Tennis: New perspectives in research and practice

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Goals of the Presentation

- Introduce ITF and its activities
- Justify the need of sport science and research in tennis
- Present some recent trends in tennis research
- Discuss relationships between research and practice
- Conclusions

Tennis

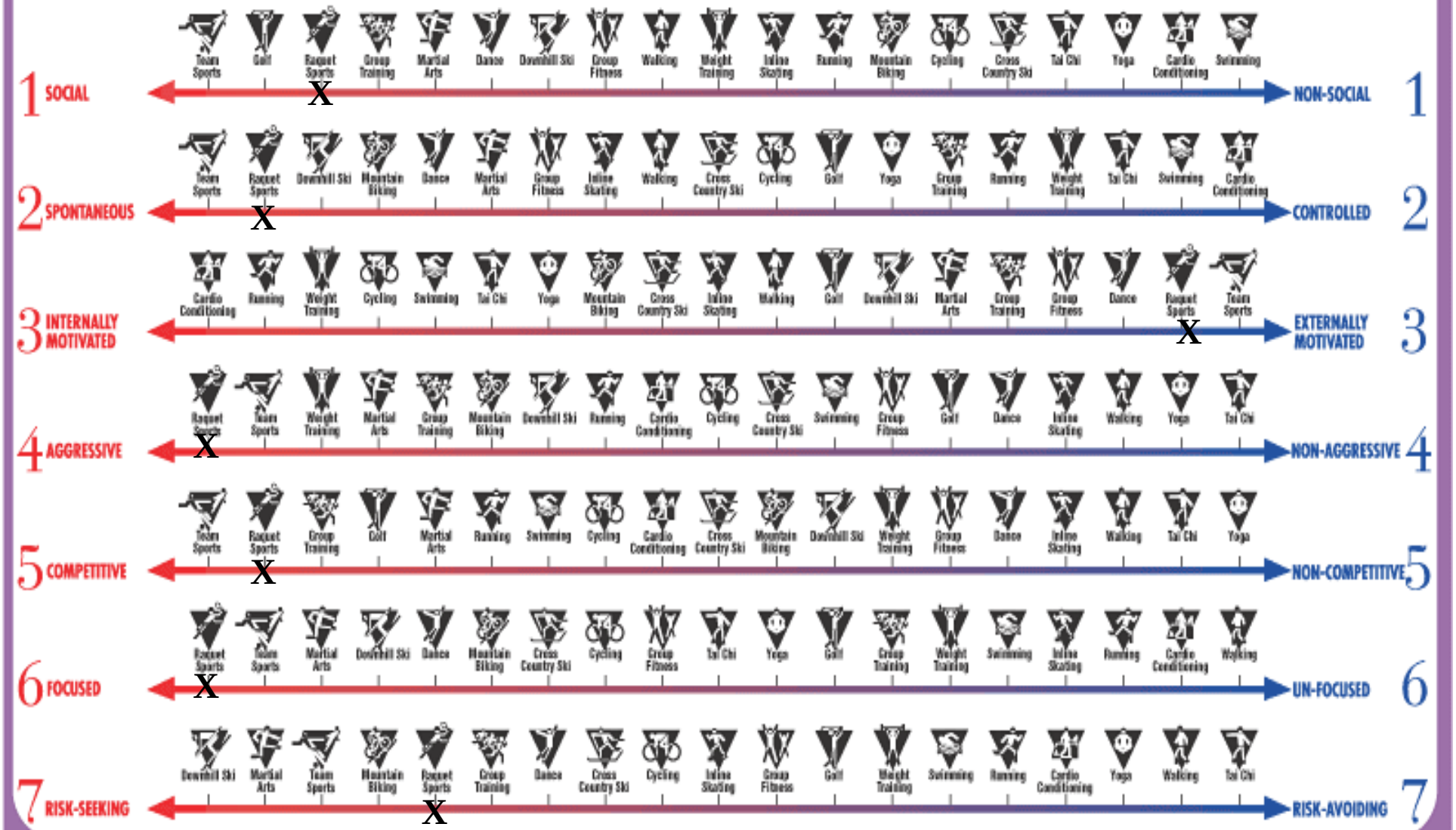
- Played by 60+ million people
- 200+ countries worldwide
- One of the top individual sports
- Long tradition

Fitness Personality Profile

See which activities fit your style

Sports build character. What personal traits are you developing through your fitness program?

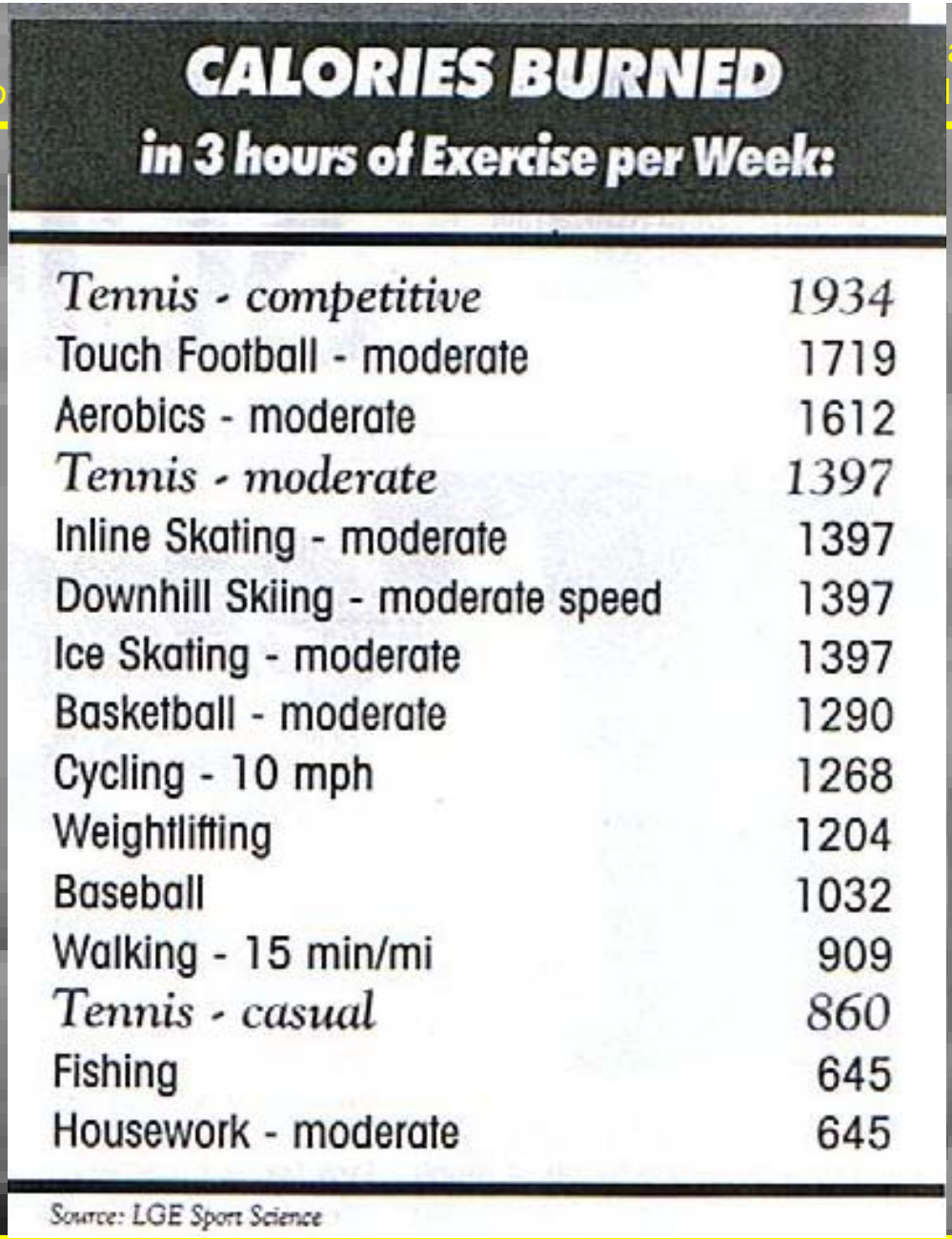
See how seven (7) Psychosocial Traits are developed by different sport and exercise programs in the chart below.



