Worldwide Food Scandal: How the DNA Can Help the Industry

…and the lessons to be learnt from these incidences

Sunil Kumar Verma, D.Phil.
Principal Scientist
CCMB, Hyderabad



Florida Fish Scandal, 2006



What was the scandal?

- In Florida, the expensive fish Grouper is the most popular fish
- Restaurants in USA were putting some fish other than expensive grouper inside the burgers and selling it under the name grouper but the customers never know it!
- The restaurants were exposed breaking the law and tricking consumers
- Florida Attorney General's Office and the ABC7 Whistleblower, a big news company of USA along with the Therion International, an animal DNA testing service in Saratoga, N.Y., became the News headlines within overnight….entire Florida was shaken with the news….

"State hunts bogus grouper" by Terry Tomalin, St. Petersburg Times - St. Petersburg, FL. (November 22, 2006).

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and so on…….

County	Case Number	Business Name	License Number	Date AC Issued	Status	District	Violation
Charlotte	2006045708	HOWARD'S	1800024	8/23/2006	Final Order Clerked	7	52-01-1
Charlotte	2006040253	FAULL INN	1801312	7/25/2006	Final Order Clerked	7	52-01-1
Charlotte	2006045546	JB'S CONCH CAFE	1801407	8/22/2006	Respondent Returned Signed Stipulation	7	52-01-1
Charlotte	2006040287	THE END ZONE	1801424	7/25/2006	Order Clerked and Completed	7	52-01-1
Charlotte	2006045751	THE ORIGINAL BARNACLE BILL'S	1801602	8/23/2006	Final Order Clerked	7	52-01-1
Charlotte	2006040331	SILVER SPOON DINER	1801616	7/25/2006	Final Order Clerked	7	52-01-1
Collier	2006046096	SCOOTERS SANDWICH SHOP	2100648	8/24/2006	Case Issued	7	52-01-1
Collier	2006041425	SAW GRASS GRILL	2101265	7/31/2006	Final Order Clerked	7	52-01-1
Collier	2006048659	DA RU MA JAPANESE STEAK HOUSE	2101463	9/8/2006	Case Issued	7	52-01-1
Collier	2006039226	BONITA BEACH GRILLE	2102567	7/19/2006	Final Order Clerked	7	52-01-1
Collier	2006048192	FLORIDIAN CLUB	2102764	9/6/2006	Respondent Returned Signed Stipulation	7	52-01-1
Lee	2006041344	DIXIE MOON CAFÉ	4602066	7/31/2006	Order Clerked and Completed	7	52-01-1
Lee	2006049143	CAMACHOS SPORTS BAR & GRILL	4602333	9/11/2006	Case Issued	7	52-01-1
Lee	2006051858	RIB CITY GRILL	4602922	9/22/2006	Case Issued	7	52-01-1
Lee	2006052926	BUCKETTS	4602960	9/27/2006	Case Issued	7	52-01-1
Lee	2006041339	MORETTI'S	4604786	7/31/2006	Final Order Clerked	7	52-01-1
Lee	2006046148	HOGBODY'S OF NORTH FT. MYERS	4604992	8/24/2006	Case Issued	7	52-01-1
Lee	2006039281	MIMI'S CAFE	4605710	7/19/2006	Case Awaiting Requested Hearing	7	52-01-1
Lee	2006030462	SHRIMP SHACK	4605743	6/5/2006	Order Clerked and Completed	7	52-01-1

Horse Meat Scandal (15.01.2013)

Food Safety Authority of Ireland and Europe



- On 16 January 2013 the Prime Minister asked the Food Standards Agency (FSA) to launch an urgent investigation into the contamination of beef products with horse and pig DNA

- UK local authorities carry out a wide range of checks at over 600,000 food businesses and also sea ports and airports, to ensure that food on sale or in the food chain, and imported in to the UK, meets food safety requirements, and that consumers are protected from fraud

Company	Date notified to FSA	Products that tested positive for horse DNA	Action taken[4]
Bird's eye	22 February 2013	Traditional Spaghetti Bolognese	Product Withdrawal
		Beef lasagne	Product Withdrawal
Brakes	19 February 2013	Brakes spicy minced beef skewer	Product Withdrawal
The Burger Manufacturing Company[8]	19 February 2013	Burger	Product Withdrawal
The Co-operative[9]	4 February 2013	Frozen: 4 Beef Quarter Pounder Burgers	Product Withdrawal
Findus	4 February 2013	Findus Beef Lasagne, 320g, 360g, 500g	Product Recall
Hungarian Food Ltd	20 March 2013	Kockázott Marhaús, 1.010kg (frozen diced beef)	Product Withdrawal
King Fry Meat	28 February 2013	Beef burger	Product Withdrawal

Table 1b All results submitted 05.07.2013

Table 1b Collated test results for horse (results submitted for all seven reports by FSA)			
Sample type	**Testing for horse**		
	Total number of tests	**Tests negative for horse**	**Tests positive for horse**
Beef products			
Products	12743	12696	47
Raw materials/ingredients	29125	29125	0
Total	41868	41821	47
Other (non-beef) meat products			
Products	2966	2966	0
Raw materials/ingredients	6042	6042	0
Total	9008	9008	0
All tests	**50876**	**50829**	**47**

News and updates

- News centre
- Food alerts news
- Allergy alerts news
- Consultations
- Campaigns
- Help shape our policies

Cymraeg

FSA welcomes horse meat sentencing

Last updated: 23 March 2015

The FSA welcomes the conclusion of the first prosecution brought as a result of the investigation into the horse meat incident in 2013.



Peter Boddy was today fined £8000 at Southwark Crown Court after he admitted failing to comply with food traceability regulations. He had admitted to selling horses for meat but failed to keep proper records to show who bought them. David Moss was given a four-months suspended prison sentence for falsifying an invoice. They were each asked to pay costs of more than £10,000.

Jason Feeney, Chief Operating Officer at the FSA, said: 'We are pleased with the successful conclusion of this prosecution. The rules on food traceability are there to protect consumers and legitimate businesses.

Meat scandal from other parts of the world

- Fake Lamb Meat (2008): + duck meat in goat or sheep urine to give the duck the smell and taste of lamb
- Lamb Meat Scandal of China (2013): + rat, fox or mink
- Fake beef Scandal of China (2013): + pork with chemicals, such as paraffin wax and industrial salts
- Cat meat Scandal of China (2013): Cat meat was sold as rabbit
- Gutter oil scandal ! internal organs, and expired or otherwise low quality meat which is then cooked in large vats in order to extract the oil

The Furry Heinz of Brazil +rodents



Most recent Peanut scandal of China (2015)



cheap peanuts and almonds are secretly being used in dishes claiming to contain more expensive cumin seeds

The list of food and meat scandals exposed during last decade is very long…..

