



How to Improve the Fight Against Doping

A perspective from the German Sport University and the Institute of Biochemistry

Wilhelm Schänzer

Cologne - 5th October 2011



Manfred Donike

23.8 1933 – 21.8.1995

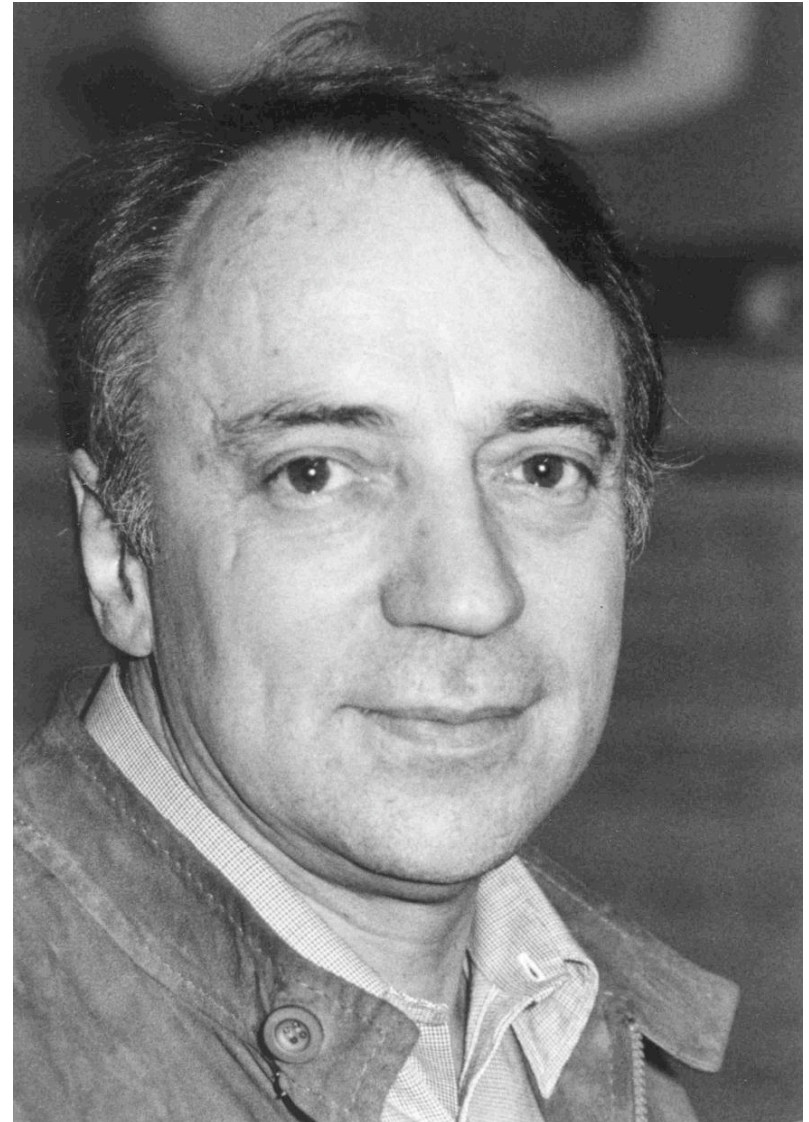
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1969 Synthesis of MSTFA

