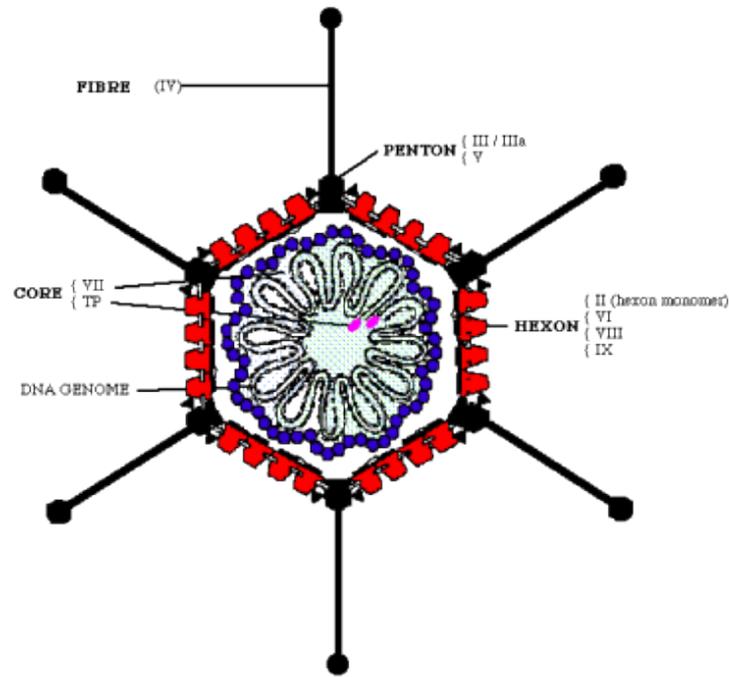


Changing dimensions of Fowl Adenovirus in India and the concepts to control



 **5th Edition** 
PASCHIM BANGA
POULTRY MELA-2017



Dr. Prakash B. Reddy
DGM-Technical Services
Ventri Biologicals, Division Of VHPL

Ideal Balanced Diet

Nutrition

Genetics

**Rich History of
BV300 and
VenCobb 400/430**

Husbandry

**Changing Dimensions
of “Poultry Health”**

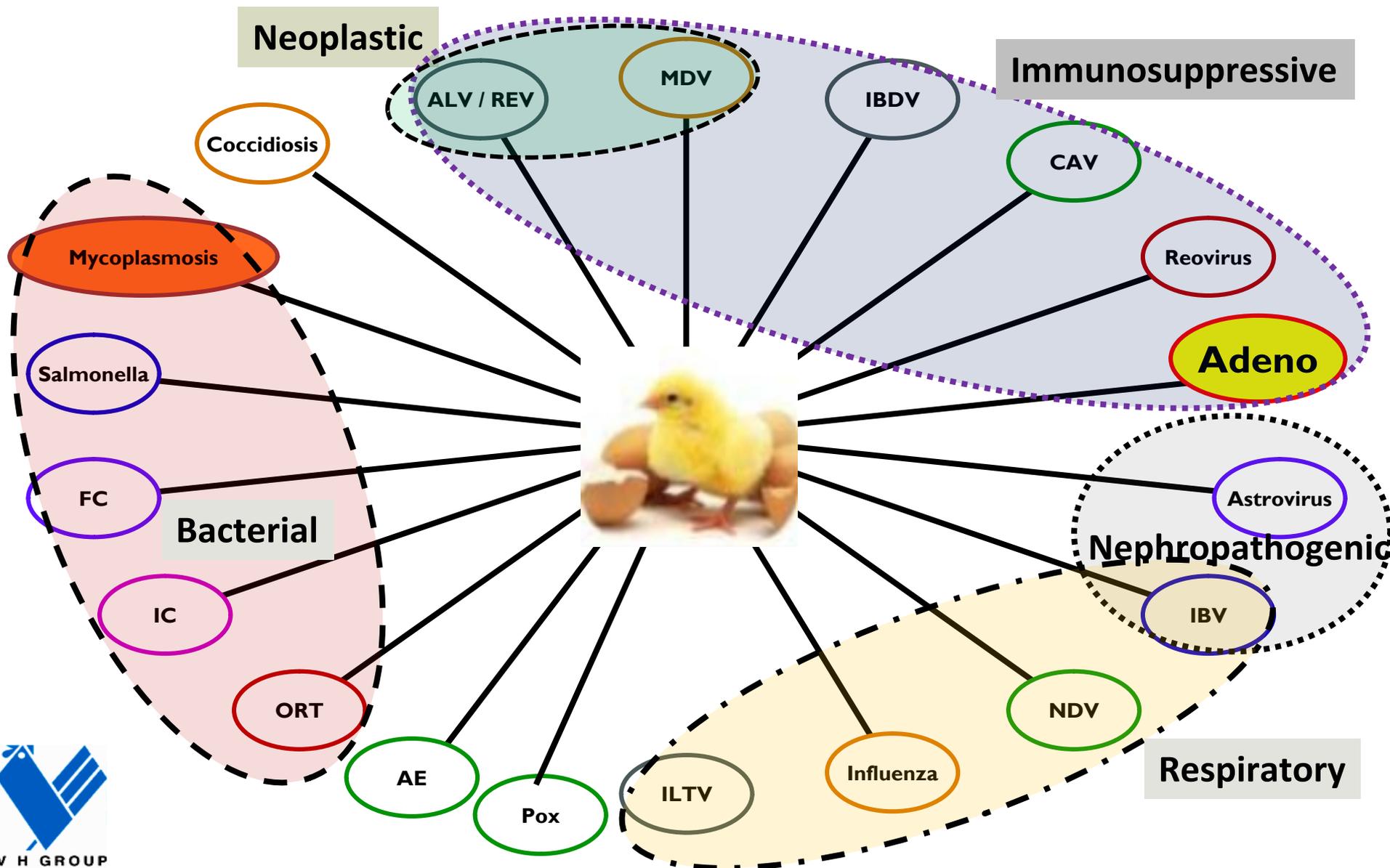
**Animal
Welfare**

**Disease
management**

Doesn't happen by accident

**Most Vaccinated
Species in the World**

Changing Poultry Disease Threats in India



Challenges To The Poultry Industry For Control

Disease complexes

- Respiratory diseases
- Immunosuppressive diseases

Complex diversity of RNA viruses

- Segmented RNA Viruses- Avian influenza, Reoviruses
- Single stranded RNA viruses- IBV, NDV
- Double stranded segmented RNA - IBDV