What was the technological invention behind these investigations ?

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and so on…….

Florida Fish Scandal

(2006)

Therion INTERNATIONAL
36 Phila Street · Saratoga Springs · New York 12866
(518) 584-4300 · (518) 584-2310 Fax

Client: Katie LaGrone, ABC-7 News

Species: fish species identification

Sample type: frozen cooked tissue

Number received: 8

Date: November 8, 2006

Project # 20220

Received: October 11, 2006

Florida Fish Scandal

(2006)

THERION INTERNATIONAL
FINAL REPORT
Project # 20220

Methodology:

DNA was extracted from the tissue samples using a modified organic extraction procedure. An aliquot of the DNA was amplified by the polymerase chain reaction (PCR™) using universal primer pairs to the mitochondrial cytochrome *b* gene (Verma & Singh, 2003, Molecular Ecology Notes, 3, 28-31).

A novel universal approach of species identification for forensic applications

Methodology

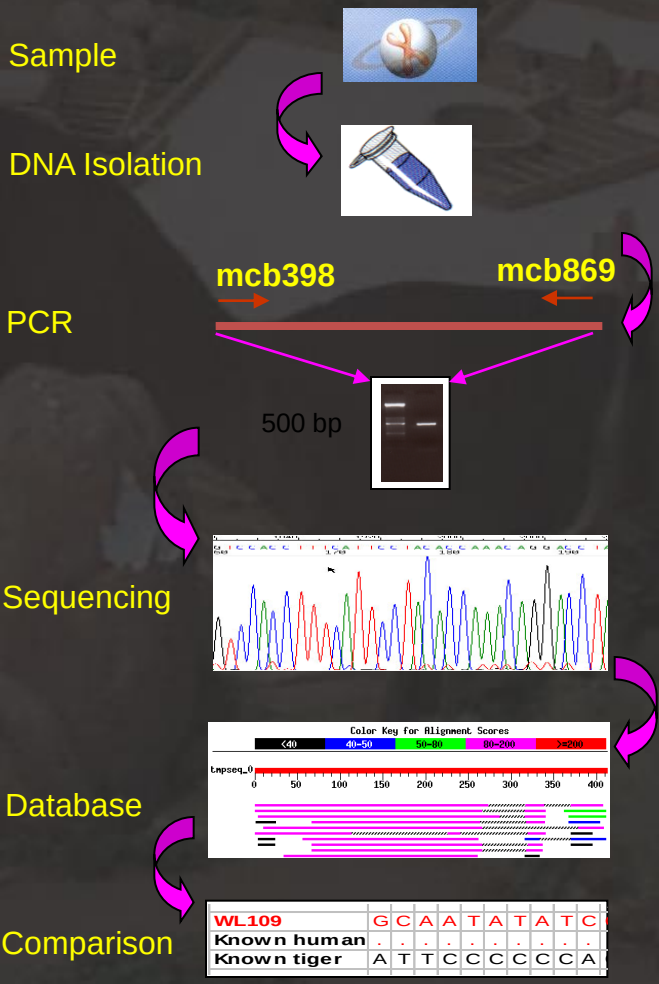
Salient features

Does not require prior information about the origin of the samples..

Universally applicable..

Can be performed with minute amounts of confiscated remains..

Simple, quick and authentic..



Universal Primer Technology

Verma & Singh (2001)

12 patents granted so far

US Patent no. 7141364, South Africa Patent no. 2003/7489, China Patent no. ZL01823181.0, Australia Patent no. 2001258719, India Patent no. 224401, Japan Patent no. 2002-575320, Germany Patent no. 01932045.6, France Patent no. 1373558, Great Britain Patent no. 1373558, Ireland Patent no. 1373558, Netherlands Patent no. 1373558

3 National Awards

CSIR Technology Award 2008



NRDC Meritorious Invention Award – 2009 (GOI)



BioAsia Innovation Award 2009

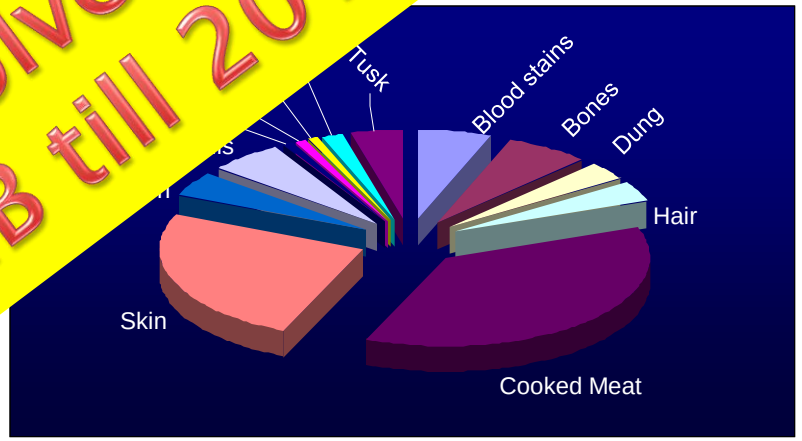












~1500 cases solved in LaCONES/CCMB till 2014







Print

Press Information Bureau
Government of India
Ministry of Science & Technology

06-August-2014 16:56 IST

CSIR-Centre for Cellular & Molecular Biology (CSIR-CCMB) had developed DNA barcoding technology.

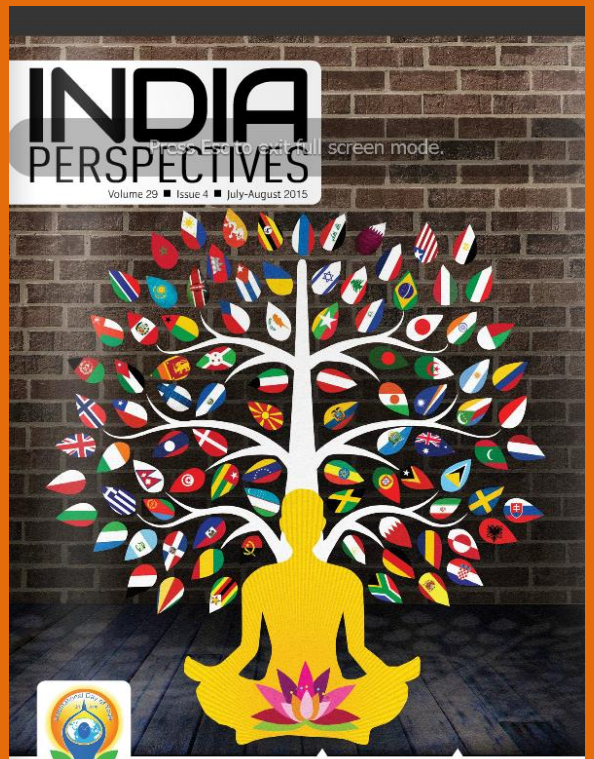
In March 2001, Verma and Singh invented the "Universal primer technology" to address the question pertaining to establishment of the identity of any unknown biological sample and assign it to its known species source (Verma and Singh, US and PCT Patent application No: PCT/IN01/00055, First Filling Date: 28/03/2001; Priority date: 28/03/2001).

