Virus Name: Wesselsbron	Abbreviation: WSLV

Status
Arbovirus

Select Agent
No

SALS Level
3

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

Other Information
USDA Permit Required, Hepa Filtration, USDA Restricted

Antigenic Group
B

SECTION I - Full Virus Name and Prototype Number

Prototype Strain Number / Designation
van Tonder strain

Accession Number

Original Date Submitted
10/6/1984

Family
Flaviviridae

Genus
Flavivirus

Information From
B.M. McIntosh

Address
National Institute for Virology, P/Bag X4, Sandringham, 2131, South Africa

Information Footnote
Revised

Section II - Original Source

Isolated By (name)
K.E. Weiss, et al (1)

Isolated at Institute
Onderstepoort Vet. Res. Lab., Pretoria

Host Genus
Merino sheep

Species

Host Age/Stage
8 days-old

Sex
Not Answered

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

Signs and Symptoms of Illness
Donor lamb died during outbreak of mortality in lambs and abortion in ewes

Arthropod

Time Held Alive before Inoculation

Collection Method

Collection Date
3/1/1955

Place Collected (Minimum of City, State, Country)
Wesselsbron, South Africa

Latitude
28° S

Longitude
26° E

Macrohabitat
Temperate; grassland plateau ca. 4,000 feet above sea level

Microhabitat

Method of Storage until Inoculated
Carcass posted to laboratory without refrigeration

Footnotes

Section III - Method of Isolation

Inoculation Date

Animal (Details will be in Section 6)
nb mice

Route Inoculated
Intracerebral

Reisolation
Not tried

Other Reasons

Homologous Antibody Formation by Source Animal

Test(s) Used

Footnotes

Section IV - Virus Properties

Physicochemical

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)	After Treatment Titer	Control Titer
Lipid Solvent (chloroform)	After Treatment Titer	Control Titer
Lipid Solvent (deoxycholate)	After Treatment Titer	Control Titer

Other (formalin, radiation)

Virion Morphology

Shape

Dimensions
45 nm (2)

Mean
nm

Range
nm

Measurement Method
Electron microscopy

Surface Projections/Envelope

Nucleocapsid Dimensions, Symmetry

Morphogenesis

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

Hemagglutination

Hemaggiutination	Antigen Source	Erythrocytes (species used)
Yes	**SMB ext. by sucrose-acetone**	**Goose**
pH Range	pH Optimum	
6.0-7.0	**6.5**	
Temperature Range	Temperature Optimum	

Remarks

Serologic Methods Recommended
HI, CF, NT

Footnotes

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

Antigens or Antibodies	WSL Antigen CF (3)	WSL Antibody CF (3)
Bagaza	8	32
Ntaya	32	16
West Nile	32	64
Usutu	32	32
Koutango	32	256
Banzi	64	16
Uganda S	64	128
Bouboui	32	32
Saboya	>128	64
Spondweni	256	128
Zika	32	256
Dengue 1	64	1024
Yellow fever	>128	64
Dakar bat	>64	>1024

Results expressed as ratio, homologous/heterologous titers.

In cross PRNT with 42 flaviviruses WSL gave a completely monospecific response [4] . Placed in the West Nile serological subgroup [5] . In a later study, 60 registered and 5 unregistered flaviviruses were tested against antibody to WSL virus in PRNT. The antibody did not cross-react with other flaviviruses, such that WSL virus could not be assigned to a given complex in group B [40] .

Section VI - Biologic Characteristics

Virus Source (all VERTEBRATE isolates)
Blood (LV)

Lab Methods of Virus Recovery (ALL ISOLATIONS)
Primary duck embryo cell cultures NOTE: Original mosquito suspensions nonpathogenic for suckling 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)	
PS (CL)	MB 146				5		7.0* (6)		
Vero (CL)	MB 15				3	3 mm	9.2 (7)		
LLC-MK2 (CL)					5	7 mm	9.5 (7)		
LLC-MK2 (CL)					6	2-5 mm	8.1 (8)		
MA-104 (CL)					7	<1 mm	5.7 (8)		
PC-C1 (CL)					6	1-2 mm	8.7 (8)		
Vero (CL)					4	1 mm	5.8 (8)		
BHK-21 (CL)	MB 17	2	4+	6.5* (9)					