Vertically transmitted diseases

- Viruses: ALV, **Adenovirus**, Astrovirus, AE, CAV, Reovirus,
- Bacteria: Mycoplasma, Salmonella, ORT

Indiscriminate use of Live vaccines

Complex Vaccination schedules

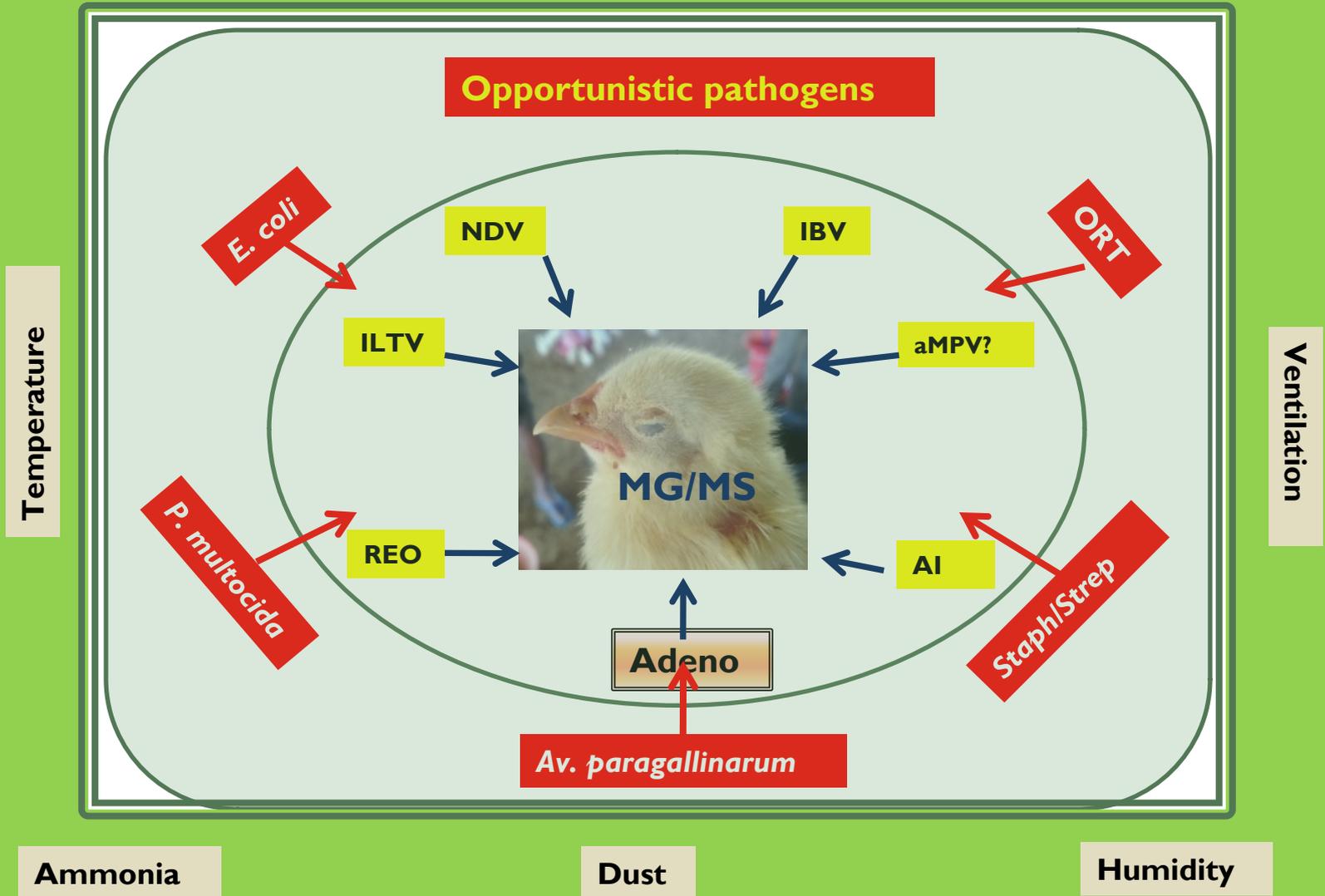
- Vaccines should be used as prophylactic not therapeutic