This technology worked across large range of animal species in a universal manner and was able to detect any of the endangered species of India (and that of entire world indeed), from birds to fishes to mammals to provide "beyond a reasonable doubt" evidence on species identity in the court of law. Patent related to this invention was filed in several countries and the research papers were published in various journals. This technique of CSIR-CCMB revalorized the arena of Wildlife Forensics. It is currently being used routinely in LaCONES of CSIR-CCMB to provide the wildlife forensics services to the Nation in the cases pertaining to wildlife crime.

CCMB is self reliant in this aspect with advanced technology

This was stated by Union Minister of State for Science and Technology and Ministry of Earth Sciences Dr. Jitendra Singh in a written reply in Lok Sabha today.

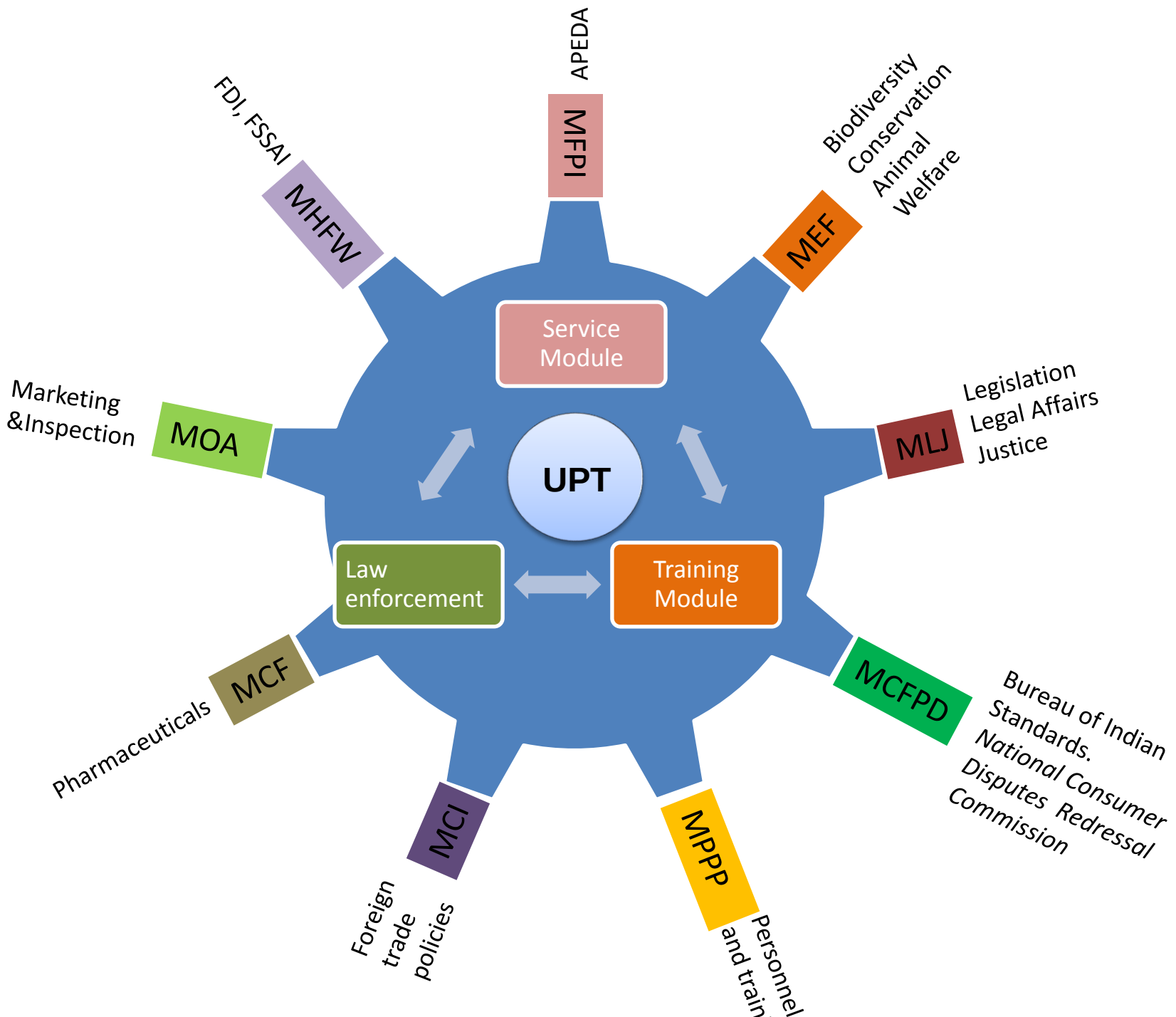
A revolution in *wildlife forensics*



Food testing in India ??

No DNA test has been conducted till date in India for any food commodity including meat!

