

Status: Arbovirus

SALS Level: 3

Antigenic Group: B

Taxonomic status: *Flavivirus*

Other Information: Department of Commerce permit required.

Select Agent:  
SALS Basis: S

HEPA Filtration:

**Section I - Full Virus Name and Prototype Number****Full Virus Name:** Prototype Number:

St. Louis encephalitis

Information from: Carl M. Eklund, M.D. Date:  
\* 2/18/1985

Address: Rocky Mountain Laboratory, Hamilton, Montana

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Reviewed by editor

**Section II - Original Source**Isolated by: Muckenfuss, R.L., et al. (1,2) at: St. Louis, Missouri  
Genus and species: Man Sentinel X  
Age/Stage: Not known Sex:

Isolated From	Isolation detail
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Signs and symptoms of illness: Typical acute encephalitis

Arthropod engorged depleted gravid

Time held alive before inoculation:

Collection date: Method: Brain specimen at autopsy

Place collected: St. Louis City and County, Missouri, USA

Latitude: 40° ' " N Longitude: 90° ' " W

Macrohabitat:

Microhabitat:

Method of storage until inoculated: Fresh brain suspension (1); 50% glycerine (2)

Footnotes:

**Section III - Method of Isolation and Validity****Inoculation Date:**Animal: Monkey \* Embryonated egg: Tissue Culture:  
(Details in Section VI - Biologic Char.)

Route inoculated: ic and ip Reisolation: Not tried

Other reasons: Independently isolated by (2) and (1) with different methods.

Homologous antibody formation by source animal (See Section II): Yes

Test used: HI CF NT

Other:

Footnotes:

## Section IV - Virus Properties

### Physicochemical:

RNA: X      DNA:      Single Strand: X      Double Strand:  
Pieces:      Infectivity:      Sedimentation coefficient(s): /strong>  
Percentage wt. of virion protein      , lipid      carbohydrate  
Virion polypeptides:  
Number:      Details:  
Non-virion polypeptides:  
Number:      Details:  
Virion density:      Sedimentation coefficient:  
Nucleocapsid density      Sedimentation coefficient:

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### Stability of infectivity (effects) pH

Lipid solvent:  
(ether) 20%; 30 min., 5C (4) After treatment titer 2.66 dex      Control titer 4.33 dex  
(chloroform)      After treatment titer      Control titer  
Detergent:  
(deoxycholate) 1:1000 (5)      After treatment titer 3.5;3.8;4.1 dex loss      Control titer  
Other (formalin, radiation):

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### Virion morphology:

Shape Spherical particles      Dimensions 38 nm  
Mean (nm)      range (nm)      how measured Electron microscopy (24)  
Surface projections, envelope Uniform lucid envelope observed  
Nucleocapsid dimensions, symmetry Electron-dense core; diameter = 27 nm

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### Morphogenesis:

Site of constituent formation in cell  
Site of virion assembly  
Inclusion bodies  
Other

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### Hemagglutination:

Hemagglutination Yes      Antigen source SMB ext. by acetone-ether, sucrose-acetone  
Erthrocytes Goose      pH range 6.0-7.9      pH optimum 7.0  
Temperature optimum 22dC      range 4dC to 37dC  
Remarks \* Rhesus monkey (1); mice (2)  
Serologic methods recommended HI, CF, NT  
Footnotes: \* Rhesus monkey (1); mice (2)

## **Section V - Antigenic Relationship And Lack of Relationship To Other Viruses**

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St. Louis virus falls into Group B and as far as is known it is not antigenically related to any viruses not in this group. For published antigenic relation within Group B see References [6] , [7] , [38] .

Recent antigenic studies still place SLE virus in the JBE-MVE-WN complex or subgroup [38] , [39] .

## Section VI - Biologic Characteristics

Virus source (all VERTEBRATE isolates):

Lab Methods of Virus Recovery (ALL ISOLATIONS): Newborn mice

Susceptibility of Cell Culture Systems:

Cell system (a)	Virus passage history (b)	Evidence of Infection						Growth Without CPE			
		CPE		PLAQUES							
		Day (c)	Extent (d)	Titer TCD50/ml (e)	Day (c)	Size (f)	Titer PFU/ml (e)				
SLE virus produces CPE and plaques in various continuous and primary cell culture systems. Cell cultures derived from human, primate, rodent, swine and avian tissues and invertebrate cell cultures support the multiplication of SLE virus with or without CPE. SLE virus has produced CPE in primary chick embryo, duck (questionable) and hamster kidney cell cultures; in HeLa human amnion, human epithelial-like, BHK-21, Vero, PS; and plaques in KB, BHK-21, Vero, LLC-MK2, MA-104, BS-C-1, and PS continuous cell cultures. Plaques also were produced in primary chick embryo and duck kidney cell cultures (40).											