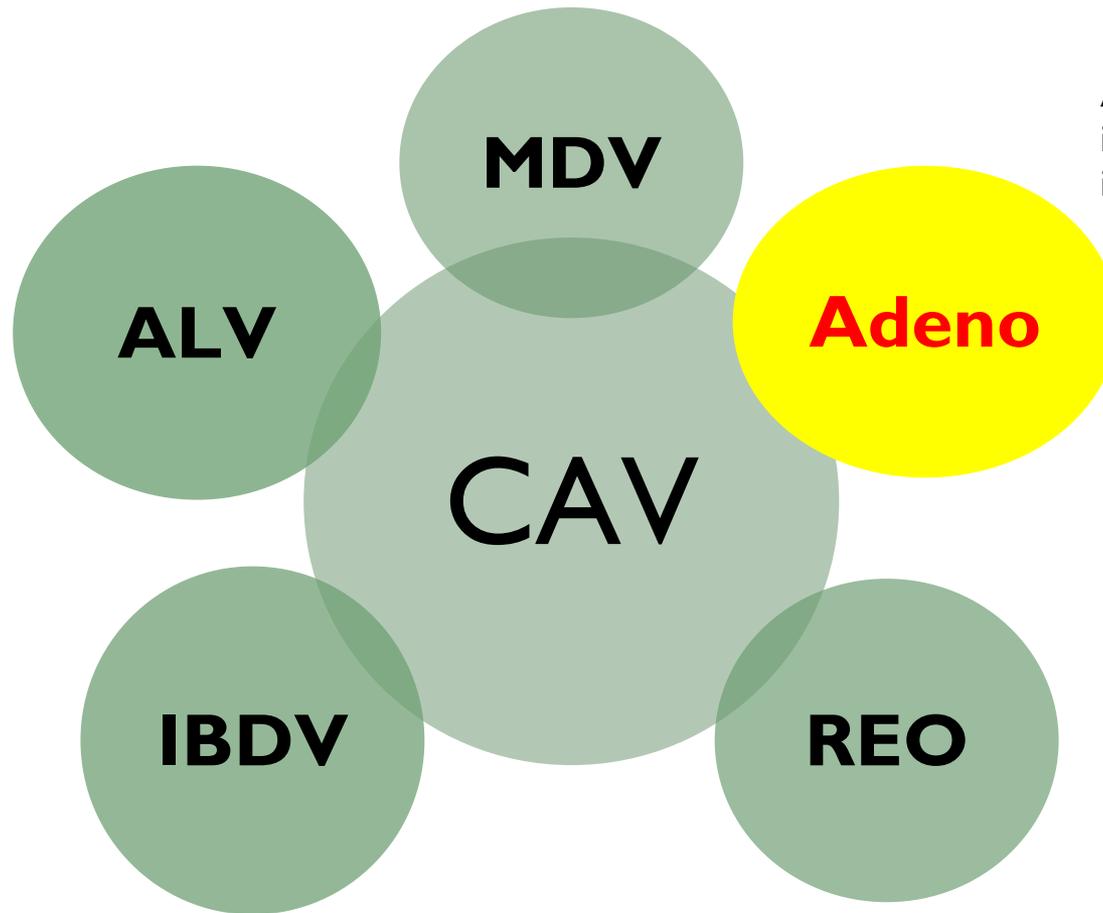
CRD - CCRD - SHS

Complex Respiratory Diseases

Environmental Factors aggravating the Disease



Immunosuppressive Disease Complex



1986: v.Bülow et al.:
Adenoviruses
increase after co-
infection with CAV

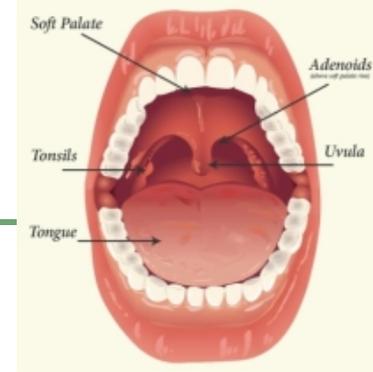
1976: Fadly et al.:
Co-infection of
Adenovirus with IBDV

Fowl Adenovirus Infections

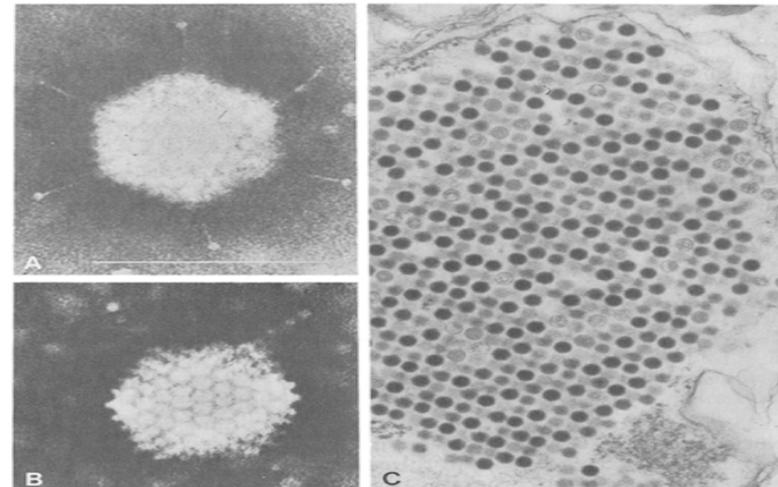
A Primary Pathogen in Chickens?

A Subclinical infection?

Adenoviridae



- **Adenovirus** were first recovered from explants of human adenoid tissue (adeno gland).
- Adenoviruses infect a wide variety of mammals and birds and **replicate in endothelial cells**, e.g. kidney, liver, respiratory mucosa.
- Most disease self-limiting, lasts ~ 2 weeks
- Virus Characteristics:
 - non-enveloped, Icosahedral
 - Linear dsDNA of 30-38 kbp