Future Directions

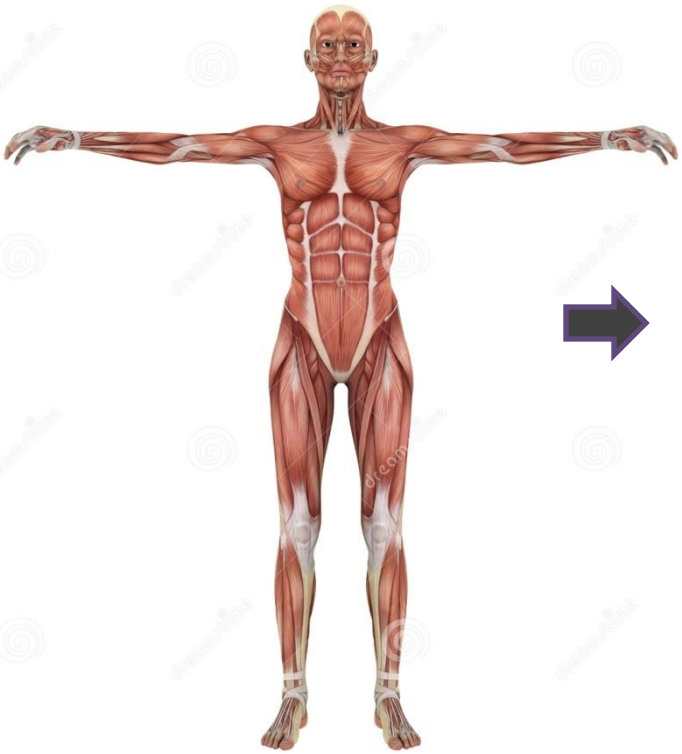

APEDA
MFPI
Biodiversity
Conservation
Animal
Welfare
MEF
FDI, FSSAI
MHFW
Service
Module
Marketing
&Inspection
MOA
UPT
Legislation
Legal Affairs
Justice
MLJ
Law
enforcement
Training
Module
Pharmaceuticals
MCF
MCFPD
Bureau of Indian
Standards.
National Consumer
Disputes Redressal
Commission
Foreign
trade
policies
MCI
MPPP
Personnel
and train

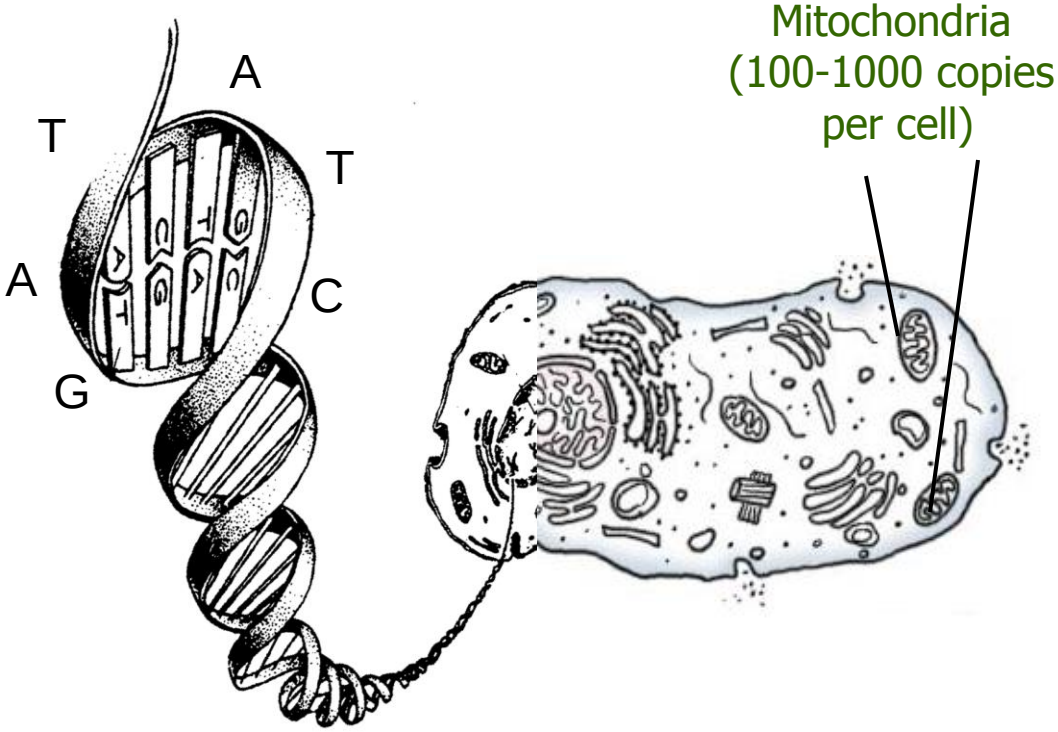

Thank you

What is DNA?

An Introduction

DNA

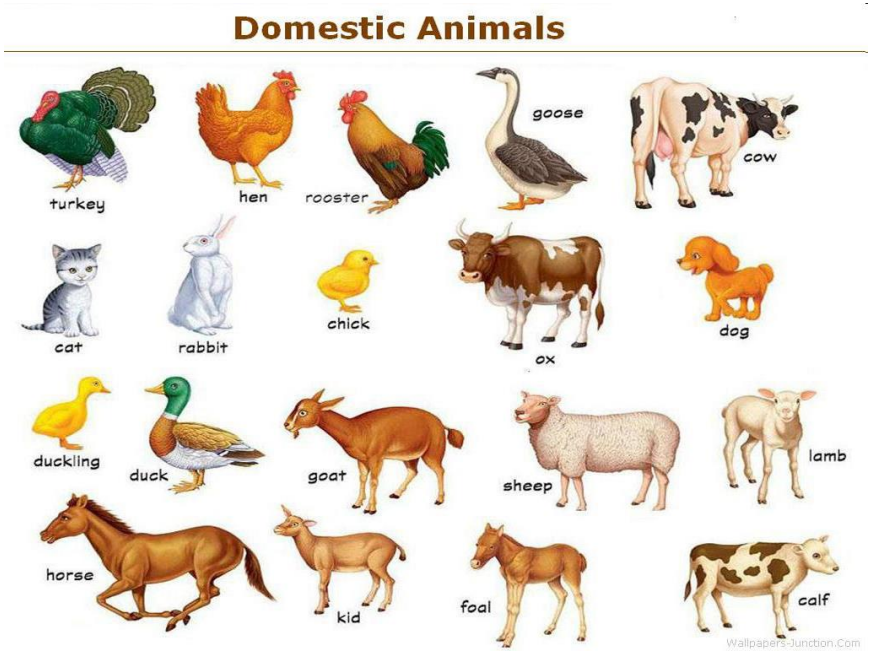




Each cell contains = 3.12 Billion Building Blocks
Length of each Block = 0.34×10^{-9} m
Total No of such block in each cells = 3.12 Billion
Total No of Cells in Body = 10^{13}
Toatal length of DNA in human Body = 2.0×10^{13} meters

i.e. nearly 70 trips from Earth to Sun and back…….

Every individual animal has a unique DNA







How the DNA test is done?

Can we identify by eye?

REAL OR FAKE

A





B

A: Real Skin

B: Fake Skin

Identify these by Eye?