Tennis... outperforms other sports in developing personality characteristics!

	TENNIS	GOLF	RUNNING	WEIGHT LIFTING	INLINE SKATING	DOWNHILL SKIING
Sociability	Very High	Very High	Low	Moderate	Low	High
Spontaneity	Very High	Low	Very Low	Very Low	Moderate	High
Creativity	Very High	High	Low	Low	Moderate	High
Competitiveness	Very High	Very High	Moderate	Moderate	Low	High
Adventure	High	High	Very Low	Moderate	Moderate	Very High
Mental Focus	Very High	Very High	Very Low	Moderate	Moderate	Moderate High
Assertiveness	High	Moderate High	Moderate	Very High	Low	Moderate High

Source: Jim Gavin, Ph.D., Concordia University, Author of The Exercise Habit, Writer, Psychology Today



CALORIES BURNED
in 3 hours of Exercise per Week:

Tennis - competitive	*1934*
Touch Football - moderate	1719
Aerobics - moderate	1612
Tennis - moderate	*1397*
Inline Skating - moderate	1397
Downhill Skiing - moderate speed	1397
Ice Skating - moderate	1397
Basketball - moderate	1290
Cycling - 10 mph	1268
Weightlifting	1204
Baseball	1032
Walking - 15 min/mi	909
Tennis - casual	*860*
Fishing	645
Housework - moderate	645