Adenoviridae { *Mastadenovirus*
Aviadenovirus

group I

group II

group III

- chicken: FAV1-12
- goose: GAV1-3
- duck: DAV2
- turkey: TAV1,2
- pigeon: PiAV

- turkey: HEV
- pheasant: MSDV
- chicken: AASV

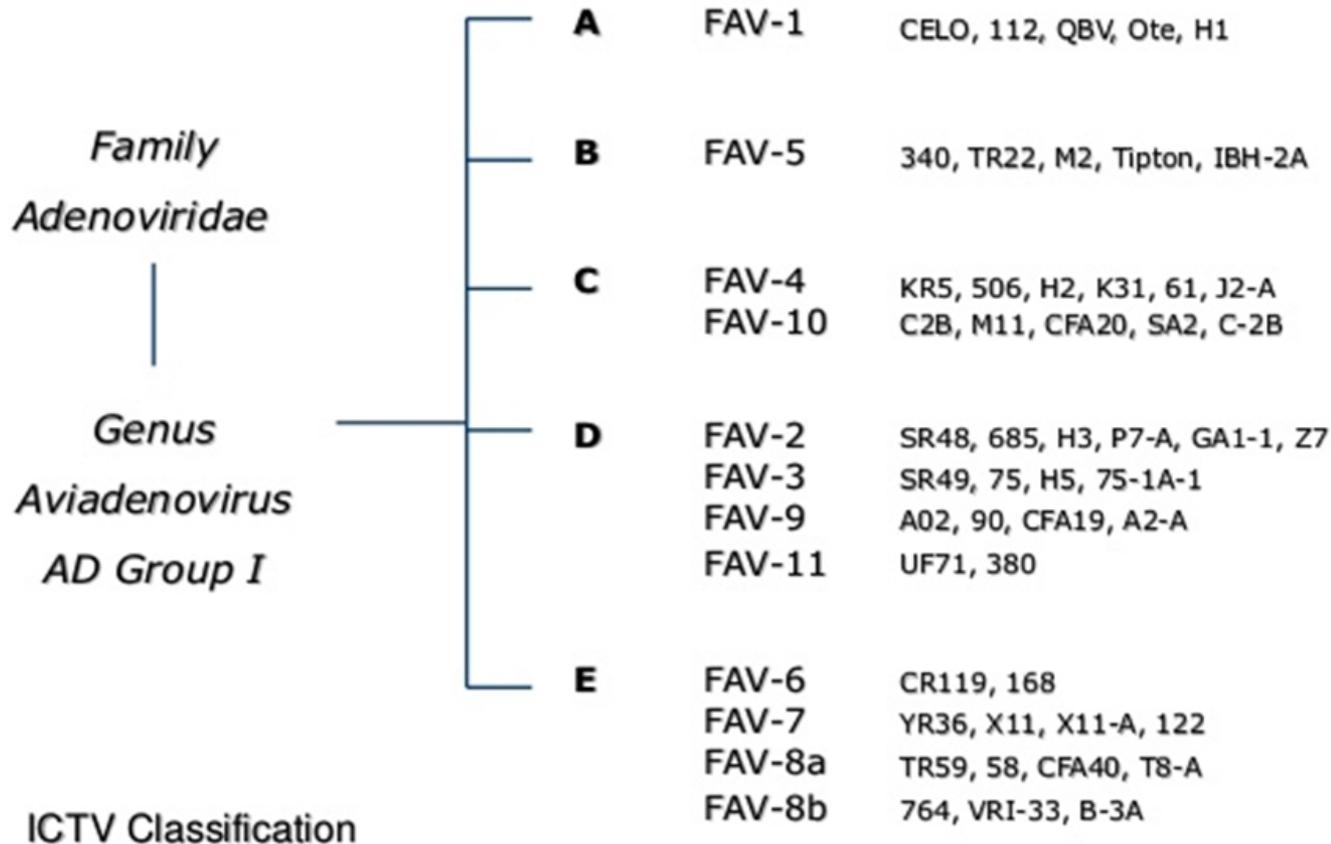
- chicken: EDS virus (DAV1)

New genus: Ataadenovirus

Classification of Fowl adenovirus serotypes (I-12)

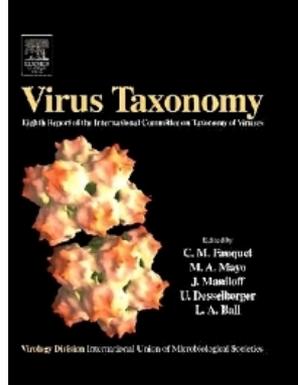
Species	Serotype number			Type strain		
	Europe	USA	ICTV	Europe	USA	ICTV
A	1	1	1	CELO	QBV/Phelps	112,Ote,HI,CELO,QBV
B	5	8	5	340	M2/TIPTON	TR-22,340,TIPTON,M2
C	4	4	4	KR5	J2	506,H2,K31,61,J2,KR5,
	11	10	10	C2B	C2B	M11,CFA20,SA2,C2B
D	2	2	2	GAL-1	P7	685,SR-48,H3,GAL-1,P7
	3	3	3	SR49	-	75,H5,SR49
	10	9	9	A2	A2	90,CFA19,A2
	12	12	11	380	-	UF-71,380
E	6	5	6	CR119	-	168,CR119
	7	11	7	TR36/X11	X11	YR-36,122,X-11
	8	6	8a	TR59	T8	58,CFA40,TR-59,T-8
	9	7	8b	764	B3	VRI-33,764,B3

VIIIth Report of the International Committee on Taxonomy of Viruses



Note:

A special problem that has been addressed, but not resolved is the lack of consensus in the numbering of the individual serotypes.



Epidemiology and Pathogenesis

- Ubiquitous in chickens: Demonstrated by serological and virological studies in sick and healthy birds.
- **Horizontal Transmission:** Related with Immunosuppression

Aerosol spread

- With in the farms
- But between farms is **highly unlikely**

Excreted in high titers in the feces

Contaminated poultry litter from a depopulated house

Secretions and excretions:

Nasal and tracheal mucosa, conjunctiva and kidneys

Semen

Important when artificial insemination is used.

Vertical transmission is very important in spread.



Infected chicks

- Approx. >3d-18-20 d
- Do not excrete until 2-4 wks of age or until maternal antibodies decline.

Massive interchange of strains

- Chicks from **different parent flocks (Breeds):** concurrent infections of one bird with 2-3 serotypes

Layer replacement flock

- Virus excretion maximum at 5-9 wks.