**1972 Dope testing
Olympic Games Munich
GC and MS**

**1977 Professor (appointment)
Institute of Biochemistry
German Sport University**

**1980 Member of the IOC MC-
subcommission „Doping and
Biochemistry“**



Tour de France 1967



Tom Simpson

tragic death

Mont Ventoux

amphetamine

alcohol



Manfred Donike

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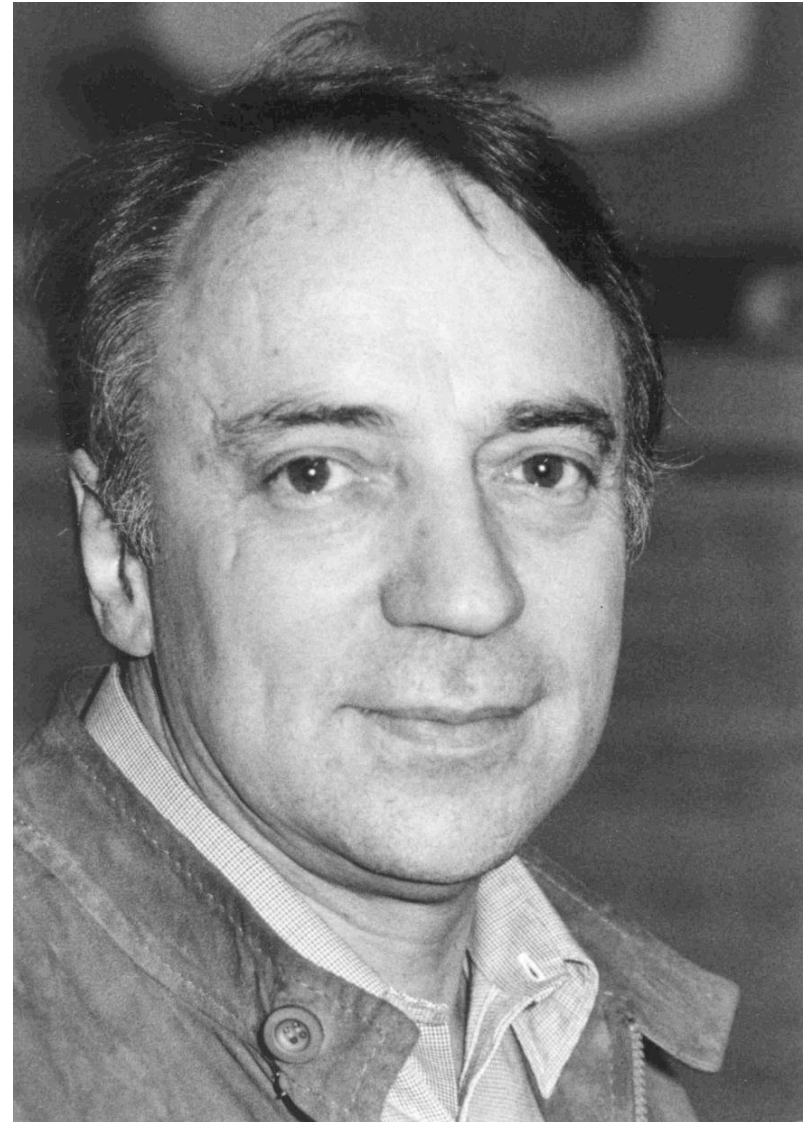
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List of prohibited substances for the Olympic Games in Munich 1972

- a) Stimulants
- b) Narcotics



Stimulants

a) Psychomotoric Stimulants e.g.	c) Different Substances of the Central Nervous System e.g.
Ethylamphetamine	Amiphenazol
Amphetamine	Bemegrid
Benzphetamine	Leptazol
Cocain	Nikethamide
Diäthylaminopropiophenon	Strychnin
Dimethylamphetamine	and related substances
Fencamphetamine	
Methylamphetamine	
Methylphenidate	
Norpseudoephedrine	
Phendimetrazin	
Phenmetrazin	
Prolintane	d) Narcotics and Analgetics e.g
and related substances	Dextromoramide
	Dipipanone
b) Sympathomimetic Amines e.g.	Heroin
Ephedrine	Methadone
Methylephedrine	Morphine
Methoxyphenamine	Pethidine
and related substances	and related substances

Narcotics



The 2011 Prohibited List - World Anti-Doping Code

Substances and Methods prohibited in competition

S0 Non-approved substances and methods

S1 Anabolic agents

Anabol androgenic steroids (AAS)

