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

Isolated From	Isolation Details
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

surface projec

Morphogenesis

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

Hemagglutination

Hemaggiutination	Antigen Source	Erythrocytes (species used)
Not tried		
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

Section V - Antigenic Relationship and Lack of Relationship to Other Viruses

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, polioencephalitis 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, Triniti, 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).

	Mouse Hyperimmune Immune Serum or Ascitic Fluid						
Antigen	**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							
		CPE			PLAQUES			Growth Without CPE	
		Day (c)	Extent (d)	Titer TCD50/ml (e)	Day (c)	Size (f)	Titer PFU/ml (e)	+/- (g)	
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).

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		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 (days)	Titer log10/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 log10/ml (b)		Incubation period (c)		Transmision 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)
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	Residual	Death
Significant	**Reported**	**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

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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.