Latency

- When all breeders seroconvert shedding stops-vertical transmission stops
- Re-excrete virus throughout life, and aggravated during stress.



Avian adenoviruses and the diseases associated

Respiratory, Intestinal

- Respiratory disease, diarrhoea
- Detrimental effects on FCR and arthritis

Reproductive - Egg drop syndrome

IBH (inclusion body hepatitis)

Hydropericardium syndrome

- Popularly called as '**Litchi heart disease**' in broilers

Gizzard Erosion

Chick Embryo Lethal Orphan (CELO) virus

Quail bronchitis virus

Undefined aetiology

Egg-drop syndrome'76

First in laying birds, 1976 in Europe

Genus: **ATadenovirus.**

- High 'AT' content in the genome

Strains

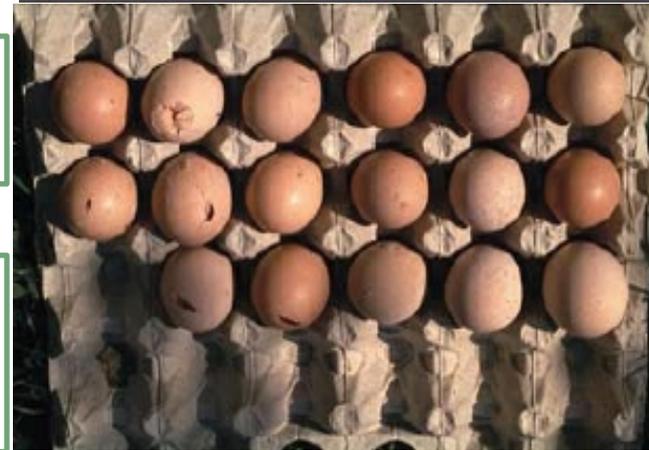
- Several genotypes but only one serotype

Clinical signs

- Reduced egg production up to 40% for 4-10 wks; soft-shelled, thin-shelled, shell-less eggs

Histology

- Virus replication in the pouch shell gland



Inclusion body hepatitis

“The 3 days disease”

- **First described in 1960's in USA**
- 3d increase Mortality, 3d Plateau and 3d Drop in mortality.
- Mortality up to 30%.

Disease

- Meat producing birds between in 3-7 wks.
- Liver is primary organ affected.
- With Co-infection with CAV and IBDV, target organ is haemopoietic system.
- PM: liver is swollen, light brown to yellow with hemorrhages, marked anemia, icterus of skin, fat deposits and haemorrhages in various organs, pale inactive bone marrow



Serotypes associated with outbreaks of IBH

Common serotypes prevalent around the World

- Serotype 2, 8b, 9, 11

Australia

- Serotype 6, 7 and 8 belonging to Group E

Newzealand

- Principally F8 and also F1 and F12 belonging to Group E
- In addition to liver lesions, atrophy of bursa and thymus, with aplastic bone marrow

Canada

- FAV-8 of Group E and FAV-11 of Group D

Europe

- FAV-2 of Group D

India

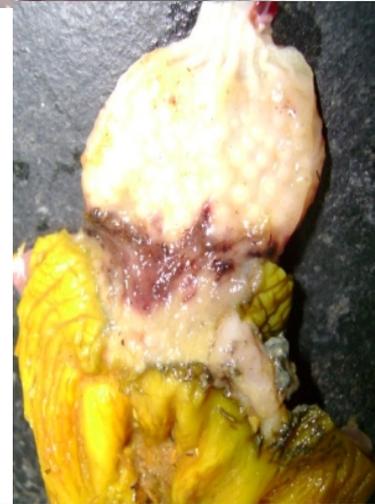
- **FAV-4** of Group C, **FAV-11** of Group D and **FAV-8** of Group E

Associated with CAV in layers

Necrotising pancreatitis



Proventriculitis



Gizzard erosions and/or ulcerations



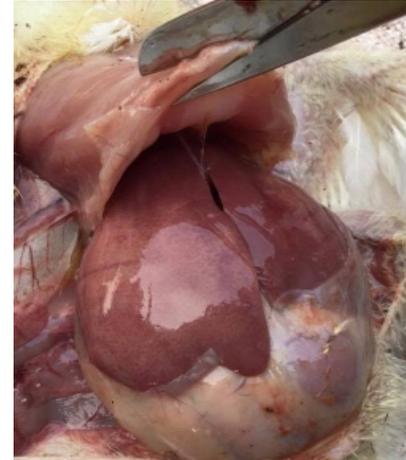
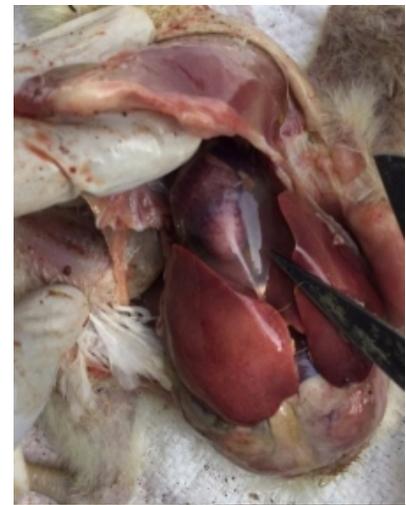
Hydropericardium syndrome

History

- A new syndrome in 1987 recognised at Angara Goth near Karachi in Pakistan.
- Subsequently recognised in India, Kuwait, Iraq, Mexico, Central and South America, Japan and Russia.