Other anabolic agents

S2 Peptide hormones, growth factors and related substances

S3 Beta-2 Agonists

S4 Hormone antagonists and modulators

S5 Diuretics and other masking agents

S6 Stimulants

S7 Narcotics

S8 Cannabinoids

S9 Glucocorticosteroids

M1 Enhancement of oxygen transfer

Blood doping

Artificial oxygen uptake, transport or delivery

M2 Chemical and physical manipulation

M3 Gene doping

Substances prohibited in particular sport

Alcohol, Beta-Blockers



Detection of Testosterone misuse

1983

Testosterone / Epitestosterone
T/E - ratio > 6

Sport: Leistung und Gesundheit / Kongreßbd. Dtsch. Sportärztekongreß 1982 Köln

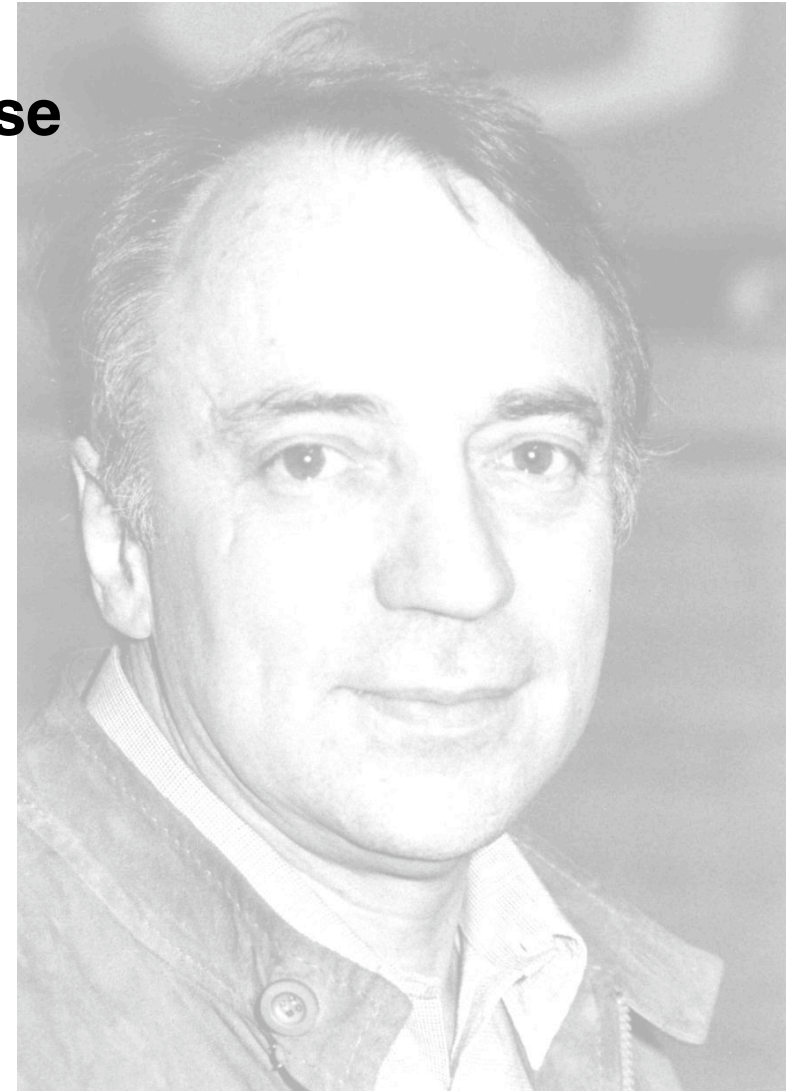
Nachweis von exogenem Testosteron

The detection of exogenous testosterone

M. Donike, K.-R. Bärwald, K. Klostermann, W. Schänzer, J. Zimmermann

Institut für Biochemie der Deutschen Sporthochschule Köln

Anschrift für die Verfasser: Prof. Dr. rer. nat. M. Donike,
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- 1981 Opening of a new laboratory - Institute of Biochemistry
at the 7th floor of the new building - German Sport University**
- 1981 Symposium organized under participation of the Medical
Commission of the IOC and the Medical Commission of the IAAF**
- 1983 1st Cologne Workshop on Dope Analysis**
- Next year**
- 2012 30th Cologne Workshop on Dope Analysis
“Manfred Donike Workshop for Dope Analysis”**