Source: LGE Sport Science

The International Tennis Federation

- World governing body of tennis
- Created in 1912
- Around 200 member nations

Professional Events

ITF International Tennis Federation

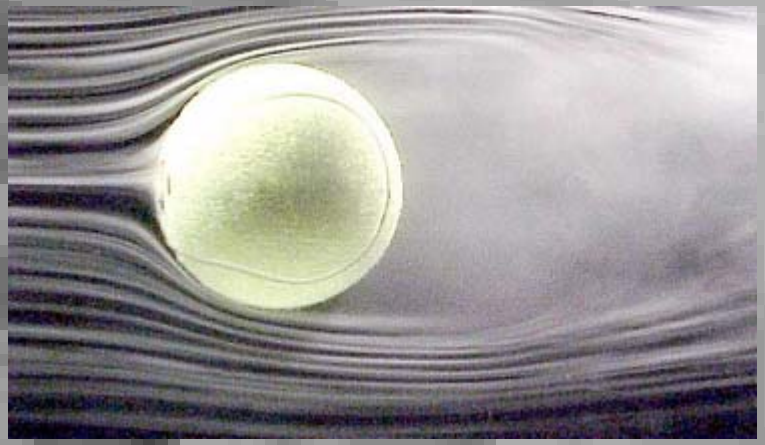
FED CUP

DAVIS CUP by BNP PARIBAS

Australian Open

US OPEN

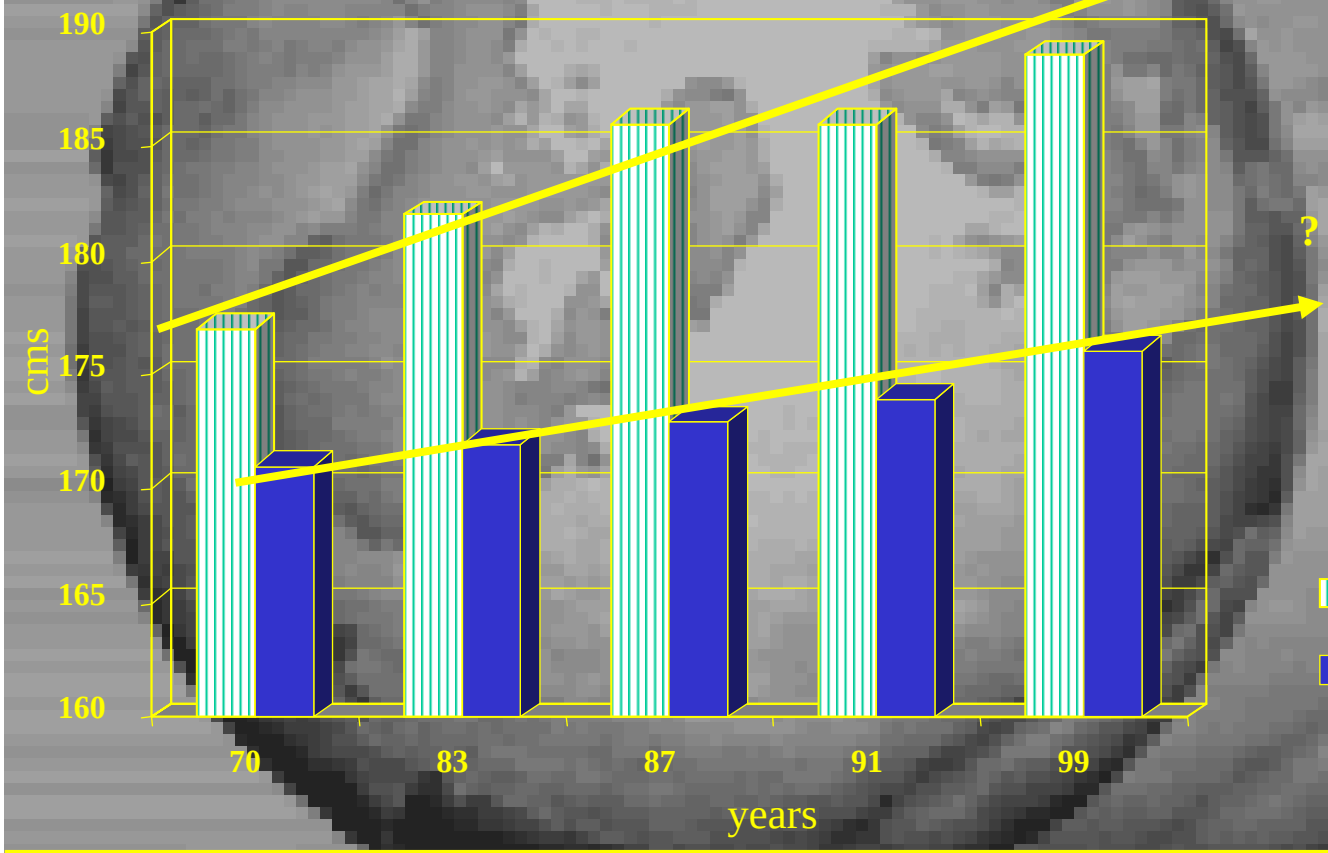
Development



Tennis and Sport Sciences

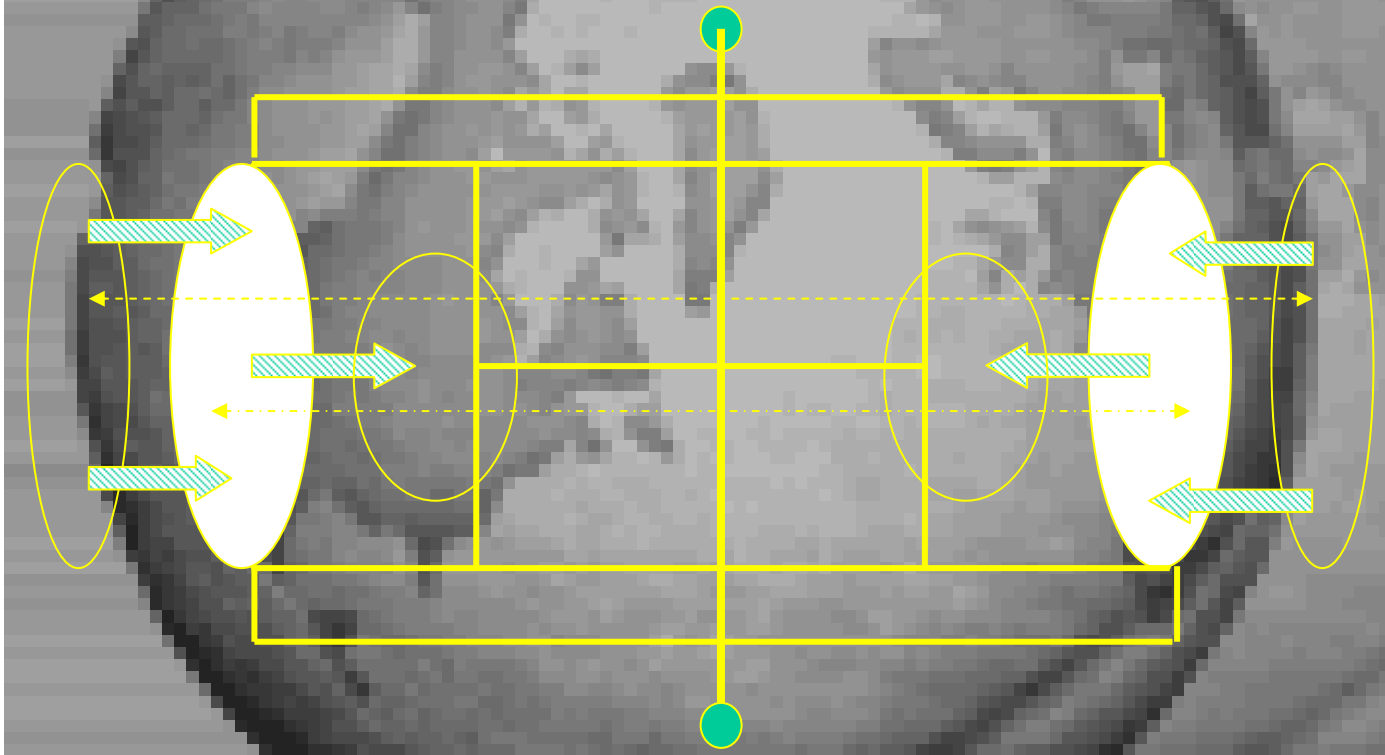
Evolution of Competitive Tennis

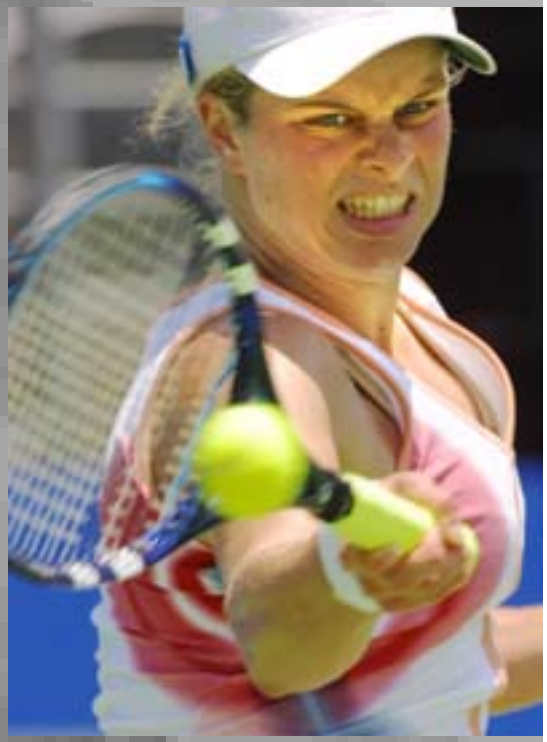
Average height of top 100 players



Schonborn (2003)

New position from the baseline





Schonborn (2003)