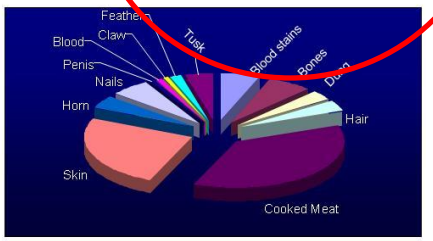


















First case of Wildlife Identification

solved in India using molecular interventions
Verma & Rao, 1999

1999

First case solved in India using the Molecular interventions

❖ Political dinner of Khammam district of AP)

- In the year 1998, the wildlife officials Confiscated cooked meat suspected to be that of a wild pig.
- A DNA based **microsatellite approach** established the identity of the sample as a porcine source (Verma & Rao, 1999).
- This was the fist report from India, where the molecular intervention was employed to resolve a case of wildlife crime.



Verma SK, Rao, GV. DNA microsatellites based identification of a wild animal. Proceedings of the 15th Triennial Meeting of International Association of Forensic Sciences held in University of California during August 22-28, 1999 at Los Angeles USA.

Emerging Forensic Scientist Continental Award to SKV by IAFS at University of California, USA in 1999

First case of Wildlife Identification

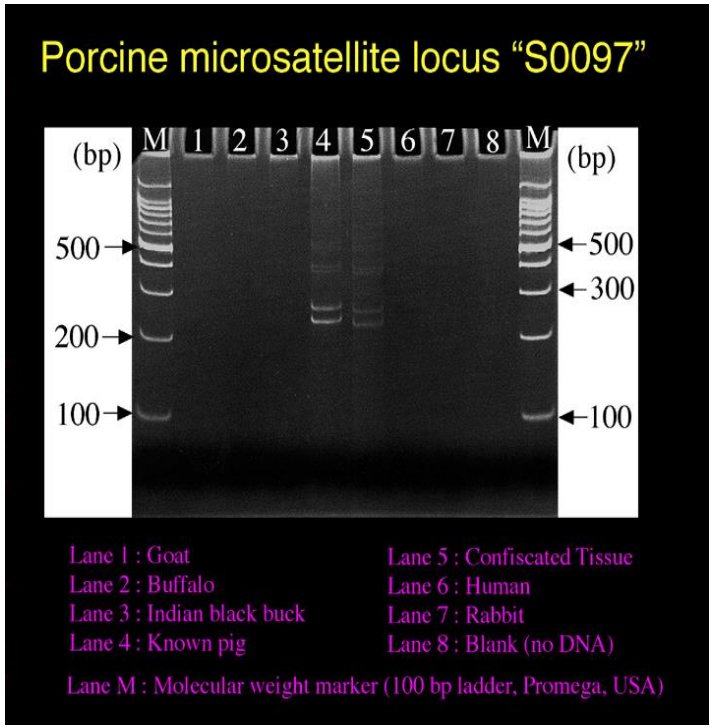
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Second case of Wildlife Identification

solved in India using molecular interventions
Verma & Rao, 1999

1999

Second case solved in India using the Molecular interventions

❖ The black buck poaching case of jodhpur

- In 1998, a famous cine star was accused of hunting and killing the endangered black buck in the forest of Jodhpur, India
- The confiscated meat sample were investigated to establish the species source of the sample and the total numbers of animals killed in the forest
- The case was investigated using DNA forensics (RAPD & PCR-RFLP) and the accused was convicted by the court



(State vs. Salman Khan 2001 (2) WLC 535, 2007 (3) WLN 324)

Second case of Wildlife Identification

1999

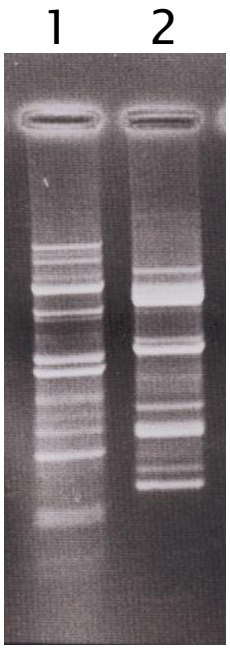
Second case solved in India using the Molecular interventions

solved in the country using molecular interventions

Verma & Rao, 1999

- The black buck poaching case of jodhpur

No. of animals killed



RAPD analysis: Showing two different patterns of bands



(State vs. Salman Khan 2001 (2) WLC 535, 2007 (3) WLN 324)

Second case of Wildlife Identification

1999

Second case solved in India using the Molecular interventions

solved in the country using molecular interventions

Verma & Rao, 1999

- The black buck poaching case of jodhpur

Species of animal killed

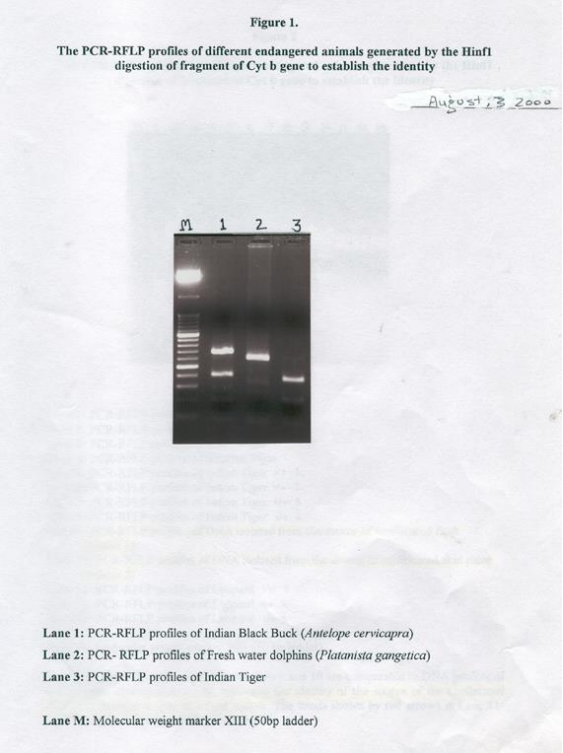


Figure 1.