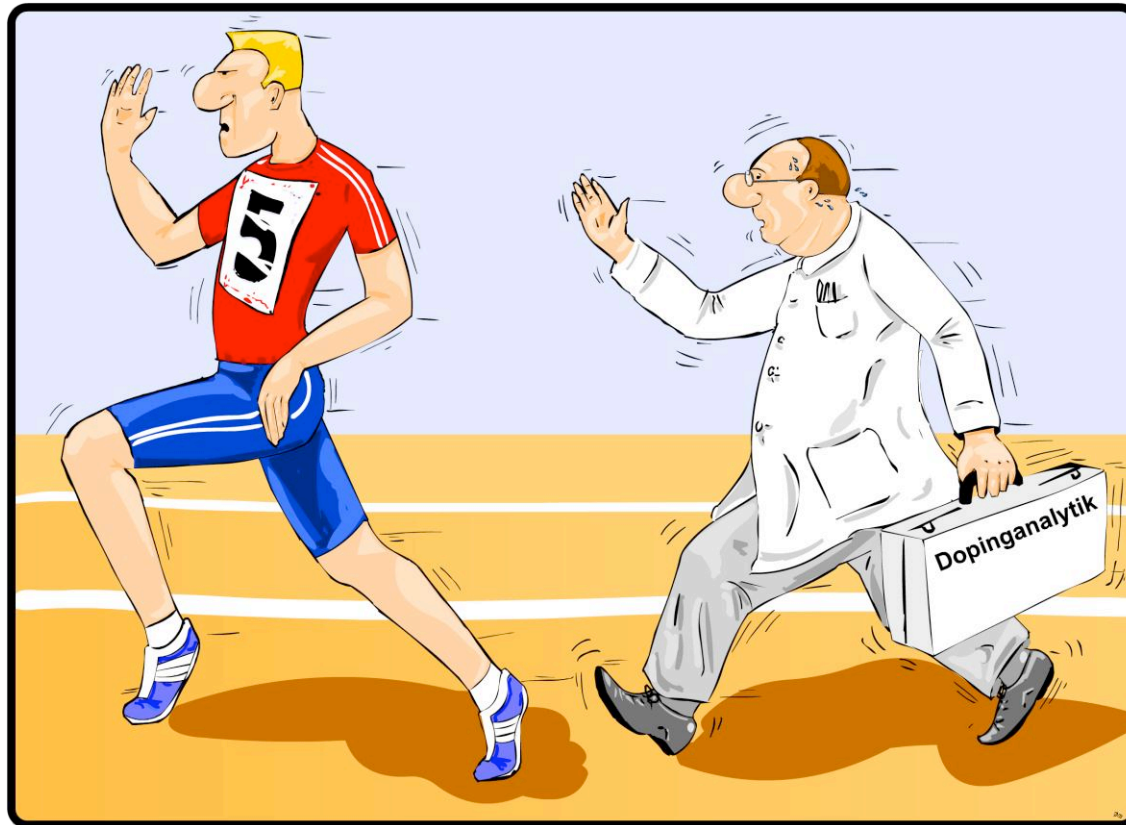


20th Proceedings in 2011



World Association of Anti-Doping Scientists

- Experts in dope analysis
- Working in an accredited laboratory
- Charing of knowledge (new substances, new methods)
- Exchange of reference material



New Doping Methods

Doping Control

WADA List of Prohibited Substances and Methods 2011

S0 Non-approved Substances			?	?
S1 Anabolic Substances				
1. Anabol Androgenic Steroids (AAS)				
<i>a. Exogenous AAS:</i>	46 Substances	> 46		
<i>b. Endogenous AAS:</i>	21 Substances	21		
2. Other Anabolic Substances	4 Substances	4		
	SARMs		SARMs	
S2 Peptide Hormones	EPO + Analogs	> 20	EPO + Analogs	
	Choriogonadotropin	1		
	Growth Hormone	1	GHRH, GHRP	Growth factors
	Insulin Analogs	5		Human Insulin
				IGF-1
			LHRH	LH
			Synacthen	
S3 Beta-2 Agonists	6 Substances	> 6		
S4 Hormone Antagonists and Modulators	12 Substances	12		Myostatin-Inhibitors
S5 Diuretics and other Masking Agents	18 Substances	> 18		Albumin
S6 Stimulants	63 Substances	> 63		Adrenalin
S7 Narcotics	11 Substances	> 11		
S8 Cannabinoids	1 Substance	1		
S9 Glucocorticosteroids	16 Substances	> 16		
M1 Enhancement of Oxygen transfer	3 Methods	3	blood transfusion	
M2 Chemical and Physical Manipulation	dif. Techniques		dif. Techniques	
M3 Gene Doping	2 Substances	1	AICAR	AICAR
			Gene Therapy	Gene Therapy
P.1 Alcohol	1 Substance	1		
P.2 Beta Blockers	19 Substances	> 19		