Economic Impact & Participation

★USA★ TENNIS

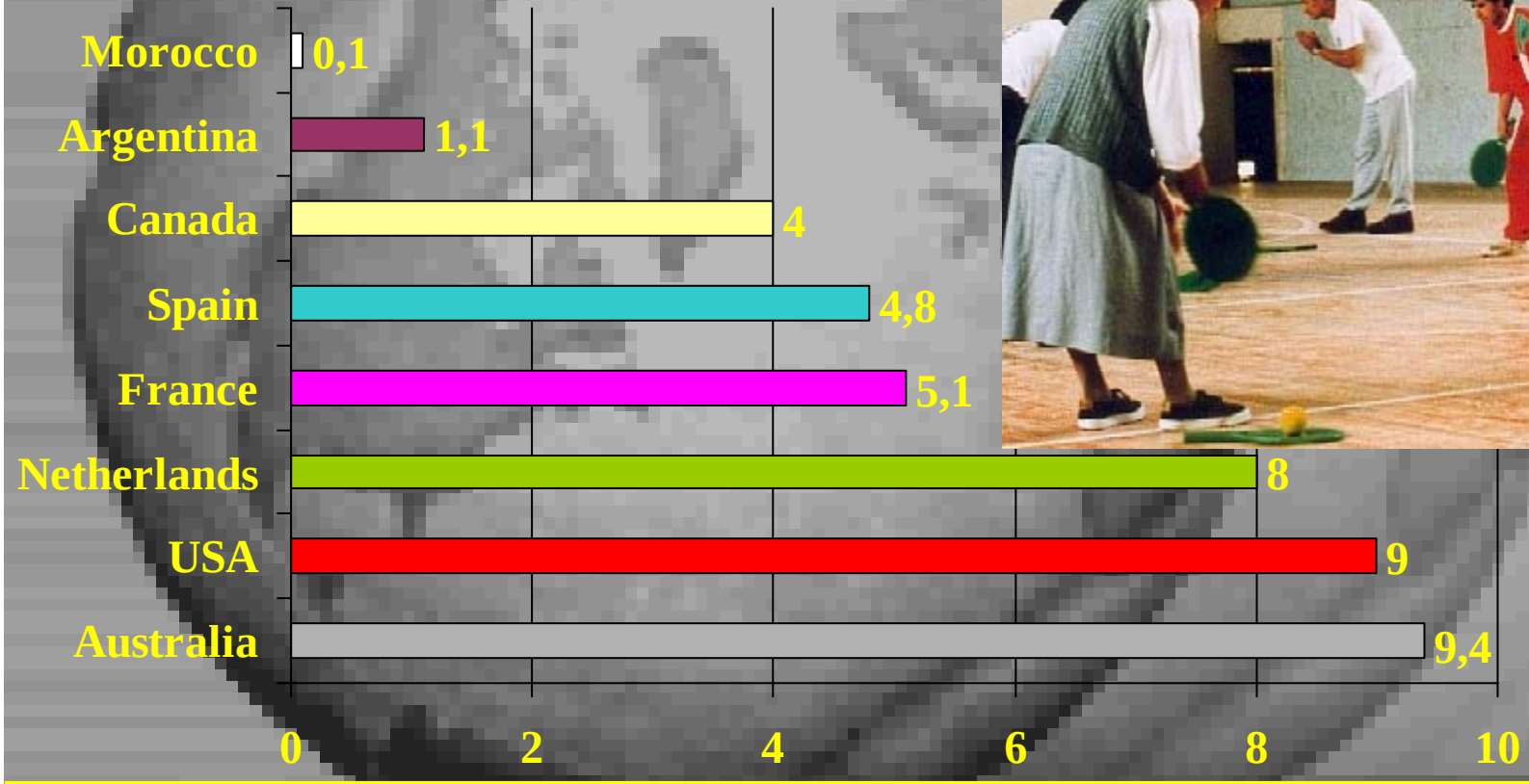
- 10.3% growth
- Only traditional sport to progress in last 5 years.
- Increase since 2003:
  - Racquet shipments: 26.4%
  - Sales tennis balls: 10.1%.
- 2005 Participation:
  - 24.7 million,
  - Highest number of total players since 1992.

US OPEN

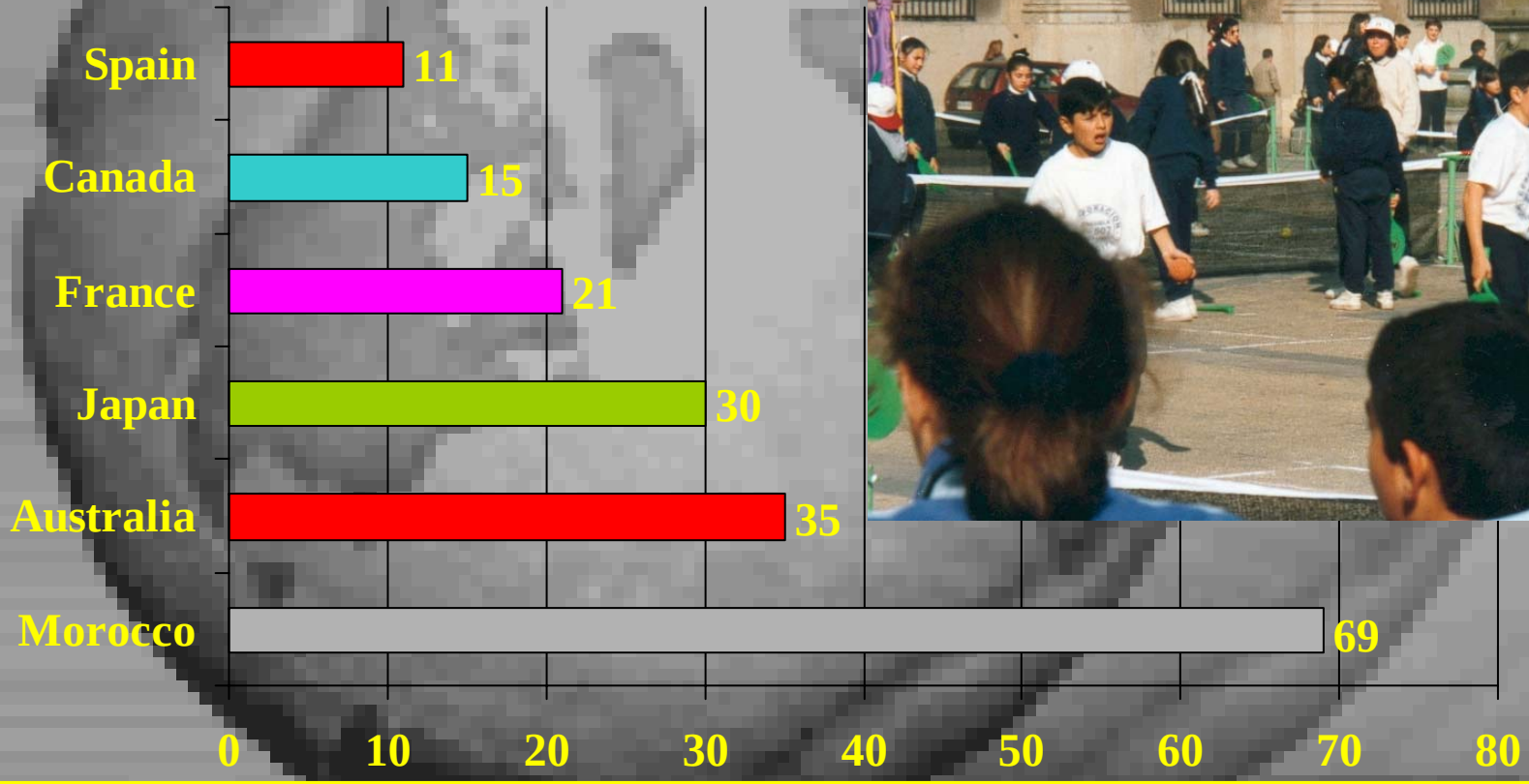
- First time all night sessions during first week sold out or 99%capacity.
- Attendance Record:
  - Night: 23,376
  - Day/night: 60,505 September 3.