The PCR-RFLP profiles of different endangered animals generated by the Hinf1 digestion of fragment of Cyt b gene to establish the identity

August 13 2000

M 1 2 3

Lane 1: PCR-RFLP profiles of Indian Black Buck (*Antelope cervicapra*)
Lane 2: PCR- RFLP profiles of Fresh water dolphins (*Platanista gangetica*)
Lane 3: PCR-RFLP profiles of Indian Tiger

Lane M: Molecular weight marker XIII (50bp ladder)

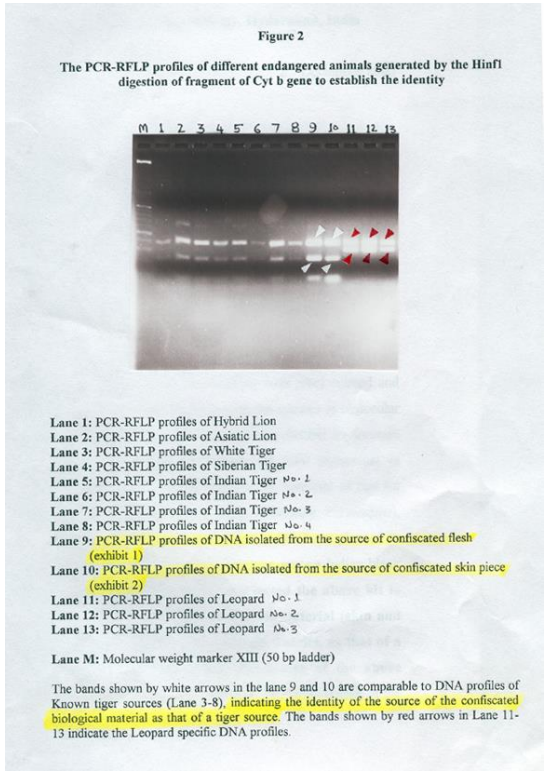


Figure 2

The PCR-RFLP profiles of different endangered animals generated by the Hinf1 digestion of fragment of Cyt b gene to establish the identity

M 1 2 3 4 5 6 7 8 9 10 11 12 13

Lane 1: PCR-RFLP profiles of Hybrid Lion
Lane 2: PCR-RFLP profiles of Asiatic Lion
Lane 3: PCR-RFLP profiles of White Tiger
Lane 4: PCR-RFLP profiles of Siberian Tiger
Lane 5: PCR-RFLP profiles of Indian Tiger No. 1
Lane 6: PCR-RFLP profiles of Indian Tiger No. 2
Lane 7: PCR-RFLP profiles of Indian Tiger No. 3
Lane 8: PCR-RFLP profiles of Indian Tiger No. 4
Lane 9: PCR-RFLP profiles of DNA isolated from the source of confiscated flesh (exhibit 1)
Lane 10: PCR-RFLP profiles of DNA isolated from the source of confiscated skin piece (exhibit 2)
Lane 11: PCR-RFLP profiles of Leopard No. 1
Lane 12: PCR-RFLP profiles of Leopard No. 2
Lane 13: PCR-RFLP profiles of Leopard No. 3

Lane M: Molecular weight marker XIII (50 bp ladder)

The bands shown by white arrows in the lane 9 and 10 are comparable to DNA profiles of Known tiger sources (Lane 3-8), indicating the identity of the source of the confiscated biological material as that of a tiger source. The bands shown by red arrows in Lane 11-13 indicate the Leopard specific DNA profiles.



(State vs. Salman Khan 2001 (2) WLC 535, 2007 (3) WLN 324)

Identification of Animal from partially burnt bones

2000

First case solved using the Molecular Signature Technology

(CCMB case No WL101)

➢ Establishing species identity of a poached animal

- In the year 2000, a cub of a carnivore suspected to be that of a tiger or that of a leopard was killed and buried in the forest of Adilabad district of Andhra Pradesh.
- The skeleton of the animal was burnt and defaced; therefore it was not possible to confirm the identity of the species of poached animal using morphological features.
- Samples of half burnt bones recovered from the scene of crime were forwarded to us (CCMB) to establish the identity of the species.
- The case was investigated using the 'Molecular Signature Technology' (Described in US patent 7,141,364) and the identity of the sample was assigned to *Panthera pardus* (Leopard) species



Verma S. K., Singh, L. Universal Primers to establish the identity of animal parts and products. PCT Patent Application No: PCT/IN01/00055, **First Filling Date**: **28/03/2001; Priority date: 28/03/2001.**

12 patents granted **so far to the 'Molecular Signature' technology of Verma & Singh. The details are –**

US Patent no. 7141364, South Africa Patent no. 2003/7489, China Patent no. ZL01823181.0, Australia Patent no. 2001258719, India Patent no. 224401, Japan Patent no. 2002-575320, Germany Patent no. 01932045.6, France Patent no. 1373558, Great Britain Patent no. 1373558, Ireland Patent no. 1373558, Netherlands Patent no. 1373558

Elusive panther has officials on wild goose chas

EXPRESS NEWS SERVICE

Chennai, Jan 6: For 15 days, ignar Anna Zoological Park Vandalur, Chennai, has seeing a circus. The ring- er happens to be a now e-now missing "stray car- rous animal" that has led from here to Delhi on e chase.

couldn't determ- was – A lioness? A A team from Delhi leared that doubt. dying pug marks and atter, it said yester- it was definitely a but would do a DNA be absolutely sure. e animal came a mystery. Environ- alu,

functioning and wonders if the entire episode isn't the result of "lack of efficiency or sheer carelessness". Smarting, state Minister for Forests S.S. Thirunavukkar-

enter the trap".

To those familiar with the search, that seems to be just what they have been doing so far. Meanwhile, the zoo has been closed to public and the

seem to have ever come to catching it.

Recently, Baalu took ers into his own hand, an ered Member Secretary, ral Zoo Authority (CZA) Sinha to the zoo. After cting the evidence, he sed a preliminary report ing the animal was a pa and said he would se

First they couldn't determine what it was – A lioness? A panther? A team from Delhi finally cleared the doubt. After studying

Position	219	222	223	257	263	266	272	278	280	284	290	298	299	317	319	320
WL112	C	G	C	G	A	C	T	C	T	T	C	A	T	G	C	T
WL113	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
WL114	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
WL115	.	.	T	.	.	.	.	.	.	.	.	.	.	.	.	.
LEOPARD	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
TIGER	.	A	.	A	G	.	.	.	.	C	.	.	C	.	G	C
Asiatic Lion	T	A	.	A	A	T	C	T	C	C	T	G	C	A	C	T

Figure: Comparison of molecular signatures



Zoo officials trap panther

Chennai: Forest officials in the Vandalur zoo, near Chennai, on Saturday heaved a sigh of relief when they successfully

केन्द्रीय चिड़ियाघर प्राधिकरण
Central Zoo Authority
[STATUTORY BODY UNDER THE MINISTRY OF ENVIRONMENT & FORESTS, GOVT. OF INDIA]

Bikaner House, Annexe-VI,
Shahjahan Road, New Delhi - 110 011
Website : http://envfor.nic.in/cza

No.26-6/99-CZA(Vol-II) **Date : 26.9.2001**

To

The Chief Wild Life Warden
of all the States

You are aware that earlier, facilities for carrying out DNA Fingerprinting and modern molecular tests were not available in our country. Therefore, requests used to be received from various sources in the country in the Ministry for sending samples of biological materials for molecular analysis to institutes outside India. Now, such a facility is available in our country at Centre for Cellular & Molecular Biology where a Laboratory for Conservation of Endangered Species (LaCONES) has been established in collaboration with Dept. of Biotechnology, Central Zoo Authority and Andhra Pradesh Forest Department. CCMB has agreed to undertake analysis of samples of wild animals like blood, bones or any other biological material in matter of court cases, scientific projects etc. The CCMB would charge Rs.3000/- for analysis of each sample. Getting the biological samples analysed within the country in an institution under CSIR would also ensure that no biopiracy of such materials takes place.