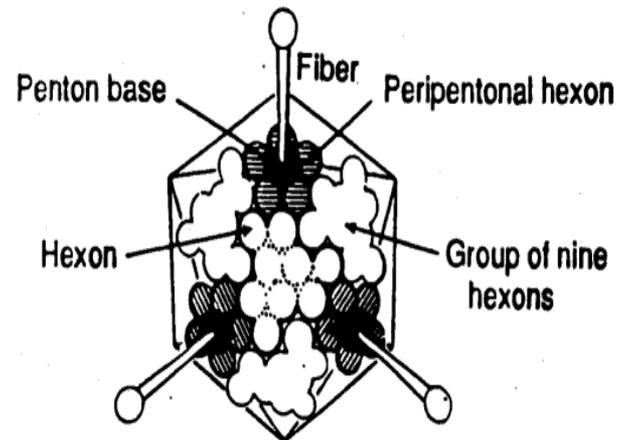
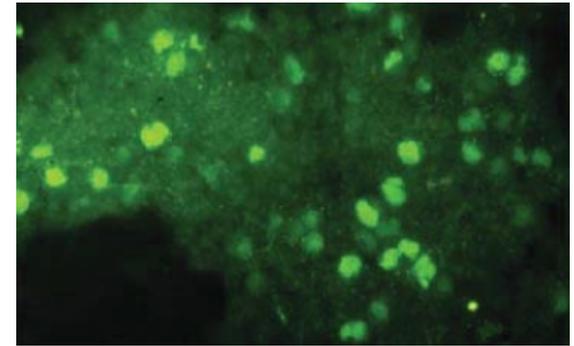
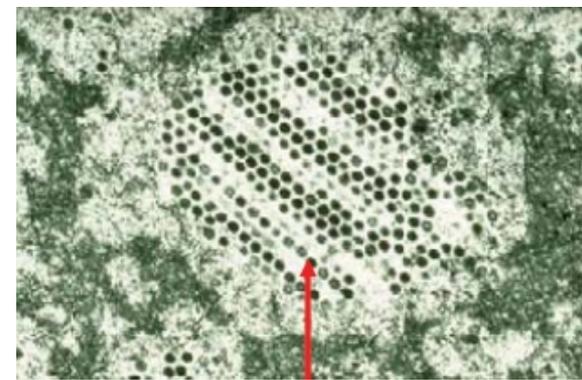
Disease

- Meat type birds between 3 -6wks, with mortality from 20-80%.
- Breeding and laying flocks with low mortality
- PM:
 - Enlarged pericardial sac, thickened and filled with straw colored fluid which is characteristic.
 - Liver is pale and enlarged and there is accumulation of fluid in the abdominal cavity.
 - Pulmonary edema, enlarged kidney
- Also associated with immunosuppression

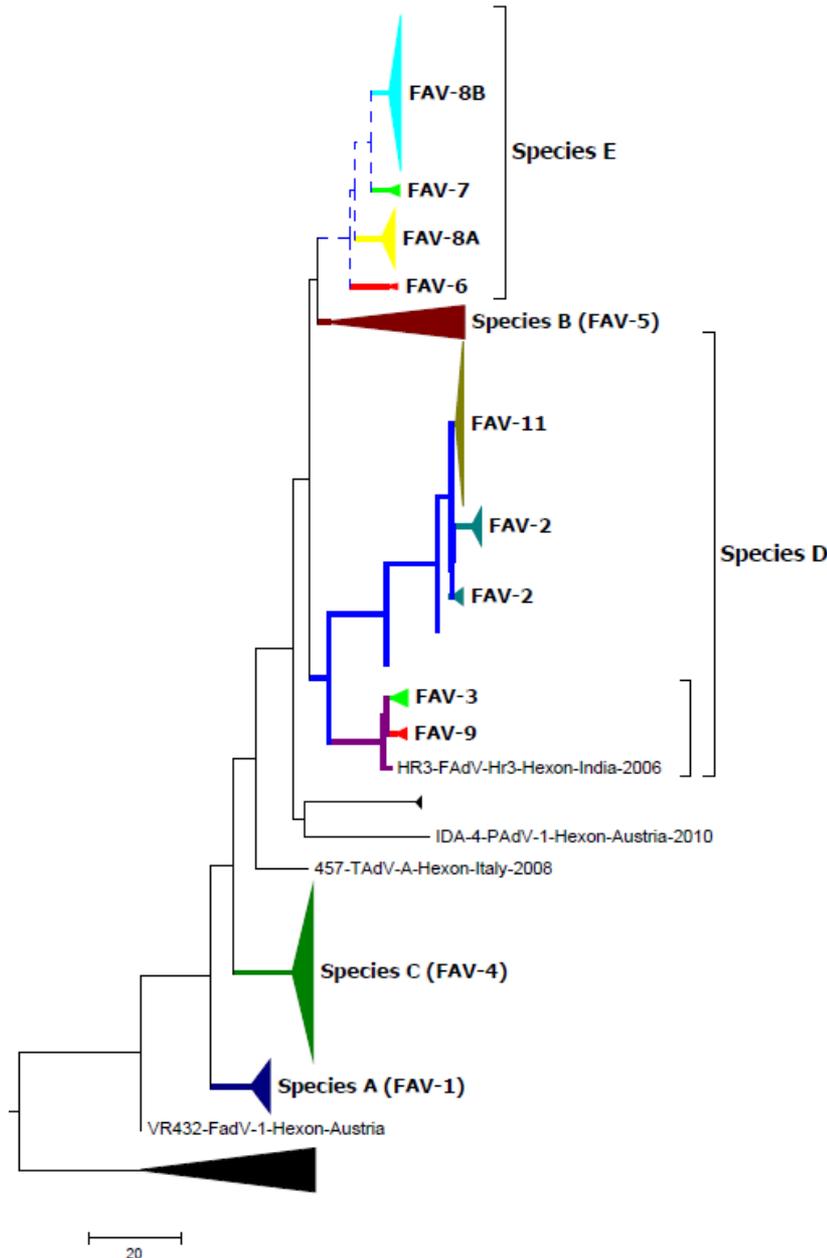
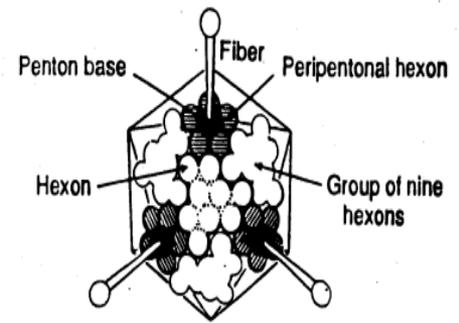