(TIA, 2006)

Evolution of Participation rate

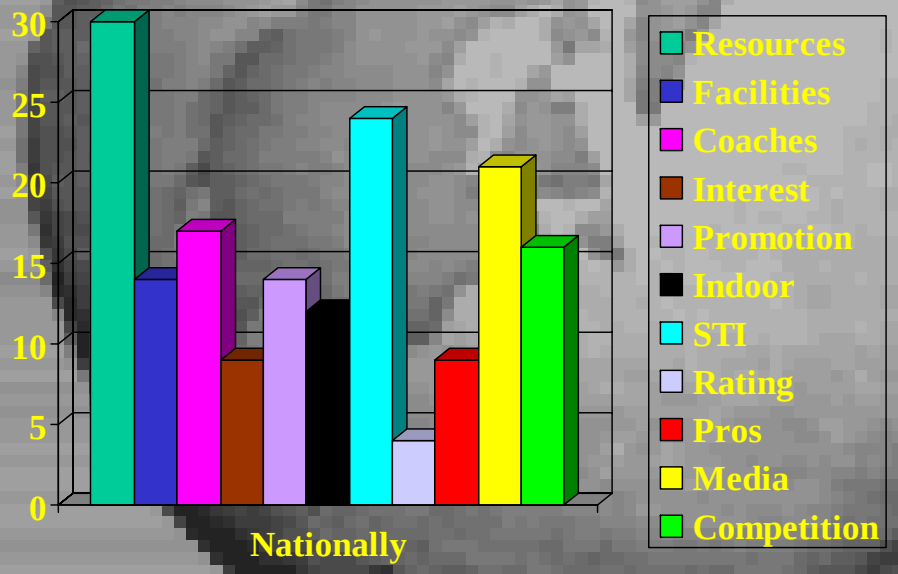


Tennis as favourite Sport among tennis players

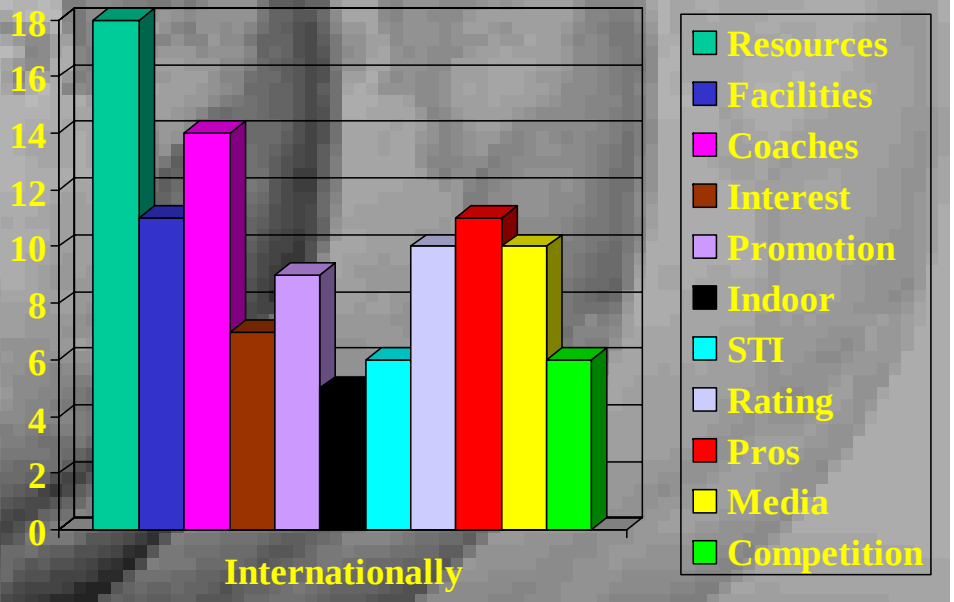


Limiting factors for Tennis Development

Nationally



Internationally



Why perform tennis research ?

- Better understand the game
- Benefit the players and the game

Why perform tennis research ?

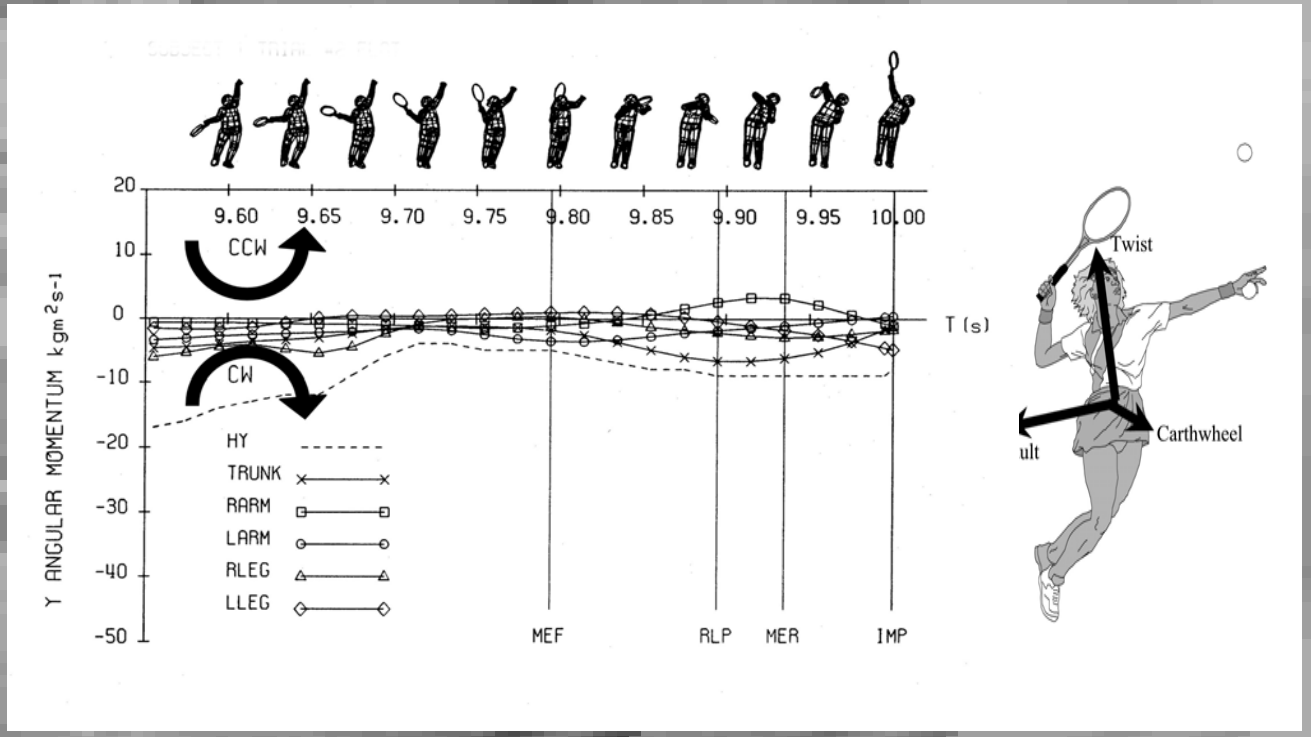
- Apply the most updated technologies
- Sport science at the core of the programmes and policies of tennis organisations

Why perform tennis research ?

- Closer links between tennis and science
- Suggest new models and training systems

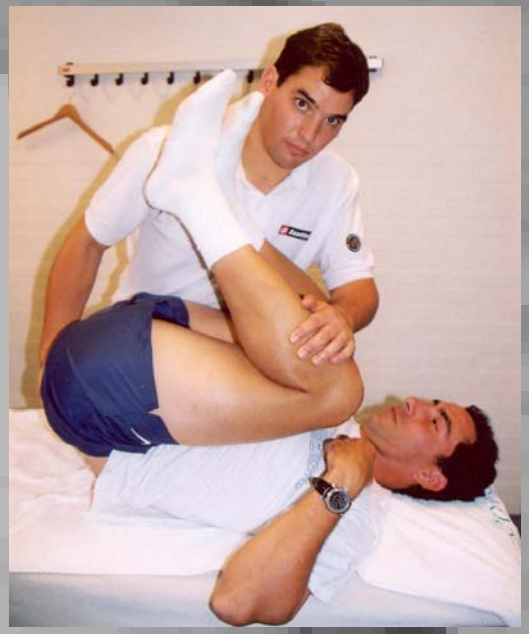
Why perform tennis research ?