* 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 (blood)	7	507/4,293 NT	South Africa (1, 3, 10-13)
Man	1		Senegal (21)
Man		189/855 NT	Mozambique (14)
Man		54/492 NT	Angola (15)
Man		27/120 NT	Caprivi, Namibia (16)
Man		48/323 NT	Okavango, Botswana (16)
Man		95/2,551 HI	Zimbabwe (17)
Sheep	Many	23/114 NT	South Africa (1, 3, 18, 19)
Cattle	3	64/173 NT	South Africa(3, 19, 20)
Cattle	1	302/409 NT	Zimbabwe (20)
Desmodillus auricularis (rodent)	1		South Africa (3)
Camel	1		Nigeria (22)
Aedes caballus/juppi	13		South Africa (23)
Ae circumluteolus	12		South Africa (3, 24)
Ae lineatopennis	17		Zimbabwe (25)
Ae dentatus	1		Kenya (26)
Ae dalzieli	4		Senegal (27)
Ae tarsalis and 5 other species			Cameroun (28)
Ae abnormalis and 2 other species			Central African Republic (28)
Ae mediolineatus and Ae lineatopennis	4		Bang Phra, Thailand (29)

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)	H 177	ic	Death	3-4	9.0
Mice (nb)		ip			
Mice (nb)		sc			
Mice (wn)		ic	Death	7-10	8.0
Mice (wn)		ip	Death occasionally		
hamster		sc	Viremia		8.4
Desmodillus auricularis		sc	Viremia (3)		7.2
sheep (ad)			Fever, viremia, 20% mortality in pregnant ewes, hydrops amnii, foetal hydranencephaly and arthrogryposis (18,30,39)		
lamb			Viremia, fever, mortality 29% (30)		8.0
cattle			Viremia (17) foetal infection with porencephaly, cerebellar hypoplasia, abortion (17,38)		7.2

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
Ae caballus *	Wild caught females				sheep	6 mosq. fed 1 sheep; transmission occurred (31)			
Ae caballus *	Viremic sheep		21-22		mice	Lots of 6 and 3 mosq; both transmitted (31)			
Ae circumluteolus	X		6-67		mice	Lots of mosq. Transmitted 89 of 118 attempts (32)			
Ae aegypti	4.5		>14		mice	4/27; 13/62 mosq. Infected Titres 1.7-5.1 (33)			
Cx quinquefasciatus	4.5		>22		mice	4/28; 34/68 mosq. Infected Titers 1.7-4.4 (33)			
Ornithodoros savigney	5.5-8.0		>6	26	hamster	6 infected ticks failed to transmit; 11/50 ticks infected (34)			
Cx. zombaensis	8.4		20-30	26	hamster	1 lot of 6 transmitted day 20; 1 lot of 2 transmitted day 30; 13/26 mosq. infected(34)			

* Taxon "caballus" has since these experiments been split into two species, "caballus" and "juppi".

Section X - Histopathology

Character of lesions (specify host)
Sheep - liver shows fatty infiltration, bile pigmentation, necrosis of parenchymal cells, infiltration of lymphocytes and neutrophiles (18,35)

Inclusion Bodies — Intranuclear

Organs/Tissues Affected
Hepatitis, hydrops amnii in pregnant sheep, hydranencephaly, arthrogryposis, hypoplasia of spinal cord and muscular atrophy in ovine foetuses (30)

Category of tropism
Hepatotropic, neurotropic

Section XI - Human Disease

In Nature
Reported

Residual

Death

Subclinical

Overt Disease
Reported

Clinical Manifestations
Fever (biphasic), headache, eye pain, body pains, anorexia, insomnia, hepatomegaly, splenomegaly, disturbances in speech, hearing, vision, rise in blood transaminases (11,36,37)

Number of Cases
9

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

Section XII - Geographic Distribution

Known (Virus detected)
South Africa (1,24), Zimbabwe (20), Senegal (27), Nigeria (22), Kenya (26), Cameroon (28), Central African Republic (28), Thailand (29)

Suspected (Antibody only detected)
Mozambique (14), Angola (15), Namibia (16), Botswana (16)