## Section VII - Natural Host Range

Vertebrate (species and organ) and arthropod	No. isolations/No. tested	No. with antibody/No. tested Test used	Country and region

ISOLATIONS: Man (blood): 1 St. Louis, MO (9); 2 Panama (27); 1 Trinidad (26,30) Man (CNS): 11 St. Louis (1,2); 1 Texas (29); 1951 1 Florida (10); 1962, 3 Florida (25); 1 Calif. VERTEBRATES (blood): 1 flicker, Kentucky; 1 mourning dove, California, white-tipped dove, silver-beak tanager, pale-vented robin, blue and white manakin, Trinidad; blue jay, mockingbird, domestic goose, pigeon, Texas; house sparrow, Missouri; house sparrow, Illinois; homing pigeon, Florida. (Other tissues): Pool liver, spleen, kidney - 3 house sparrows, chimney swift, cat bird, Illinois; cardinal, blue jay, robin, Missouri. Spleen and liver: Pool of three ruddy ground doves Panama. Brain: 1 homing pigeon Florida. Brain and other organs - flame-headed manakin, Trinidad. MAMMALS: From brain and spleen-Mexican free-tailed bat, Texas; brain, gray fox, California. ARTHROPODS: Culex tarsalis, Washington, California, Montana, Idaho, Oregon, North Dakota, Colorado; Cx peus, California; Aedes dorsalis (melanimon), California; Cx pipiens, Kentucky, Illinois, Missouri, Indiana, Tennessee; Cx quinquefasciatus, Arizona, Texas; Cx nigripalpus, An crucians, Florida; Ornithomyus sylviarum, Dermanyssus americanus, California; Dermanyssus gallinae, St. Louis, Missouri; Sabethes chloropterus, pool Sabethes spp., pool Trichoprosopon sp., pool Wyeomyia sp., Deinocerites pseudes, Panama; Cx caudelli, Cx coronator, Psorophora ferox, Cx spissipes, Cx taeniopus, Cx virgultus, Cx nigripalpus, Ae serratus, Ae scapularis, Trinidad; Cx nigripalpus, Jamaica; Sabethes belisarioi, Gigantolaelops sp., Brazil. NOTE: Articles listing isolates from man also discuss isolation from arthropods. Field and lab observations indicate that Cx tarsalis, Cx quinquefasciatus, Cx pipiens, and Cx nigripalpus are the most important vectors in the US. ANTIBODIES: Epidemics have occurred in Missouri, Illinois, Kentucky, Texas, Arizona, Colorado, New Jersey and in adjacent Pennsylvania and small numbers of patients seen in several other states. NT, CF and HI antibodies demonstrated. Antibody surveys show high antibody rates in epidemic areas and frequently in areas with sporadic cases. No epidemics outside US - 2 patients in Panama, 1 in Trinidad and 2 in Argentina; mild febrile disease and virus isolated from blood. Serological surveys in Panama, Jamaica, Trinidad and Argentina show presence of antibodies. Among lower vertebrates--antibodies in wild and domestic birds and among domestic and wild mammals but rate higher in birds (9,12,13,14,15,16,17,30,31,32).

Dermacentor variabilis, 1 isol. from 5 ticks, Memphis, Tennessee, USA (43).

## Section VIII - Susceptibility To Experimental Infection (Record Viremia)

Experimental host and age	Passage history and strain	Inoculation Route-Dose	Evidence of infection	AST (days)	Titer log10/ml	
Mice (nb)	P-1, Parton	ic 0.02	Death (12)	5	9.0	
Mice (nb)		ip 0.05	Death (12)	7	8.0	
Mice (nb)		sc				
Mice (wn)		ic 0.03	Death (12)	5	9.0	
Mice (wn)		ip 0.05	Death (12)	7	2.0	
Mice (6 wk)	P-100, Hubbard	ic 0.03	Death (9)	5	8.0	
Mice (6 wk)		in 0.03	Death (9)	6	4.0	

Vertebrates shown to be susceptible to experimental infection with signs of infection being death, viremia or development of antibodies: Hamster, rhesus monkey, guinea pig, horse, English sparrow, redwing blackbird, dove, duck, chicken, and chick embryos.

## 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
Many arthropods have been infected experimentally. Of major importance are the findings with respect to Cx tarsalis, Cx pipiens, Cx quinquefasciatus and Cx nigripalpus (9,33,,35).										
Transovarial transmission demonstrated in colonized C. pipiens complex mosquitoes originally collected in Memphis, Tennessee, and McLeansboro, Illinois (37).										

## Section X - Histopathology

**Character of lesions:** Perivascular cuffing, cellular infiltration, and nerve cell degeneration in the cortex, midbrain, medulla, pons, and upper levels of the cord (21). Lesions in thymus (L.B. Dias).

### Inclusion bodies:

Cytoplasmic:(M) (LV) Intranuclear: (M) (LV)

Organs-tissues affected: Brain (M), upper spinal cord (M)

Category of tropism: Neurotropic

## Section XI - Human Disease

Human disease:	In nature:	(S) X
	Death:	(S) X
	Residua:	(S) (R) X
Laboratory infections:	Subclinical:	(S) (R)
	Overt Disease:	(S) (R) X

Clinical manifestations: Fever (S), headache (S), prostration (S), stiff neck (S), CNS signs (including encephalitis) (S), and CNS pleocytosis (S)

Category: Encephalitis No. of cases: More than 2500

## Section XII - Geographic Distribution

### Known (virus):

Most parts of USA; Mexico, Trinidad, Brazil, Jamaica, Argentina, Haiti, Canada (36)

### Suspected (antibody):

Surinam (41), Venezuela (42).

## Section XIII - References

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**Section XIV - Remarks**

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