Virus Name: Japanese Encephalitis	Abbreviation: JBEV

Status
Arbovirus

Select Agent
No

SALS Level
3

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

Other Information
DOC Permit Required, USDA High Consequence Agent

Antigenic Group
B

SECTION I - Full Virus Name and Prototype Number

Prototype Strain Number / Designation
Nakayama

Accession Number

Original Date Submitted
8/3/1984

Family
Flavivirus

Genus

Information From
Akira Oya and W.F. Scherer

Address
National Institutes of Health, Tokyo, and Cornell University Medical College, N.Y.

Information Footnote
Revised

Section II - Original Source

Isolated By (name)
T. Mitamura and M, Kitaoka, et al.

Isolated at Institute
Tokyo, Japan

Host Genus
Man

Species

Host Age/Stage
19 years

Sex
Male

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

Signs and Symptoms of Illness
encephalitis

Arthropod

Time Held Alive before Inoculation

Collection Method
autopsy

Collection Date
8/21/1935

Place Collected (Minimum of City, State, Country)
hospital in Tokyo

Latitude
35° N

Longitude
140° E

Macrohabitat
urban

Microhabitat

Method of Storage until Inoculated
no storage

Footnotes

Section III - Method of Isolation

Inoculation Date
8/21/1935

Animal (Details will be in Section 6)
wn mice

Route Inoculated
intracerebral

Reisolation
Yes

Other Reasons

Homologous Antibody Formation by Source Animal
No

Test(s) Used
NT, day 4 serum tested

Footnotes

Section IV - Virus Properties

Physicochemical
RNA, Single Strand

Pieces (number of genome segments)
one

Infectivity
yes

Sedimentation Coefficients
(s)
(S)

Percentage wt, of Virion Protein

Lipid

Carbohydrate

Virion Polypeptides: Number
3

Details
9,000-10,000 MW (membrane polypeptide), 13,000-15,000 MW (capsid polypeptide), 55,000-59,000 MW (spike, glycoprotein, hemagglutinin) (35, 36)

Non-virion Polypeptides: Number
5

Details
10,500, 19,000, 45,000, 71,000, 93,000 MW (36)

Virion Density
1.19 gm/cm^3 (35) in sucrose

Sedimentation Coefficients(s)
200S (36)(S)

Nucleocapsid Density
1.31 (36) in sucrose

Sedimentation Coefficients(s)
(S)

Stability of Infectivity (effects)

pH (infective range)

Lipid Solvent (ether - % used to test)
inactivated (3)

After Treatment Titer

Control Titer

Lipid Solvent (chloroform)

After Treatment Titer

Control Titer

Lipid Solvent (deoxycholate)
inactivated (26)

After Treatment Titer

Control Titer

Other (formalin, radiation)
inactivated by urea (29)

Virion Morphology

Shape
spherical

Dimensions
53.1 +- 4.5 nm

Mean
nm

Range
nm

Measurement Method **electron microscopy**	Surface Projections/Envelope **spikes, 10 nm in length; diameter of envelope = 44.8 +- 3.2 nm (35)**	Nucleocapsid Dimensions, Symmetry **diameter = 29.8 +- 2.5 nm**

Morphogenesis

Site of Constituent Formation in Cell	Site of Virion Assembly **cytoplasm (41)**	Site of Virion Accumulation **cytoplasm vacuolum (41)**
Inclusion Bodies **not observed**	Other	

Hemagglutination

Hemaggiutination **Yes**	Antigen Source **SMB ext. by borate-KCl, pH 9.0; acetone-ether; sucrose-acetone (17)**	Erythrocytes (species used) **goose**
pH Range **6.0 - 7.2**	pH Optimum **6.6**	
Temperature Range **4-37dC**	Temperature Optimum **25dC**	

Remarks

Serologic Methods Recommended
HI, CF, NT

Footnotes

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

Related antigenically to other flaviviruses (group B) especially West Nile, Murray Valley and Saint Louis encephalitis viruses. See reference [46] .

Section VI - Biologic Characteristics

Virus Source (all VERTEBRATE isolates)
blood (M)(LV), CSF (M), CNS (M)(LV), heart (LV), lung (LV), liver (LV), spleen (LV), kidney (LV). Present in most organs of lower vertebrates during viremia.

Lab Methods of Virus Recovery (ALL ISOLATIONS)
newborn and weaning mice, primary chick embryo cell cultures and C6/36 clone of Aedes albopictus cells.