- Motivate research and stimulate researchers



Why perform tennis research ?

- Contribute to injury prevention and safe practice of the game
- Prevent and avoid drop-out and burn-out



Why perform tennis research ?

- Facilitate the access of the most up to date information on sport sciences and tennis to all those involved

Why perform tennis research ?

- Facilitate the achievement of a fun, enjoyable and lifetime experience
- Overall improvement of the game

Rotator cuff injuries

Lateral Epicondilytis

Lower back injuries

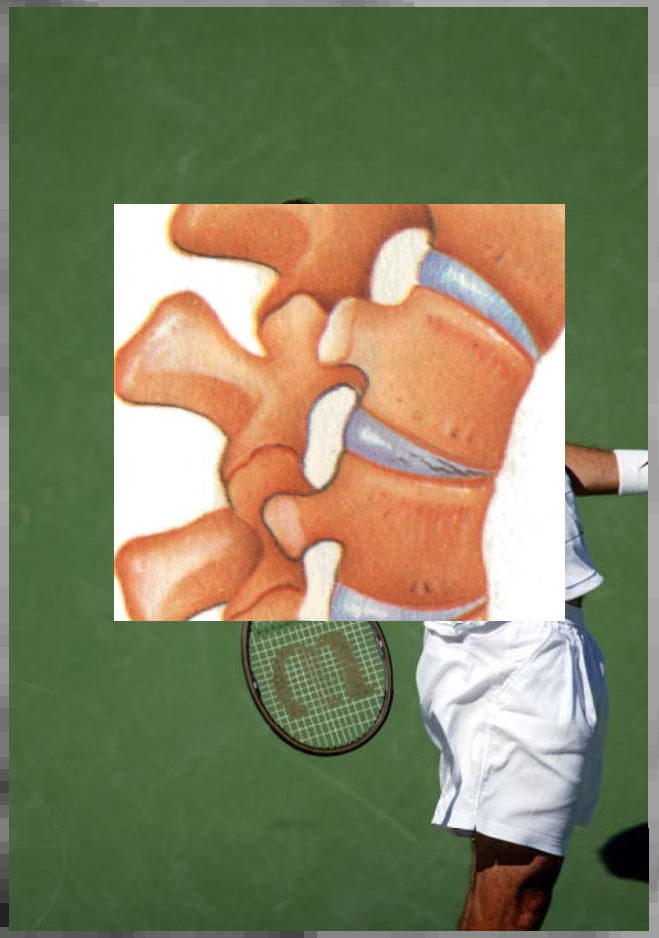
Knee injuries

Hamstring and Achilles tendon injuries

Ankle injuries

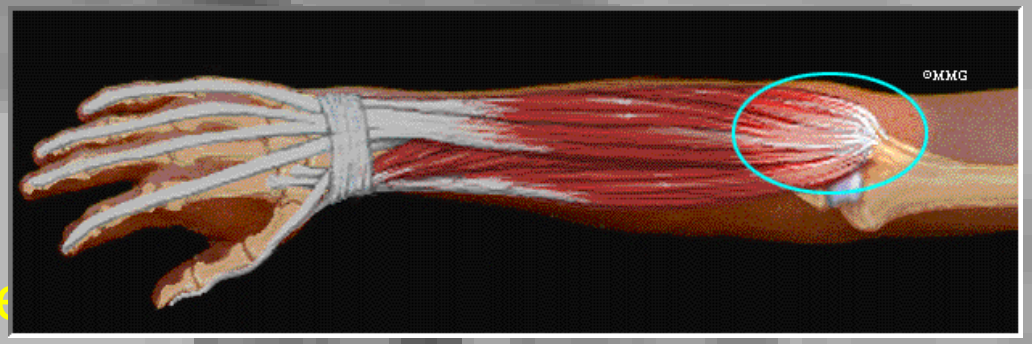
Medicine: Advances

- Improvements in speeding up the rehab process
- Less invasive surgery methods
- Application of scientific knowledge to clinical knowledge
- Increased relevance of preventive techniques
- Concern on developmental processes and overuse injuries in juniors



Medicine: Trends

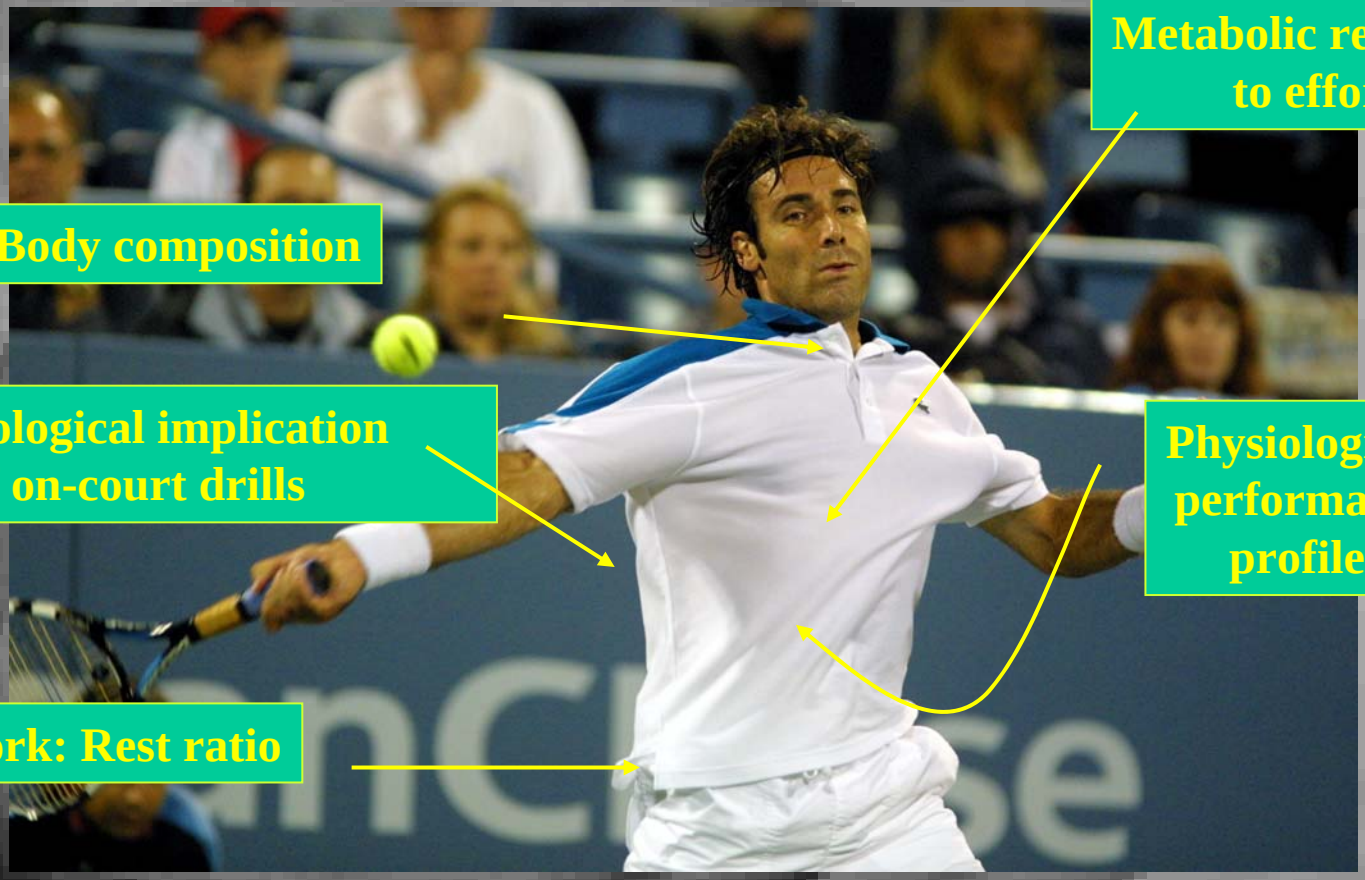
- New diagnostics, treatments, injury prevention and recove procedures (i.e. Injury Tracker)
- Guidelines for specific treatments
- Growth, development and health care of players (overtraining)



