| Virus Name: Venezuelan equine encephalitis | Abbreviation: VEEV |
|---|---|

Status
**Arbovirus**

Select Agent
**Yes**

SALS Level
**3**

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

Other Information
**USDA Permit Required, DOC Permit Required, Hepa Filtration, USDA Restricted, USDA High Consequence Agent, Vaccination Recommended**

Antigenic Group
**A**

## SECTION I - Full Virus Name and Prototype Number

Prototype Strain Number / Designation

Accession Number

Original Date Submitted
2/14/1985

Family
**Togaviridae**

Genus
**Alphavirus**

Information From
**Arbovirology Unit**

Address
**Center for Disease Control, Atlanta, Georgia 30333, USA**

Information Footnote
**Reviewed by editor**

## Section II - Original Source

Isolated By (name)
**V. Kubes and F. Rios (1)**

Isolated at Institute
**Caracas, Venezuela**

Host Genus
**Horse**

Species

Host Age/Stage

Sex
**Not Answered**

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

Signs and Symptoms of Illness
**Encephalomyelitis and death**

Arthropod

Time Held Alive before Inoculation

Collection Method

Collection Date
**1/1/1938**

Place Collected (Minimum of City, State, Country)
**Venezuelan Guajira**

Latitude
**10° N**

Longitude
**72° W**

Macrohabitat

Microhabitat

Method of Storage until Inoculated
**Unknown**

Footnotes

## Section III - Method of Isolation

Inoculation Date
**1/1/1938**

Animal (Details will be in Section 6)
**GP****

Route Inoculated
**ic, ip, im, sc**

Reisolation

Other Reasons
**Brain material from Venezuela also studied by Beck and Wyckoff (3) with similar results**

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)<br>**50%** | After Treatment Titer<br>**Inact. (28)** | Control Titer |
| Lipid Solvent (chloroform) | After Treatment Titer | Control Titer |
| Lipid Solvent (deoxycholate)<br>**1:1000** | After Treatment Titer<br>**3-4.7 dex inact.(5)** | Control Titer |

Other (formalin, radiation)
**Total inactivation of infectious properties by formalin difficult (6).**

### Virion Morphology

| | | |
|---|---|---|
| Shape<br>**Spherical particles** | Dimensions<br>**60 nm; 46 nm (4)** | |
| Mean<br>nm | Range<br>nm | |
| Measurement Method<br>**Thin section electron microscopy** | Surface Projections/Envelope<br>**Envelope observed** | Nucleocapsid Dimensions, Symmetry<br>**Capsid: diameter 30 nm (4)** |

**Capsid, diameter 50 nm (4)**

## 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 acetone-ether or sucrose-acetone (7)** | **Goose** |

| pH Range | pH Optimum |
|---|---|
| **6.0-6.4** | **6.2** |

| Temperature Range | Temperature Optimum |
|---|---|
| **4dC, 22dC, 37dC** | **37dC** |

Remarks
**The ip NT in wn mice is very sensitive (11). notes * * First recognized as an equine disease in 1936, two years before actual isolation date. ** And rabbits (1)**

Serologic Methods Recommended
**HI, CF, NT.**

Footnotes
**The ip NT in wn mice is very sensitive (11). notes * * First recognized as an equine disease in 1936, two years before actual isolation date. ** And rabbits (1)**

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

The following basic data were extracted from Casals [8] . For antigenic relationships to newer members of Group A, consult their respective catalogue cards. Hearn [9] has shown some crossing between EEE and VEE viruses in mouse NT tests.

| | VEE Antigen HI | | | VEE Immune Mouse Serum HI | |
|---|---|---|---|---|---|
| Immune Mouse Sera | Ht/Ho | Index | Antgens | Ht/Ho | Index |
| Chikungunya | ND/1280+ | | Chikungunya | 80/640+ | 1/8+ |
| Mayaro | 40/1280+ | 1/32+ | Mayaro | 80/640+ | 1/8+ |
| Semliki | 80/2560 | 1/32 | Semliki | 40/640+ | 1/32+ |
| Sindbis | 10/1280 | 1/128 | Sindbis | 20/640+ | 1/32+ |
| WE | 160/10,240 | 1/64 | WE | 80/640+ | 1/8+ |
| EE | 80/10,240 | 1/128 | EE | 160/640+ | 1/4+ |

See Reference [10] by Young and Johnston for original antigenic classification of viruses of the VEE complex. In their classification, based upon kinetic HI studies, this original strain of VEE virus is designated type IA.
For further information on antigenic classification, see Reference [31] .

## Section VI - Biologic Characteristics

Virus Source (all VERTEBRATE isolates)
**Cerebrospinal fluid (M)**

Lab Methods of Virus Recovery (ALL ISOLATIONS)
**Newborn mice and Vero 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) | |

Produces CPE in many types of cell cultures, forms plaques in duck and chick embryo, Vero, LLC-MK2, CER, BHK-21 and others.