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)	
chick embryo (PC),			Minimal CPE		5-7	Plaques		+	
human epithelial (CL),								+	
L mouse cells								+	
Vero (CL)	P-52				4	3mm	9.1* (28)		
LLC-MK2 (CL)					3	8mm	9.4 (28)		
C6/36 (CL)			CPE			Plaques (40)			
PS (CL)	P-43	3	4+	8.0*	3-4	5-6mm	8.3 (45)		

* 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	numerous		Eastern Asia from Japan to, India (11)
Horses	numerous		
Pigs	numerous		
Wild birds-chiefly herons and egrets (7-10)	numerous		
Other domestic animals		Reported anti-body prevalences are low	
Wild rodents			
Cx tritaeniorhynchus	3		Java (33)
Culex tritaeniorhynchus	numerous		Northeastern Asia
Culex pipiens	rare		North and, SE Asia
Culex gelidus	some		SE Asia
Culex annulus	2		Taiwan (31)
Culex fuscocephala	some		Thailand (39)
Poikilothermic hosts	poss. isol.		Korea and, Taiwan (27)
Bats:			
Hipposideros a. terasensis	1		Taiwan (31)
Miniopterus s. fuliginosus	2		
Culex vishnui	2		W. Bengal, India (32)
Anopheles barbirostris	1		
An hyrcanus	1		

In man, horses, and pigs, inapparent infection is the rule. Anitbody prevalences range up to 90-100%.

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)		ic 0.01	Encephalitis and death	3-4	8-9
mice (nb)		ip 0.01	Encephalitis and death	4-5	8-9
mice (nb)		sc			
mice (wn)		ic 0.03	Encephalitis and death	5-6	7-8
mice (wn)	certain strains only	ip 0.2	Encephalitis and death	6-10	1-9
monkeys, rhesus and cynmolgus	mosquitoes or low mouse	peripheral	Asymptomatic viremia		
hamsters		ic	Encephalitis and death		
hamsters		peripheral	Asymptomatic viremia		
guinea pigs		ic or peripheral	Asymptomatic viremia; antibody		
rabbits		ic or peripheral	Asymptomatic viremia; antibody		
chickens, herons and some other birds		peripheral	Asymptomatic viremia; anitbody		
horses		ic or peripheral	Encephalitis with some strains		
pigs - not pregnant		peripheral	Asymptomatic viremia; antibody		
pigs - pregnant		peripheral	Birth, sometimes premature, of infected often dead fetuses		
bats		peripheral	Asymptomatic viremia		
embryonated egg		ys, other routes	Death		

Rats, toads, frogs and snakes circulate virus (18, 38)

Dogs, foxes, cats, and goats undergo paralysis and death after ic or iv inoculation (13-16)

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
Culex tritaeniorhynchus									
Viremic pig (19)	4.7		15-29	23-25	chicken	92			
Viremic chicken (19,200)	3.6-4.0		10-34	23-25	chicken	46	3.0-5.7		weanling mice ic
Culex fuscocephalus									
Viremic pig (42)	3.6		17-18	28	chicken	40			
Viremic chicken (43)	3.9		10-27	25-27	chicken	16			
Culex gelidus									
Viremic chicken (23)	4.0-4.9		6-21+	27	chicken	50			
Viremic chicken (23)	5.1		21	27			6.2-6.9		weanling mice ic

Transovarial transmission demonstrated in Aedes albopictus, Ae togoi (44). Successfully infected adults of Culex quinquefasciatus, Cx. Jepson: (= Cx (Cux sitiens) (larvae as well) and Ae vexans; JBE transmitted to SM by bite (47).

Section X - Histopathology

Character of lesions (specify host)
acute encephalitis

Inclusion Bodies — Intranuclear

Organs/Tissues Affected
brain (M) (LV)

Category of tropism
neurotropic, encephalitis

Section XI - Human Disease

In Nature	Residual	Death
Significant	**Significant**	**Significant**

Subclinical	Overt Disease
Reported	**Reported**

Clinical Manifestations
fever (S), headache (S), prostration (S), stiff neck (R), CNS signs including encephalitis (S), CNS pleocytosis (S)

Number of Cases	Category (i.e. febrile illness, etc.)
thousands	**encephalitis**

Section XII - Geographic Distribution

Known (Virus detected)

Suspected (Antibody only detected)
Viet Nam, Burma

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Remarks

In Japan, ecologic cycle involves vectors (Culex tritaeniorhynchus), available amplifier hosts (pigs, herons, egrets and other birds) and diseased hosts (man, horses and pregnant pigs).