Virus Name: La Crosse	Abbreviation: LACV

Status
Arbovirus

Select Agent
No

SALS Level
2

SALS Basis
Results of SALS surveys and information from the Catalogue.

Other Information

Antigenic Group
Califrona

SECTION I - Full Virus Name and Prototype Number

Prototype Strain Number / Designation

Accession Number

Original Date Submitted
12/29/1984

Family
Bunyaviridae

Genus
Bunyavirus

Information From
Wayne H. Thompson

Address
Department of Prev. Med., University of Wisconsin, Madison, WI

Information Footnote
Reviewed by editor

Section II - Original Source

Isolated By (name)
W.H. Thompson

Isolated at Institute
State Lab of Hygiene, Madison, WI

Host Genus
Man

Species

Host Age/Stage
4 year-old

Sex
Female

Isolated From	Isolation Details
Organs/Tissues	**Brain tissue**

Signs and Symptoms of Illness
A fatal case of meningo-encephalitis*

Arthropod

Time Held Alive before Inoculation

Collection Method
Brain tissues taken at autopsy by B.F.Kalfayan (1)

Collection Date
9/14/1960

Place Collected (Minimum of City, State, Country)
Pathology, La Crosse, Lutheran Hosp., Wisconsin

Latitude
44° N

Longitude
91° W

Macrohabitat
Child had lived in a forested valley area near the Mississippi river, upper midwestern USA;alt=600ft

Microhabitat

Method of Storage until Inoculated
Original tissues frozen in glass jars at -40dC

Footnotes

Section III - Method of Isolation

Inoculation Date
5/4/1964

Animal (Details will be in Section 6)
nb mice

Route Inoculated
ic and ip

Reisolation
Yes

Other Reasons
Sera of the mother, father, and three of the eight other chidlren had antibodies.

Homologous Antibody Formation by Source Animal

Test(s) Used
HI, CF, NT

Footnotes

Section IV - Virus Properties

Physicochemical
RNA

Pieces (number of genome segments)	Infectivity	Sedimentation Coefficients(s) (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) **1:2**	After Treatment Titer **2.3 dex**	Control Titer **5.8 dex**
Lipid Solvent (chloroform)	After Treatment Titer	Control Titer
Lipid Solvent (deoxycholate)	After Treatment Titer	Control Titer

Other (formalin, radiation)

Virion Morphology

Shape	Dimensions **95 nm**	
Mean nm	Range nm	
Measurement Method **Electron microscopy (19)**	Surface Projections/Envelope **Envelope observed**	Nucleocapsid Dimensions, Symmetry

Morphogenesis

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

Hemagglutination

Hemaggiutination	Antigen Source	Erythrocytes (species used)
Yes	**SMB ext. by sucrose-acetone**	**Goose**
pH Range	pH Optimum	
6.0-6.2		
Temperature Range	Temperature Optimum	

Remarks
HA activity has not been consistent quality or high enough titer to be used in HI tests. Maximum titer has been 1:40 * Hospitalized three days after onset of fever, headache, vomiting, convulsion and pleocytosis. ** A suit**

Serologic Methods Recommended
HI, CF, NT, and immunodiffusion tests

Footnotes
HA activity has not been consistent quality or high enough titer to be used in HI tests. Maximum titer has been 1:40 * Hospitalized three days after onset of fever, headache, vomiting, convulsion and pleocytosis. ** A suit**

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

Results of complement-fixation tests with the human isolate and other members of the CAL group [1] .

Antigens	Mouse hyperimmune sera: LAC	BFS283	SSH	TVT	Melao
La Crosse	128/>512	8/>512	8/512	8/512	8/512
BFS-283	32/64	32/128	8/256	8/128	8/256
Snowshoe hare	32/256	8/256	32/256	16/128	8/256
TVT	<8/<8	8/128	<8/<8	64/128	8/64
Melao	32/256	<8/<8	<8/<8	16/128	32/256

Antigen titer/antibody titer

Results of additional comparative CF, NT and immunodiffusion tests have since been reported also indicating serologic relationship of the La Crosse isolate to, but antigenic differences from, other California group viruses. [4] , [5] , [6]
Results of neutralization tests with antisera to isolates from Wisconsin mosquitoes [7] .

	Virus

Antisera	La Crosse (199 TCID50)	Snowshoe hare (31 TCID50)	Jamestown Canyon (31 TCID50)	Trivittatus (63 TCID50)
W-1805-64	40 [a]	20	20	10
W-2827-65	120	60	<10	<10
W-2985-65	160	20	80	20
W-401-67	640	40	15	30
W-581-67	80	30	30	15
W-968-67	>1280	30	80	80
W-946-67	160	15	20	15
W-1042-68	320	160	80	20
LAC	640	80	20	10
SSH	40	320	20	<10
JC	<10	<10	640	<10
TVT	<10	<1-	20	160

Antisera: prepared in guinea pigs.