Section XIII - References

1. WEISS, K.E., et al. 1956. Onderstepoort J. Vet. Res. 27:183-195.
2. LECATSAS, G. and WEISS, K.E.. 1969. Arch. gesam. Virusforsch. 27:332-338.
3. McINTOSH, B.M. Unpublished.
4. DE MADRID, A.T. and PORTERFIELD, J.S. 1974. J. Gen. Virol. 23:91-96.
5. PORTERFIELD. J.S. 1980. The Togaviruses. Schlesinger, R.W. Editor. Academic Press. p. 22.
6. DE MADRID, A.T. and PORTERFIELD. J.S. 1969. Bull. Wld. Hlth. Org. 40:113.121.
7. STIM, T.B. 1969. J. Gen. Virol. 5:329-338.
8. WAY, H.J., et al. 1976. J. Gen. Virol. 30:123-130.
9. KARABATSOS, N. and BUCKLEY, S.M. 1967. Am. J. Trop. Med. Hyg. 16:99-105.
10. SMITHBURN, K.C., et al. 1957. S. Afr. J. Med. Sci. 22:113-120.
11. HEYMANN, C.S., et al. 1958. S. Afr. Med. J. 32:543-545.
12. SMITHBURN, K.C. 1959. S. Afr. Med. J. 33:555-561.
13. McINTOSH, B.M., et al. 1962. S. Afr. J. Med. Sci. 27:77-94.
14. KOKERNOT, R.H., et al. 1960. Anais Instit. Med. Trop. 17:201-230.
15. KOKERNOT, R.H., et al. 1962. Trans. Roy. Soc. Trop. Med. Hyg. 59:563-570.
16. KOKERNOT, R.H., et al. 1965. Ibid. 59:553-562.
17. SWANEPOEL, R. and CRUIKSHANK, J.G. 1974. Central Afr. J. Med. 20:71.
18. COETZER, J.A.W., et al. 1978. Onderstepoort J. Vet. Res. 45:93-106.
19. KOKERNOT, R.H., et al. 1961. Ann. Trop. Med. Parasitol. 55:73-85.
20. BLACKBURN, N.K. and SWANEPOEL, R. 1980. J. Hyg. 85:1-33.
21. JAN, C. and RENANDET, J. Rapport Annuel de l'Institut Pasteur de Dakar. 1974-76. p. 56.
22. MOORE, D.H. Personal communication. 1971.
23. KOKERNOT, R.H., et al. 1960. S. Afr. Med. J. 34:871-874.
24. McINTOSH, B.M., et al. 1972. J. Med. Ent. 9:155-159.
25. McINTOSH, B.M. 1971. J. Ent. Soc. S. Afr. 34:319.
26. METSELAAR, D., et al. 1974. Trans. Roy. Soc. Trop. Med. Hyg. 68:114-123.
27. CORNET, M., et al. 1979. Cah. ORSTOM Ent. Med. Parasitol. 17:149-164.
28. Rapport Annuel de l'Institut Pasteur de Dakar. 1980.
29. YUILL, T.M. and RUSSELL, P.K. Personal communication.
30. COETZER, J.A.W., et al. 1978. Onderstepoort J. Vet. Res. 44:119-126.
31. KOKERNOT, R.H., et al. 1958. S. Afr. Med. J. 32:546-548.
32. MUSPRALT, J., et al. 1957. S. Afr. J. Med. Sci. 22:121-126.
33. SIMASATHIAN, P. and OLSON, L.C. 1973. J. Med. Ent. 10:587-590.
34. JUPP, P.G. and McINTOSH, B.M. Unpublished.
35. LE ROUX, J.M.W. 1959. Onderstepoort J. Vet. Res. 28:237-243.
36. WEINBREN, M.P. 1959. East Afr. Virus Res. Inst. Ann. Rept. 1958-59. No. 9. 22-23.
37. JUSTINES, G.A. and SHOPE, R.E. 1969. Health Lab. Sci. 6:46-49.
38. COETZER, J.A.W., et al. 1980. Onderstepport J. Vet. Res. 46:165-170.
39. FAGBAMI, A.H. 1980. Br. Vet. J. 136:57-62.
40. CALISHER, C.H., et al. Personal communication. 1983.

Remarks

It seems that transmission cycles involving Aedes species and domestic angulates have a significant role in the ecology of WSL virus at the present time. Because of the low clinical response, especially in cattle, much of this transmission would be unrecognized. The source of human infection would be mosquito-borne as well as acquired contagiously from domestic angulates.