Medicine: Women‘s Tennis

- Nutritional needs
- Reasons for disordered eating habits
- Female athlete triad
- Weight and body image concerns

Physiology and nutrition



Metabolic response to effort

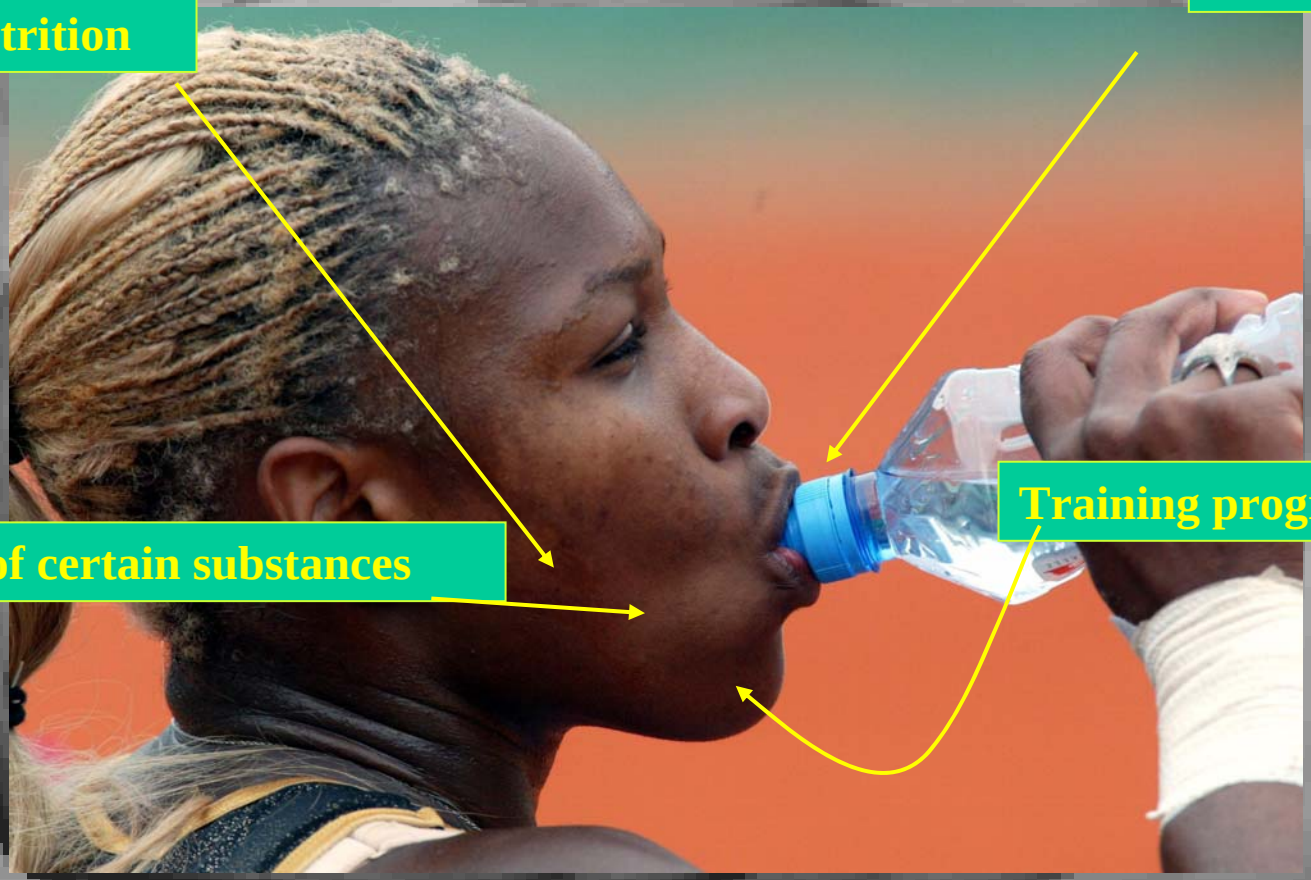
Body composition

Physiological implication of on-court drills

Physiological performance profiles

Work: Rest ratio

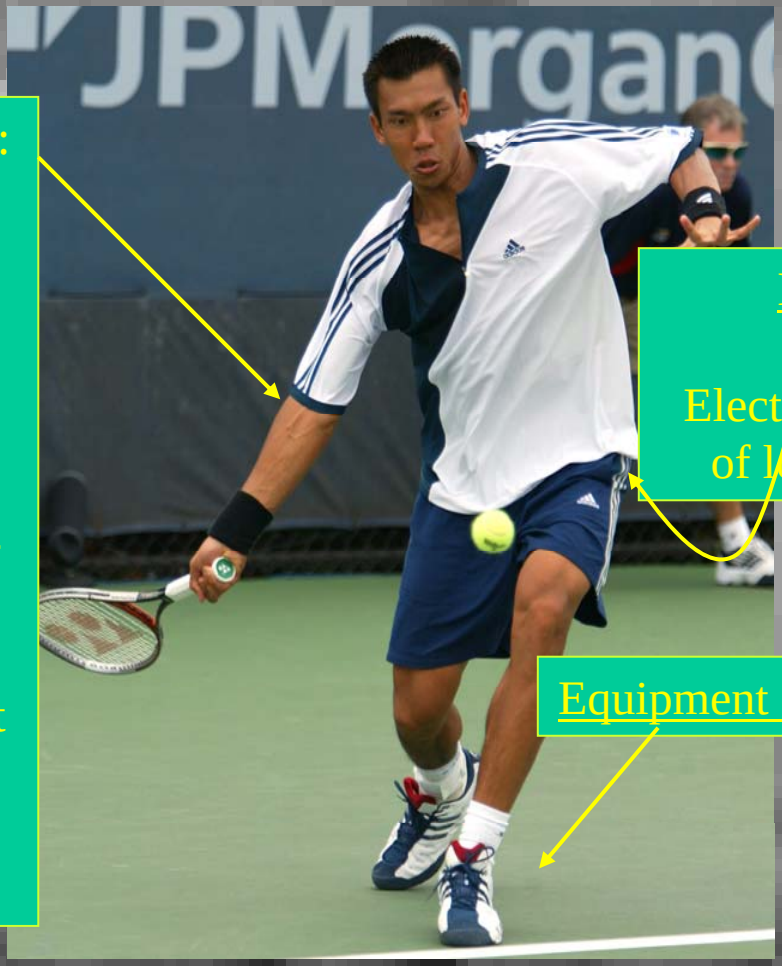
Physiology and nutrition



Physiology and nutrition

Keynote researchers	Main research fields
Elliott, Christmass	Profile of junior players, energetic characteristics of singles tennis, physiological and kineanthropometric indicators of junior performance
Bergeron, Groppel	Fluid ingestion, physiological profiles
Weber, Ferrauti, Keul, Seliger	Physiology of on-court drills, physiological responses in tennis, cardiovascular adaptations, energy metabolism

