic fluids against Lassa and LCM viruses, a low titered but reproducible cross-reaction is detected between these two viruses, also with some of the antigens of the established Tacaribe group, as shown below ([1], and unpublished).

Antigen	Mouse Hyperimmune Immune Serum or Ascitic Fluid						
	Lassa 1	Lassa 2	LCM 1	LCM 2	Amapari	Tacaribe	Pichinde
Lassa	256	256	4	2	0	0	0
LCM	16	16	256	256	4	2	4
Tacarib	4	4				512	
Amapari	4	16			256		
Junin	4	2					
Tamiami	0	2					
Pichind	0	0					512
Controls	0	0	0	0	0	0	0

Reciprocal of dilution; 0 = no fixation, dilution 1:2

Serological differences have been noted between Lassa virus and a "Lassa-like" isolate obtained in Mozambique [17]. In addition, a monoclonal antibody prepared against LCM virus reacted in an immunofluorescence test with the Mozambique isolate, but not with Lassa virus [20].

Section VI - Biologic Characteristics

Virus Source (all VERTEBRATE isolates)
Blood (LV)

Lab Methods of Virus Recovery (ALL ISOLATIONS)
BHK-21 cell cultures

Cell system (a)	Virus passage history (b)	Evidence of Infection							Growth Without CPE +/- (g)
		CPE			PLAQUES				
		Day (c)	Extent (d)	Titer TCD50/ml (e)	Day (c)	Size (f)	Titer PFU/ml (e)		
Vero (CL)			CPE				Plaques (1)		
Aedes aegypti (CL)									- (1)
Ae albopictus (CL)									- (1)

Lassa virus multiplied to high titer (5.0-6.0 dex PFU/ml) in Vero, mouse L (CL), swine kidney (CL), human embryo kidney (CL), and diploid human embryo lung (CL) cell cultures. The virus multiplied to lower titers (4.0-5.0 dex PFU/ml) in BHK-21 (CL), CV-1 (CL), FL (CL), HEp-2 (CL) and MDCK (CL) cell cultures. No virus multiplication or plaque formation in chick embryo (PC) cell cultures. Virus plaques only in CV-1 and Vero cell cultures (21).

Vertebrate (species and organ) and arthropod	No. isolations/No. tested	No. with antibody/No. tested Test used	Country and region
Man		0/1,088 CF	India (19)
Rodents, insectivores, gerbils		0/310 CF	
Man			
Clinical cases	15/16		Nigeria
Lab infections	2/2		USA
Clinical cases	12/13		Jos, Nigeria (7)
	4/8		Zorzor, Liberia (8)
	12/21		Panguma, Tongo, Sierra Leone(10, 11)
Mus musculus	0/20		Jos, Nigeria
10 species	0/112		Zorzor, Liberia (12)
(Rattus rattus, 0/64; Mastomys erythroleucus 0/19; Leggada muscubides 0/6; L. setulosa, 0/4; Lophuronys sikapusi 0/11; Hybomys trivirgatus, 0/1; Heliosciuris rufobrachium, 0/4; M. gambianus, 0/1; Protoxerus stangeri, 0/1			
Crocidura sp. (shrew)	0/1		Zorzor, Liberia (12)
Bats (various spp.)	0/43		
Mastomys natalensis	18/109		Sierra Leone (14, 15)
Mastomys natalensis	1		Mozambique (17)

NT positive results in man: Adults, Nigeria, 1965-66, 8/458; 1969-70, 17/118; children, Nigeria 1965-66, 3/81; 1969-70, 5/84; Americans in Nigeria, 1, in Guinea 3(total tested = >400); Nigeria 23/281(7) Nigeria (NE State),29/600(13).

CE positive results in man: Zorzor, Liberia, 4/133 (8); Panguma, Tongo, Sierra Leone, 43/461 (10); staff at various hospitals, Sierra Leone, 20/187(10)

Section VIII - Susceptibility to Experimental Infection (include viremia)

Experimental host and age	Passage history and strain	Inoculation Route-Dose	Evidence of infection	AST	Titer
				(days)	log ₁₀ /ml
Mice (nb)	Patient's serum	ic .02	1 of 20 dead; no illness. Survivors had virus in urine at 80 days, also CF antibody. Subpassage in mice, no illness in 20: These had virus in urine and CF antibody 30 days later.		
Mice (nb)		ip			
Mice (nb)		sc			
Mice (wn)		ic			
Mice (wn)	LP, 3rd cell cult. pass.	ic .03	11/15 mice died, tremors convulsions	7	
Mice (nb)		ic .02	Mice well; 46 days later, virus in urine, CF antibodies.		
Saimiri sciureus (squirrel monkey)		im	Mild to fatal infection (18)		

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)

Heart, lung, liver congested; liver shows small necrotic areas. Spleen congested, malpighian bodies atrophic. Small intestine, striking edematous changes (2).

Inclusion Bodies

Intranuclear

Organs/Tissues Affected

Liver (M), spleen (V), kidney (M)

Category of tropism

Pantropic

Section XI - Human Disease

In Nature

Significant

Residual

Reported

Death

Significant

Subclinical

Overt Disease

Significant

Clinical Manifestations

Fever (S), prostration (S), conjunctival inflammation (S), myalgia (S), CNS signs (including encephalitis (R), hemorrhagic signs (R), leukopenia (R), lymphadenopathy (R); toxic, prostrating illness (11)

Number of Cases

>100 (2,3,6-8,12)

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

Hemorrhagic fever

Section XII - Geographic Distribution

Known (Virus detected)

Liberia, Nigeria, Sierra Leone, Mozambique (17)

Suspected (Antibody only detected)

Guinea: antibodies in 3 temporary residents

Section XIII - References

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Remarks

This is considered to be an extremely dangerous virus to work with in the laboratory; it should be handled only by competent individuals, in specially built, air-leak-proof facilities. Cultures of Vero cell line are the choice method for isolation and neutralization tests. There is no evidence indicating that this is an arbovirus.