## 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: Infections: Many lab infections; one possible lab death (12); infections in 14/32 people receiving formalinized vaccine (6); 2 naturally acquired fatal cases of presumptive VEE in Trinidad, 1943 (13); one naturally acquired fatal case, Panama, 1961 (14); epidemic, no deaths, Colombia, 1952 (15); in Guajira, Colombia, 1962, at least 3000 cases, 30 deaths (16); probably at least 30,000 cases, 300 deaths in Venezuela, 1962-1964 (17,18); 20,000 cases and 200 deaths in Ecuador, 1969 (19). Many cases in Guatemala, Honduras, El Salvador, Nicaragua, Costa Rica, 1969-1970; in Mexico 1970, 1971; in south Texas, 1971 (20). Naturally acquired antibody: Trinidad 9/155 NT (21); Colombia, 32/94 HI (12); S. Florida, USA, 37/65 HI (22); Panama, 19/145 CF (14).

Horses: Epizootics in Trinidad, Venezuela, Colombia, Ecuador, Guyana, Cost Rica, Nicaragua, El Salvador, Honduras, Mexico, south Texas.

Wild rodents: Antibodies in cotton mice and cotton rats in south Florida Everglades (23).

Sentinels: Many isolations of epidemic and enzootic strains of the VEE virus complex have been isolated in sentinel mice, hamsters and monkeys, Trinidad and Brazil to Mexico.

Mosquitoes: Numerous isolations of epidemic strains from at least 26 species, including Aedes aegypti, angustivittatus, sollicitans, scapularis, serratus, taeniorhynchus, thelcter; Anopheles aquasalis, crucians, neomaculipalpus, pseudopunctipennis, punctimacula; Culex ocossa, corniger, (Melanoconion) sp., nigripalpus, quinquefasciatus, tarsalis; Deinocerites pseudes; Mansonia dyari, titillans; Psorophora ciliata, cilipes, confinnis, cyanescens, discolor. Enzootic strains frequently isolated from Cx (Melanoconion) sp.

Additional isolations: Cotton rat 1, opossum 1; Florida Everglades (29).Desmodus rotundus (vampire bat) 1; Mexico (30).

## 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 | | | |
| Mice (nb) | | ip | | | |
| Mice (nb) | | sc | | | |
| Mice (wn) | | ic | | | |
| Mice (wn) | | ip | | | |
| Mice: | Fatal by ic and ip routes; AST 1-8 days, depending on age and route; titers 9.0 to 11.0 dex per ml. | | | | |
| Chicks | Less than 1 day-old: fatal by sc route; AST 24-48 hrs; titers 7.0 to 8.5 dex per ml (24). | | | | |
| Chick embryos: | Fatal by ys, embryo inoc; AST 24-48 hrs; titers 9.0 to 10.0 dex per ml (24) | | | | |
| Rabbits, ad: | Fatal by all routes; AST 3-5 days (24). | | | | |
| Guinea pigs, yg ad: | Fatal all routes; AST 2-7 days; titers 9.5 to 11.0 dex per ml (24). | | | | |
| Rhesus monkey: | Usually viremia only; sometimes encephalitis and death (24). | | | | |
| Horses: | Encephalitis, leucopenia; AST 5-11 days, or weakness, weight loss and recovery (25). | | | | |
| Birds: | Viremias in white-throated and English sparrows, cardinals and pigeons (26). | | | | |
| Bats: | Eptesicus fuscus susceptible, circulates virus several days (24). | | | | |

## 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 |
| Mosquito infection by feeding and transmission by bite: Aedes aegypti, albopictus, atropalpus, canadensis, mediovittatus, sollicitans, triseriatus, vexans; Culex pipiens, tarsalis; Anopheles freeborni, quadrimaculatus, stephensi; Mansonia indubitans, titillans; Psorophora confinnis (24). For others, see References 17, 18. | | | | | | | | | |
| Epidemic cycle probably involves many species of pest mosquitoes, with the horse as main vertebrate host and source of mosquito infection. Enzootic cycles of non-epidemic strains involve mainly Culex (Melanoconion) mosquitoes and wild rodents. Enzootic cycles of epidemis strains not known. | | | | | | | | | |

## Section X - Histopathology

Character of lesions (specify host)
**Exp. infections: GP, rabbits mice - lymphomyelopoietic necrosis; monkeys, mice - encephalomyelitis, typical arbovirus CNS lesions. Fatal horse cases-pancreatic lesions (acinar cells), hematopoietic involvement with or without encephalitis. See Reference 27 for human histopathology.**

Inclusion Bodies — Intranuclear

Organs/Tissues Affected
**Brain (M)(LV), liver (LV), kidney (LV), marrow (LV) and acinar cells of pancreas**

Category of tropism
**Neurotropic and/or viscerotropic**

## Section XI - Human Disease

In Nature
**Significant**

Residual
**Significant**

Death
**Significant**

Subclinical

Overt Disease
**Significant**

Clinical Manifestations
**Fever (S), headache (S), prostration (S), stiff neck (S), myalgia (S), arthralgia (S), CNS signs (including encephalitis)(S), leukopenia (S) and vomiting (R)**

Number of Cases
**Numerous lab infections. Several thousand naturally acquired cases**

Category (i.e. febrile illness, etc.)
**Febrile illness and encephalitis**

## Section XII - Geographic Distribution

Known (Virus detected)
**Northern South America, Central America, Mexico, south Texas and south Florida**

Suspected (Antibody only detected)

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## Remarks