Improved Analytical Techniques

(especially for detection of anabolic androgenic steroids,
but also for several peptides)

1995 - High Resolution Mass Spectrometry

1997 - Tandem Mass Spectrometry

... Continuous improvement in Mass Spectrometry



High Resolution Mass Spectrometry

Applied at the

- Olympic Games
Atlanta 1996
- IOC accredited
Dope control
laboratories had to
install this technique
or a similar sensitive
MS technique

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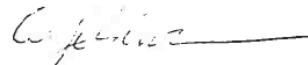
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KÖLN, DEN 9. September 1995

Monseigneur,

Regarding our discussion in Düren about the advantages of High Resolution MS in
dope control I would like to present you our results in the screening of anabolic
steroids from January to August 1995. From the 82 positive cases 50 cases were only
found by the use of High Resolution MS. This project was initiated by Prof. Donike
and it was also his intention to introduce High Resolution MS to the IOC accredited
laboratories.

With kind regards

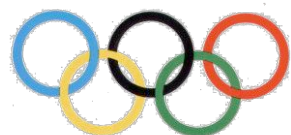

Willi Schänzer



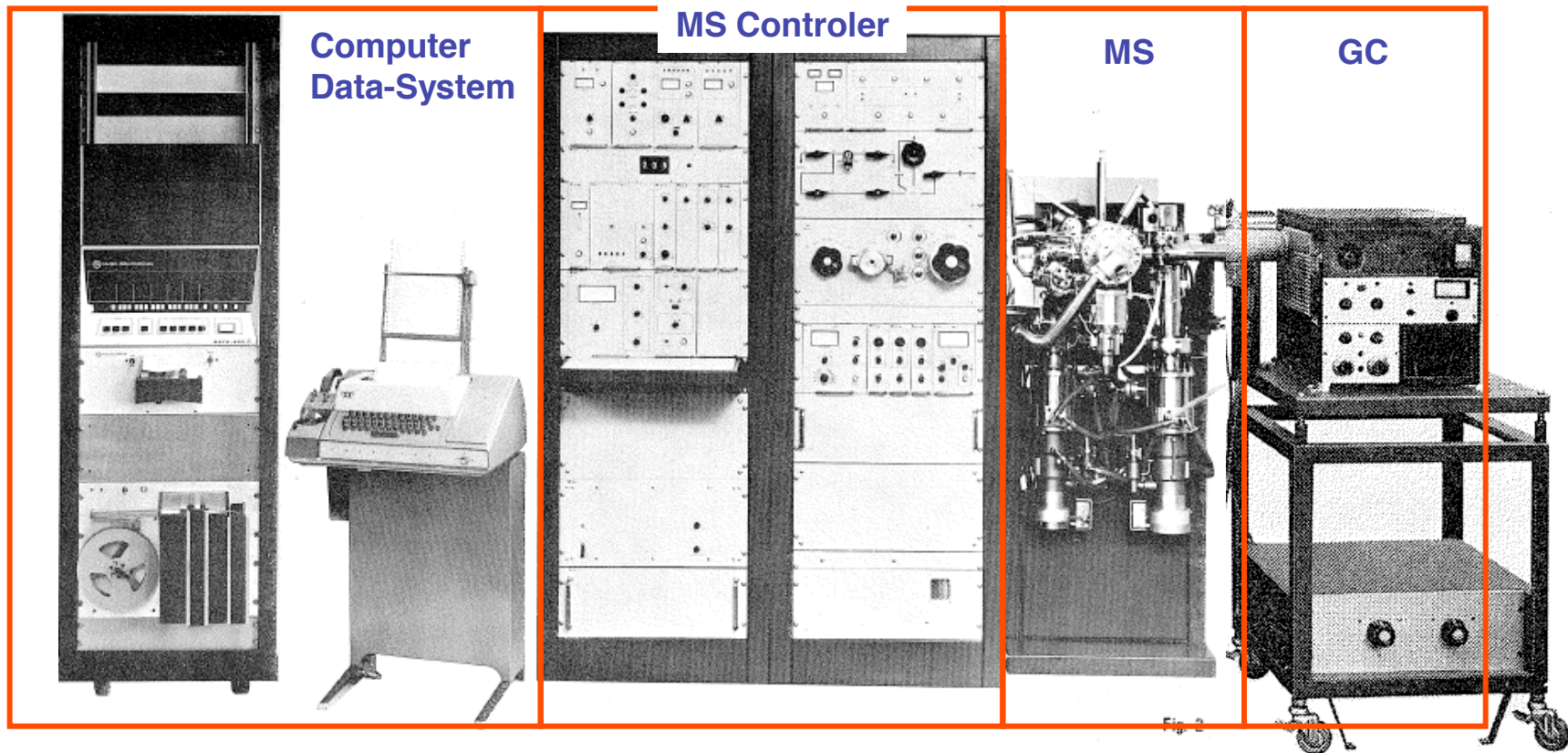
Identification of a **Longterm Excreted Metabolite** of **Metandienone** (anabolic steroid)