Diagnostic methods

- Immunodiffusion test
- Electron microscopy
- Immunofluorescence technique
- Neutralization test
- Haemagglutination inhibition test
- ELISA
- Restriction enzyme analysis
- DNA in situ hybridization
- **Polymerase chain reaction (PCR) and sequencing of the Hexon gene**



Phylogenetic analysis of the Hexon gene



FAV serotypes prevalent in India

- ✓ **Serotype-4**
- ✓ **Serotype -8**
- ✓ **Serotype-I I**
- ✓ **Serotype-2?**



VRDC, Serotype-4, Group C

- HPS1-FadV-4-Hexon-India-2003
- HPS2-FadV-4-Hexon-India-2003
- K07-1-FadV-4-Hexon-S.Korea-2007
- K09-9-FadV-4-Hexon-S.Korea-2009
- HPS2-FadV-4-Hexon-India-2003
- KRS-FadV-4-Hexon-Australia-2008
- AG234-FadV-C-hexon-Mexico-2010
- K99-07-FadV-C-hexon-Kuwait-2010
- De53-FadV-C-Hexon-Germany-2010
- K1013-FadV-C-Hexon-Ecuador-2010
- Peru53-FadV-C-Hexon-Peru-2010
- C28-FadV-10-Hexon-Australia-2008
- K31-1-FadV-C-Hexon-Pakistan-2010
- 1-FadV-4-Hexon-India-2009
- HPS4-FadV-4-Hexon-India-2003
- 022-1-FadV-C-Hexon-Germany-2010
- 09-884-FadV-C-Hexon-Austria-2009
- 4156-FadV-C-Hexon-Italy-2007
- ▲ VRDC68-PDRC-AH-Hys-Sero-4-2012
- ▲ VRDC68-PDRC-Anuragreddy-Hyd-2012
- ▲ VRDC-IBH-aeed-Hexon-Dec-2012
- ▲ VRDC-IBH-PDRC-Hexon-Dec-2012
- NRS-Har1-FadV-4-India-2001
- 24-FadV-4-Hexon-India-2009
- NIAB-01-FadV-1-Hexon-Pakistan-2008
- Palempu-FadV-4-hexon-India-2008
- ABT-ADVAC-HARYANA-07-FadV-4-hexon-India
- FadV-4-hexon-India-2009
- FadV1-1-54-Hexon-Pakistan-2005
- FadV-1-54-Hexon-Pakistan-2005
- IVRS-488-AD-FadV-4-India-2004
- IVRS-507-AD-FadV-4-India-2004
- IVRS-508-AD-FadV-4-India-2001
- IVRS-506-AD-FadV-4-India-2004
- IVRS-Bang-FadV-4-India-2004
- IVRS-Nepal-FadV-4-India-2004
- 5907-FadV-Hexon-Italy-2007
- IVRS-STD-FadV-4-India-2004
- ABT-AD-N-54-HARYANA-07-FadV-4-hexon-Ind
- APUP-FadV-C-Hexon-India-2009
- K531-FadV-4-Hexon-S.Korea-2007
- ▲ VRDC-SHL-CL-SivaSel-FAV-Vijaywada-2015
- HRD-FadV-H2-Hexon-India-2006
- IVRS-2-FadV-4-India-2002
- KC-FadV-4-Hexon-India-2007
- PP-01-FadV-4-hexon-India-2008
- RC-FadV-4-Hexon-India-2007
- PK-01-FadV-4-hexon-India-2008
- PS-04-FadV-4-hexon-India-2008
- PJ-06-FadV-4-hexon-India-2008
- PS-05-FadV-4-hexon-India-2008
- GC-FadV-4-Hexon-India-2007
- KRS-FadV-4-Hexon-Belgium-2002
- VR-025-FadV-4-Hexon-Belgium-2001
- KRS-FadV-C-Hexon-Austria-2011
- 505-FadV-4-Hexon-Belgium-2002
- ON1-FadV-4-Hexon-Canada-2004
- Ki-Gunwi-FadV-4-Hexon-S.Korea-2010
- K105-FadV-4-Hexon-Russia-2002
- IVRS-LS-FadV-4-India-2003
- FAV-10