You may kindly inform all concerned to avail of this facility. The persons who should be contacted for the purpose are following :

Dr. Lalji Singh
Director,
Centre for Cellular & Molecular Biology (CCMB),
Uppal Road,
Hyderabad - 500 007.

Or

Dr. Shivaji
Dy. Director
Centre for Cellular & Molecular Biology (CCMB),
Uppal Road,
Hyderabad - 500 007.

Director
Dr. S. Shivaji

Sent Copy to:
Dr. S. Shivaji
Dr. Lalji Singh
Dr. Khalid Hasan
FAO

1/10 To, Sunil Kumar Verma CoA. 3.10.2001

Contd.....2/

Phone : (EPABX) 011-3073072, 3381585 Fax : 3386012 E-mail : cza@ndf.vsnl.net.in

Peafowl Slaughter (2005)

Gupta et al. (2005) Molecular insight into a wildlife crime: the case of a peafowl slaughter, forensic Science International, 154:214–217.





Peafowl

Tiger skin

Gaur et al.



Dried Snake venom

Indian Cobra

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CASE REPORT

CRIMINALISTICS

Chandra S. Singh,[1,] *M.Sc.; Ajay Gaur,*[1,] *Ph.D.; Ara Sreenivas,*[1] *M.Sc.; and Lalji Singh,*[1] *Ph.D.*

Species Identification from Dried Snake Venom*

ABSTRACT: Illegal trade in snake parts has increased enormously. In spite of strict protection under wildlife act, a large number of snakes are being killed ruthlessly in India for venom and skin. Here, an interesting case involving confiscation of crystallized dried snake venom and subsequent DNA based species identification is reported. The analysis using the universal primers for cytochrome b region of the mitochondrial DNA revealed that the venom was extracted from an Indian cobra (*Naja naja*). On the basis of this report, the forwarding authority booked a case in the court of law against the accused for illegal hunting of an endangered venomous snake and smuggling of snake venom. This approach thus has immense potential for rapid identification of snake species facing endangerment because of illegal trade. This is also the first report of DNA isolation from dried snake venom for species identification.

KEYWORDS: forensic science, wildlife forensics, snake venom, species identification, mitochondrial DNA, cytochrome b

Snake in a Wine bottle
Indo-Chinese Spitting Cobra

Gaur et al. 2012

Forensic Science International 214 (2012) e51–e53

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Letter to the Editor

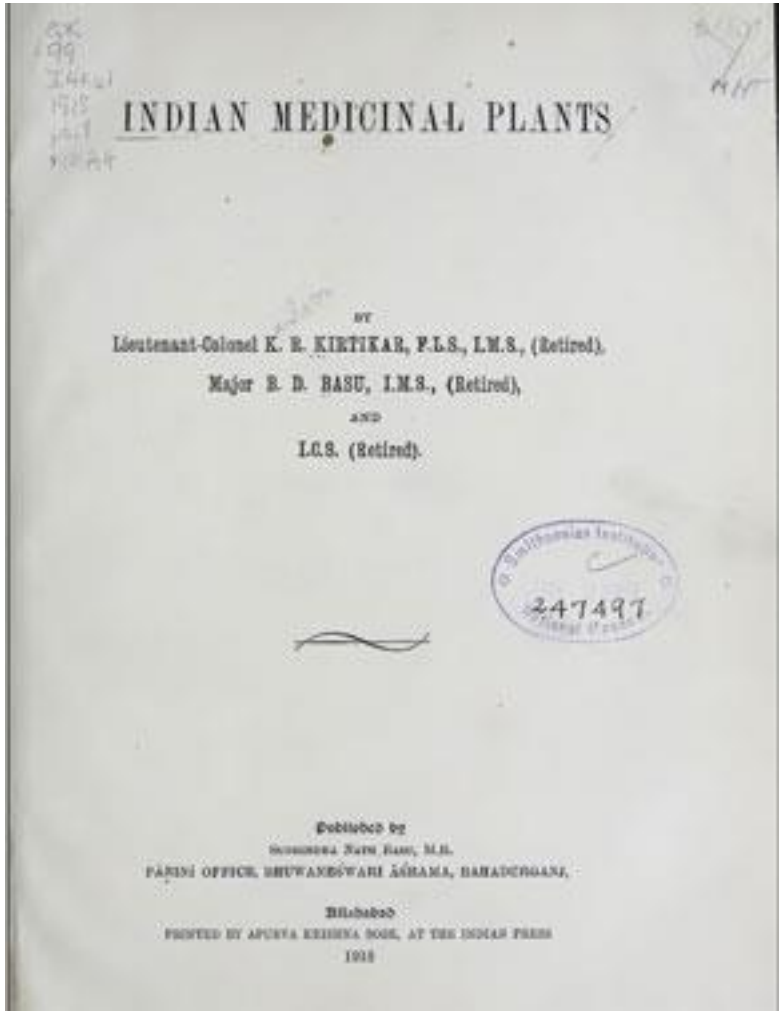
DNA-based identification of a snake in a wine bottle using universal primers: A case of mistaken identity

Dear Editor,

Conventional methods for forensic species identification in wildlife crimes are mainly based on morphological and immunological procedures, which have limited applications for old and

finely chopped, and transferred to lysis buffer [13] and incubated at 48 °C for 8 h with gentle rotation. After the complete lysis, genomic DNA was isolated from these tissues by the conventional phenol–chloroform method [13]. The DNA isolated from both tissue types was amplified using the universal primers and procedures reported by Verma and Singh [1]. The DNA extraction, amplification and sequencing for both specimen tissues were repeated three times. A PCR product of 472 bp was obtained and after editing a consensus sequence of 421 bp was analyzed using

Indian Medicinal Plants (1918)



INDIAN MEDICINAL PLANTS

BY

Lieutenant-Colonel K. R. KIRTIKAR, F.L.S., I.M.S., (Retired),

Major B. D. BASU, I.M.S., (Retired),

AND

I.C.S. (Retired).