Biomechanics: Studies



Performance improvement:
- Electromyographic or kinematic (2D & 3D) of strokes,
- Biomechanical comparison of different stroke production techniques (unit and multi-segment in GS, FU & FB technique in SV),
- Contributions of different body segments and its rotations to racquet speed in different strokes

Injury prevention:
Kinetic and Electromyographic analysis of load in different joints

Equipment design

Biomechanics

Keynote researchers	Main research fields
Elliott, Reid	SV (backswing techniques and footwork), FH & SBH & DHB (TP & SL) (high & low)), VL, APP, grip tightness.
Knudson, Bahamonde, Blackwell, Chow	Muscular activity in the trunk in different strokes, kinematic variability in different strokes, cinematic characteristics of players with and without tennis elbow, forces in the hand, use of sport science for correction of strokes, FH in open and semi-open stance, methods of stroke analysis, factors affecting the load of strokes, angular momentum in the serve, power in strokes, wrist kinematics in beginners and advanced players, muscular analysis of the volley.
Mester, Kleinoder, Yue, Van Gheluwe	Cinematic adaptations in the co-ordination of different strokes, biomechanical characteristics of the return, load in tennis strokes, kinematics of the serve, muscular actions and ground reaction forces.
Hirano, Tomosue, Miyasita	Comparisons among stroke patterns.

Biomechanics: Trends

- Optophotogrammetry
- Performance models
- Comparison of mechanical determinants of junior and pro players
- Biomechanical interventions

Psychology

- Crucial aspect at all levels of the game
- Increasing volume of research

Psychology: Studies

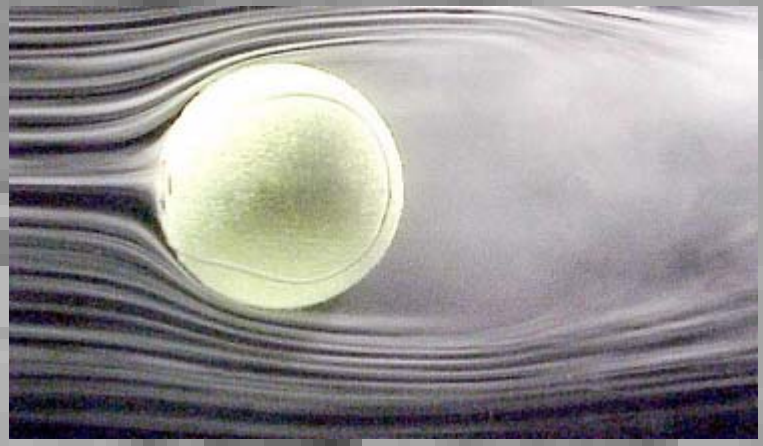
Keynote researchers	Main research fields
Weinberg, Gould, Singer	Psychological momentum during matchplay, goal-setting, "burn out", personality.
Duda, Balaguer, Harwood, Crespo, Atienza, Pérez, Jaenes, Cervelló	Motivation, goal orientation, participation motives, coaches "burn out", leadership, visualisation, routines, anxiety and self-confidence.
Ferry	Psychological training programmes.

Psychology: Trends

- Behaviours of players, coaches, relationships
- Burn-out, drop-out
- Psychological routines
- Parents role in tennis
- Practical intervention models off-, and most importantly, on-court

Technology: Studies

- Considerable advancements during last third of XXth Century.
- Research:
  - Facilities (court)
  - Materials (balls, racquets, shoes, clothing)
  - Academic institutions
  - Private companies
- Influence on materials and design



Technology: Studies

Keynote researchers	Main research fields
Elliott, Cross	Vibration and rebound characteristics of conventional and oversized racquets, racquet flexibility and string tension and its influence in the ball bounce after impact, selection criteria of tennis racquets, optimal racquet performance.
Brody, Knudson, Blackwell, Nigg, Luethi	Physics of the tennis racquet, vibration and tension, effect of string tension in the vertical ball bounce and impact precision, effects of grip models in impact precision, effect of oversized ball on serve performance and upper body activity, injuries and tennis surfaces, shoe construction, shoe characteristics.
Miller, Hatze, Haake	Racquet properties, forces, coefficient of restitution, sports engineering.

Technology: Trends

- ITF Technical Research Centre, 1997:
  - Evaluation of new materials (surfaces, clothing, shoes)
  - Rules of tennis
  - Quality control, performance, equipment safety
  - Protect the nature of the game

Motor learning / Pedagogy

- Discovery vs. prescriptive
- Tactical decision process
- Increasing demands of modern competitive tennis:
  - Speed of perception and execution
  - Time pressure
  - Observation strategies
  - Vision in tennis

Motor learning / Pedagogy

Keynote researchers	Main research fields
Abernethy	Differences between beginner and advanced players, visual search strategies.
Singer, Goulet, Fleury, Knudson	Expertise, visual quickness, anticipation and visual search, vision training, preparation for the return of serve.
Moreno, Benguigui	Observational patterns, visual strategies of coaches and players, timing.

Planning, Periodisation & Player Development: Trends

- Periodisation:
  - Nr. Matches/year/age
  - Adequate training intensity/volume
- Quantification of Long-term Player Development (contents and loads)
- Talent ID / Selection vs. Talent Development

Adapted Tennis

Marketing

Participation

History

Sociology

Practice: Importance of Applied Research

- Applied studies
- Meaningful to researchers…and players / coaches
- Practice:
  - Scientific
  - Safe
  - Modern
  - Comprehensive

The role of coach educators

- Fundamental
- “Translators" between scientific and applied worlds
- Build communication bridges
- Coaches to understand and apply research results
- Effort of researchers
- Open minded coaches

Research grants: Co-operation between institutions

- Uncommon at Federation level
- Immediate results expected
- Challenge of funding
- ITF catalyst of initiatives
- Increase of institutions doing tennis research:
  - Federations
  - Universities
  - Private companies

Conclusions

- Sport sciences have greatly contributed to increase tennis knowledge
- More investment in tennis research needed
- Application of science to health, training and development of players at all levels of the game

Conclusions

- Promising future
- Joint venture
- Challenge of knowledge and practical application of research findings
- Improvement of the game