FAV-4

Species C



VRDC, Serotype-II I, Group D Reproduction of the disease

- 17766-FAAdV-D-Hexon-Canada-2005
- 45870-FAAdV-D-Hexon-Canada-2006
- 19219-FAAdV-D-Hexon-Canada-2005
- 54595-FAAdV-D-Hexon-Canada-2003
- 54595-FAAdV-D-Hexon-Canada-2006
- 2924-1-FAAdV-D-Hexon-Canada-2005
- 3165-FAAdV-D-Hexon-Canada-2005
- 40432-Li-FAAdV-D-Hexon-Canada-2005
- 53357-71-FAAdV-D-Hexon-Canada-2004
- 56130 12d Pulli-FAAdV-D-Hexon-Canada-2004
- 23825-1-FAAdV-D-Hexon-Canada-2006
- 41265-05-FAAdV-D-Hexon-Canada-2006
- 1-CT-FAAdV-D-Hexon-Canada-2005
- CT-FAAdV-D-Hexon-Canada-2005
- K1012-FAAdV-11-Hexon-S.Korea-2008
- 25854-1-FAAdV-D-Hexon-Canada-2006
- 51178-FAAdV-D-Hexon-Canada-2004
- 55093-FAAdV-D-Hexon-Canada-2004
- 55751-FAAdV-D-Hexon-Canada-2006
- 48765-FAAdV-D-Hexon-Canada-2004
- 53906-FAAdV-D-Hexon-Canada-2003
- 4889-FAAdV-D-Hexon-Poland-2009
- 22394-FAAdV-D-Hexon-Canada-2004
- 52448-FAAdV-D-Hexon-Canada-2004
- 60057-903-FAAdV-D-Hexon-Canada-2004
- 58730-FAAdV-D-Hexon-Canada-2006
- 42854-1-FAAdV-E-Hexon-Canada-2006
- K09-21-FAAdV-11-Hexon-S.Korea-2009
- 3382-1H-FAAdV-D-Hexon-Canada-2006
- 10890-FAAdV-D-Hexon-Germany-2008
- 60057-928-FAAdV-D-Hexon-Canada-2004
- 55907-FAAdV-D-Hexon-Canada-2003
- 30487-FAAdV-D-Hexon-Canada-2006
- 60569-FAAdV-D-Hexon-Canada-2004
- 40372-FAAdV-D-Hexon-Canada-2004
- ▲ VRDC-309-SU-SZ-FAAdV-11-Inact-G23-2013
- ▲ VRDC-308-SU-SZ-FAAdV-11-Seed-G23-2013
- VRDC-JA-AdtIPF-WZ-FAAdV-11-2016
- VRDC-JA-WZ-FAAdV-11-2016
- HR4-FAAdV-Hr4-Hexon-India-2006
- VRDC-JA-WZ-DeshPF-FAAdV-11-2016
- VRDC-JA-WZ-DPF-FAAdV-11-2016
- ▲ VRDC-192-SU-Ven-SZ-FAAdV-11-2013
- ▲ VRDC-189-SU-Deksha-SZ-FAAdV-11-2013
- ▲ VRDC-190-SU-Chennak-SZ-FAAdV-11-2013
- ▲ VRDC-193-SU-Tataraj-SZ-FAAdV-11
- ABT-AD-09-HARYANA-07-FAAdV-12-hexon-Indi
- ABT-AD-83-HARYANA-07-FAAdV-12-hexon-Indi
- IVRI-617-AD-FAAdV-4-India-2002
- ABT-AD-73-HARYANA-07-FAAdV-12-hexon-Indi
- ABT-AD-27-HARYANA-07-FAAdV-12-hexon-Indi
- 7495-FAAdV-D-Hexon-Austria-2009
- 18085-FAAdV-D-Hexon-Poland-2008
- USP-01-FAAdV-11-hexon-Brazil-2006
- 52482-FAAdV-D-Hexon-Canada-2004
- RostovD2-FAAdV-D-Russia-2007
- 380-FAAdV-12-Hexon-Belgium-2001
- UF71-FAAdV-11-hexon-Australia-2008
- G26-FAAdV-11-Hexon-Belgium-2003
- OR46-FAAdV-2-Hexon-Australia-2008
- 6872-FAAdV-D-Hexon-Germany-2008
- NRB-FAAdV-D-Hexon-L1-Iran-2011
- 7190-FAAdV-D-hexon-Unitedkingdom-2009
- 8991-FAAdV-D-Hexon-Hungary-2009
- 11-15941-FAAdV-D-Hexon-Sweden-2012
- GB1340-FAAdV-D-Hexon-Sweden-2011
- 441-FAAdV-D-Hexon-Australia-2007
- 778-FAAdV-D-Hexon-Australia-2006
- 30973-FAAdV-D-Hexon-Canada-2004
- 57502-FAAdV-D-Hexon-Canada-2004
- 655-FAAdV-2-Hexon-Belgium-2002
- 5765-FAAdV-D-hexon-Italy-2007
- USP-02-FAAdV-11-hexon-Brazil-2007

FAV-11

Species D

FAV-2



Prevention and Control

Eradication

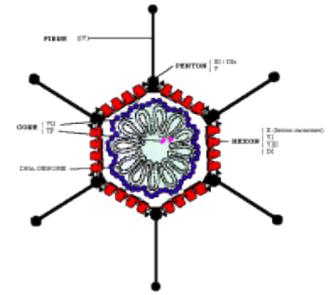
- Not possible, as widespread distribution of adenoviruses throughout the world.
- Some strains move between domestic and wild birds

Vaccines

- Developed after the outbreaks of IBH and HPS, with inactivated liver suspension with adjuvant.



Magic Bullet



- Scientific concept developed by a German Nobel laureate Paul Ehrlich in 1900
- An idea that it could be possible to kill specific microbes that cause diseases without harming the body itself.
- By further research, he realised that antibodies sometimes failed to kill microbes.
- **Abandoned his first idea on magic bullet.**

Vaccination of Breeders

- Australia and the US for **FAdV8**
- Asia (including India) and South America for **FAV-4**
- Canada and Europe: Autogenous vaccines, also followed in different parts of the world.

Cross Protection

- Primarily serotype specific, Birds can shed a serotype while having antibodies to another serotype
- Between **Serotypes 3 & 4** belonging to Species C
- Between **Serotype 2 & 11** belonging to Species D

Progeny Protection

- Level of maternal antibodies, depends on vaccine and application schedule (single, twice)
- Serotypes challenged

Take Home Message

Ubiquitous with wide array of manifestations as **“Primary Pathogen”**

Adenoviruses are involved in the **“Disease Complexes”**

“Vertical transmission”

Endemic strains vary by Region and Company

New strains may be introduced by **“Spiking males”**

FAV **“Serotype 4, 8 and 11”** are prevalent in India.

“Vaccination”: Decrease virus shedding.

Thanks