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1918

Artemisia/Artemisin/Artemisinin facts

by me in cases of ague, intermittent and remittent fever. It is a very useful febrifuge and deserves trial (B. D. Basu).

Church reported on a bundle of dry leaves received at Kew from Duthie. The following is his analysis :—

Percentage composition of *Artemisia maritima* :—

Water	13·6
Oil, resin, wax, etc.	4·0
Starch, sugar, gum, etc. (by difference)	34·2
Albuminoids (true)	6·0
Fibre	33·9
Ash (includes 2·7 of sand and mica)	8·3

Church remarks that the plant contains rather less albuminoids, less digestible carbohydrates, and more fibre than the average hay of mixed grasses. It is, however, thrice as rich in albuminoids as the straw of European cereals.

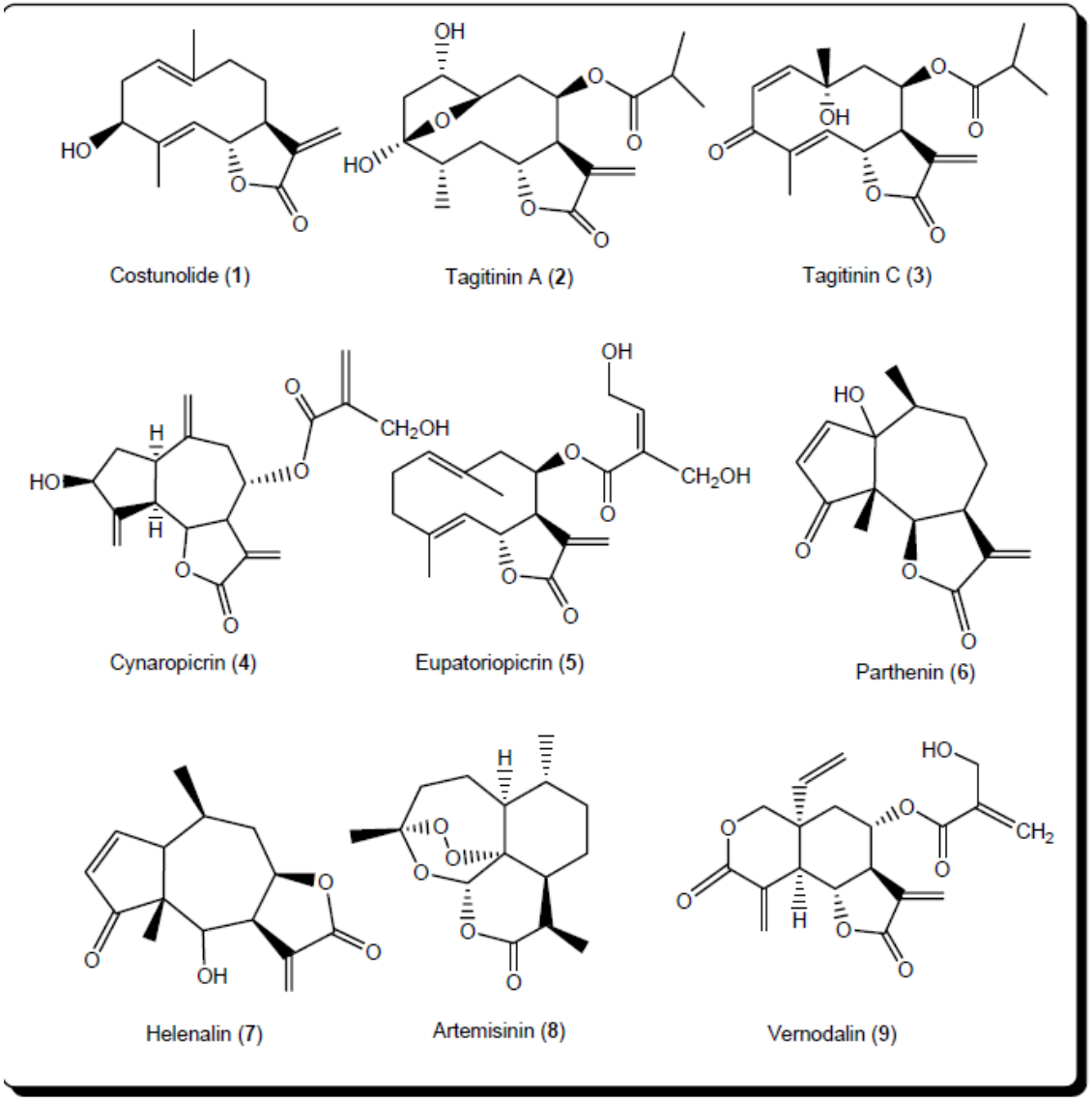
Artemisin, C_{15} H_{18} O_4, is obtained from the last mother liquors in the technical treatment of the seed of *Artemisia maritima*. It is freed from santonin by recrystallisation from chloroform, being deposited in combination with 1 mol. of the solvent, which is evolved at 90°. It melts at 200°, gradually turns yellow in the air, and is more readily soluble in water and dilute alcohol than santonin; $[\alpha]_D = -84{\cdot}3°$. The ferric chloride reaction is not characteristic; when heated with soda (10 parts) and water (40 parts), a fugitive carmine-red coloration is produced, and, like santonin, it gives the same colour with alcoholic soda. Artemisin is apparently hydroxy santonin.—**J. Ch. S. LXX, pt. I. (1896) p. 59.**

Max Jaffé, considers artemisin as *γ-hydroxysantonin*.

664. *A. vulgaris, Linn.* H.F.B.I., III. 325; Roxb.

Artemisia/Artemisin/Artemisinin facts

Sesquiterpene lactone



Nature India Special Annual Volum

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DNA-based animal identification technique in credit dispute

K. S. Jayaraman

A technique used globally for DNA-based identification of animal species is now at the centre of a credit dispute. Scientists at the Centre for Cellular and Molecular Biology (CCMB) in Hyderabad claim that credit for one of their patented inventions is being given to a group in Canada — a charge that the Canadian scientists say does not hold good since they use a different region of the gene in their technique.

The Universal Primer Technology (UPT) – for which the CCMB scientists hold a patent in 14 countries including the US – is based on a concept that just a tiny segment of the genome can serve as a 'molecular signature'. Variations in its DNA sequence can be used to identify any bird, fish, reptile or mammal from a given biological sample. It can, among other things, detect adulteration of animal meat in food products, and help curb illegal trade in wildlife.

"Wildlife forensic scientists everywhere use UPT for species identification," Sunil Kumar Verma, principal

CCMB, Hyderabad