( ): Dosage of virus in test.

[a] Reciprocal of highest dilution which neutralized CPE activity of virus in BHK-21 cells.

<10: 50% of cells alive, but some CPE evident at this dilution.

Section VI - Biologic Characteristics

Virus Source (all VERTEBRATE isolates)
Serum (M)

Lab Methods of Virus Recovery (ALL ISOLATIONS)
Newborn mice

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)	SM 4				6	1,4 mm	5.5* (25)		
LLC-MK2 (CL)					3	0.5-2.0-8.0 mm	6.0 (25)		
BHK-21 (CL)		2-3	CPE						

* 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
Tamias striatus (eastern chipmunk; blood)	7		Wisconsin, USA (21)
Sentinel gray squirrels (Sciurus carolienis; blood)	6		Wisconsin, USA (22)
Man (brain)	1		Wisconsin, USA (24)

In addition to the original isolate from the brain tissues of the fatal case of 1960, isolates have also been obtained from insects and the blood of sentinel rabbits caged in forested sites.

Of eight isolates of LAC obtained from mosquitoes in Wisconsin during 1964 through 1968, five were from 1,985 Aedes triseriatus, and one each from 35,865 Ae communis, 36,800 Ae trivittatus, and 1,818 Culex pipiens (7). Fourteen more isolates were obtained from Ae triseriatus collected in hardwood deciduous forest study areas during 1969-1970. Fifty-nine other isolates reported from or obtained by the CDC from other states, are from various species, but again, highest infection rates were in Ae triseriatus (8).

Neutralizing antibodies are present in sera of small forest-dwelling mammals in Wisconsin; in 62/117 (53%) of chipmunk, Tamias striatus; 68/176 (39%) of tree squirrels, Sciurus carolinensis and niger; 2/13 (15%) of cottontail, Sylviagus floridans; 2/40 (5%) of flying squirrels, Glaucomys volans; and 0/23 Peromyscus leucopus (9).

Although antibodies neutralizing CAL group viruses are commonly found in rural outdoor workers (10), antibodies which neutralize LAC virus in higher titers than with other CAL group viruses from the state (JC, TVT, and SSH) are usually related to those with exposure to the hardwood deciduous forests common to southwestern Wisconsin and portions of other midwestern states. Convalescent serums from cases of California encephalitis consistently neutralize LAC virus in highest titer (14).

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)	SMB 3	ic 0.02	Encephalitis, death	2	8.5
Mice (nb)		ip 0.02	"	2-3	8.0
Mice (nb)		sc			
Mice (wn)		ic 0.03	Encephalitis, death	5	7.4
Mice (wn)		ip 0.03	"	6	1.2
Chipmunk and tree squirrels: 5/6 Tamias striatus griseus and 4/5 Sciurus carolinensis developed viermias of 1.5 to 4.4 dex 2 to 5 days after sc inoculation of LAC virus, and all developed neutralizing antibodies after 6 to 17 days (14).					
Rabbits develop viremia after inoculation (20).					

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
Aedes triseriatus	Transmitted LAC virus to suckling mice when tested 15 to 17 days following feeding on viremic chipmunks and squirrels.								
Aedes triseriatus	Venereal transmission from male to female. Infected females transmitted by bite to mice and eggs (23).								
	Natural and exp. transovarial transmission demonstrated in Aedes triseriatus (26).								

Section X - Histopathology

Character of lesions (specify host)
Histologic changes included neuronal degeneration and inflammatory response with some perivascular edema in cerebral cortex, some cuffing within the cerebrum and meninges.

Inclusion Bodies — Intranuclear

Organs/Tissues Affected

Category of tropism

Section XI - Human Disease

In Nature	Residual	Death
Significant		**Reported**

Subclinical — Overt Disease

Clinical Manifestations
Fever (S), headache (S), prostration (R), conjunctival inflammation (R), CNS signs (including encephalitis) (S), CNS Pleocytosis (S), lymphadenopathy (R), convulsions.

Number of Cases — Category (i.e. febrile illness, etc.)

Section XII - Geographic Distribution

Known (Virus detected)
Numerous cases in the USA particularly in OH, WI, MN, IA, IN, IL, and 13 other states as well (8,17).

Suspected (Antibody only detected)

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Remarks