- **2006 Cologne Laboratory**
- **Additional reporting of about 53 cases for the abuse of metandienone**
(would have not been reported with the standard MS procedure)

Dope Analysis 1972 – Olympic Games Munich



Mass Analyser with Gaschromatograph



Atlas MAT CH-5 - with On-line-Data System (left) – Gaschromatograph (right)

Dope Analysis 2008 – Routine Dope Control

Mass Analyser with Gaschromatograph



GC-MS-MS Quantum (Thermo Fisher Scientific)
Gaschromatograph (GC) – Mass Analyser (MS)



Financial Support for Modern Analytical Equipment

Who will pay ?

**How to keep 35 laboratories worldwide on a comparable level
(harmonisation of analytical methods) ?**

- Sport federations, Governments, WADA, IOC ?



2002

Foundation of a Centre for Preventive Doping Research at the German Sport University Cologne

- **using the full scientific competence of other institutions
of the German Sport University**
- **Improvements in protein analysis**
- **Research on new substances possibly of
interest for doping purposes**
- **appointment of a professor ship for preventive doping research
(2005/2006) > Mario Thevis**



Research projects (peptide hormones)

- Hemoglobin-based oxygen carriers (HBOCs)
- Synthetic insulins
- IGF-1 and synthetic analogs
- LH-RH
- Synacthen
- Growth hormone releasing hormones & metabolites
- Recombinant growth hormone hGH
- HEMATIDE (EPO-mimetic)
- Proteases (manipulation)
- Desmopressin



Research projects (gene doping & other)

- **Small interfering RNA (siRNA)**
- **Generic screening assays** (Development of for targeted and non-targeted doping control analysis)
- **Multi-analyte detection methods** (Development particularly for **peptide hormones**)



Research projects (small molecules)

- **Selective androgen receptor modulators (SARMs)**
- **GW1516 (gene doping substance)**
- **AICAR (gene doping substance)**
- **Hypoxia-inducible-factor (HIF) stabilizers (“EPO mimetics“)**
- **JWH-018 (synthetic cannabinoid)**
- **S-107**



Centre for Preventive Doping Research at the German Sport University Cologne

- Doping control and anti-doping research are working in a manner of “hand to hand“
- Highly effective anti-doping strategy
- Case related research
- Best model for other anti-doping research groups



Centre for Preventive Doping Research at the German Sport University Cologne

2011

Foundation of an **European Monitoring Centre** for the early identification of new substances and methods having a potential for an abuse for doping purposes.

supported by the **Federal Ministry of the Interior (Germany)**



Identification of Doping Traps

- Protection of athletes
- Inadvertent Doping Cases
- Case related research
- Contamination of Nutritional Supplements
with prohormones (since 1999)
- Fakes of Nutritional Supplements
with anabolic steroids and stimulants
- Food contamination - clenbuterol

Summary

- Following the Cologne experience in dope control and anti-doping research we consider the situation (in Germany and several other countries) as follows:

