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Special Feature:

Exercise and Science in Ancient Times

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FOREWORD

Editorial

Katrin Koenen

The Special Feature of our October Bulletin examines and provides diverse perspectives on "Exercise and Science in Ancient Times". The articles collected and edited by Dr Suresh Harihar Deshpande from the National Association of Physical Education and Sports in India will give you an exciting overview on Exercise in the Ancient times and its continued relevance today! Many thanks, too, to the numerous authors who submitted articles!

Please also visit the ICSSPE News section where you can find information about all of ICSSPE`s current activities. For us, 2016 was already a very important year with ICSSPE meetings, including our General Assembly and elections in August in Santos, Brazil, followed by ICSEMIS 2016 - *Saying Yes to Diversity in Sport*. The theme of ICSEMIS could not have been better chosen for the 3rd edition of the International Convention on Science, Education and Medicine in Sport! Not only, because of the growing demand for equal opportunities and inclusiveness in sport and physical education, but also because of the tremendous energy and activity that the topic inspires, as was seen in the range of topics presented, the countries represented, and in a rich and diverse conference programme. Combined with Brazilian hospitality, the smiles of the volunteers, and the location of the Convention Centre not far away from the Ocean, we had the recipe for a very successful stay in the city of Pele's home club. We are thankful to the organizers for their impressive work, despite political and economic challenges.

ICSSPE staff are still busy with a number of upcoming events:

- October 31-November 5, the seminar "Communities and Crisis, Inclusive Development through Sport" in Rheinsberg;
- 21-24 November a German-Israeli bilateral symposium in Israel;
- 25-27 November the seminar "Paths to Success – Inspiring Young Leaders in Sport" in Berlin;
- 12-15 December a bilateral symposium between a Chinese and a German delegation, also in Berlin.

In addition to these activities, we are also getting ready for an exciting 2017! As well as achieving a series of important successes in receiving funding from the European Union and UNESCO projects, ICSSPE will be centrally involved in the preparations for MINEPS IV (International Conference of Ministers and Senior Officials Responsible for Physical Education and Sport) in 2017. This is obviously an extremely important responsibility.

If you are interested in being involved in one of our project, or in publishing articles or news through ICSSPE's publications, please always feel invited to contact us and let us know. All our members are also cordially invited to join our projects and publications wherever they wish!

Katrin Koenen
Director Scientific Affairs

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President‘s Message

Uri Schaefer

The 26th General Assembly of ICSSPE took place at the University of Sao Paulo in the city of Santos, Brazil where new members were elected to the various Boards. I would like to take this opportunity and extend once again my deep appreciation to all the members who had served ICSSPE in the last 4-8 years and welcome very warmly all the new members who were elected to the new term of office. I also had the honour to be elected as your President (thank you so much to each and every one of you who supported my candidacy and election) and I can assure you that I will do whatever is in my capacity to work and collaborate with you all in order that we will be successful in meeting the multi challenges that ICSSPE is facing.

During the General Assembly I presented to the members the process of developing our new ICSSPE Strategy which the President's Committee has begun to develop together with our ICSSPE Office Staff in Berlin and a strategic consultant (from Germany) last February (2016). Following a discussion during the General Assembly, it was agreed to continue with the next phase in which our members will contribute to the development of the new strategy. Please expect to receive a request to share with us your thoughts and expectations related to the strategy from the ICSSPE Office in the next couple of weeks. I personally would like to ask you to be more active and become a member of ICSSPE's new cohesive team, which is going to be dynamic and more practical in order to meet members' needs and serve as the leading global network of Sport Science, Physical Education, Physical Activity and Sport.

During the deliberations concerning our new strategy and following a SWAT analysis, we decided that everything is open for discussion including our name, logo, products, the way we market products, vision and mission, to name only some key topics which came up. Now we need to be more specific about our priorities. Thus we have identified ten 'building blocks' of high importance for ICSSPE, and now we need to drill down in order to be more specific.

We plan, once we receive ideas, feedback and remarks from our members, to sum up our new strategy by mid-January when the President's Committee meets in Berlin. In the second half of April 2017, we will call for a special General Assembly to be held in Frankfurt am Main, Germany, in order to improve the strategy and vote and hopefully confirm the new statutes and updated version of our by-laws.

Following our General Assembly in August, we participated in the ICSEMIS conference that took place from 30 August to 4 September, which we initiated in collaboration with the International Paralympic Committee (IPC), and Federation International de Medicine du Sport (FIMS). The convention was organised by the Federal University of São Paulo in the City of Santos, Brazil. Over 1,200 people participated in the convention, which was held for the first time ever in Latin America. It was a fruitful and successful professional and scientific event, and I would like to extend our sincere thanks and appreciation to the Federal University of São Paulo, the Organising and Scientific

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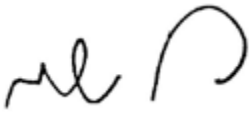
Committee of the convention and to the staff in Santos, who made every possible effort to make the experience of all participants a meaningful and pleasant one.
I also would like to express my thanks and appreciation to our ICSSPE Executive Director, Detlef Dumon and to our Scientific Affairs Director, Katrin Koenen, for their outstanding contribution in making this convention possible.

Our ICSSPE staff is very busy with the received "Erasmus+" Projects, and in addition, we are proud that UNESCO have requested ICSSPE to prepare the MINEPS VI Summit, which is scheduled to take place in July 2017 in Kazan, Russia. Furthermore, our office staff will be extremely busy to be on time with the preparation for the outstanding General Assembly. I send my deepest appreciation to all our ICSSPE staff members and I am thankful to them for being committed to ICSSPE and very productive in meeting together with our Boards' members all our responsibilities and challenges.

This bulletin is focusing on Exercise and Science in Ancient Times and I personally would like to take this opportunity to thank Prof. Dr Suresh Deshpande for collecting and editing the articles, which I trust you will find most interesting.

To all our members who have recently opened their new academic year I wish a very meaningful and successful year, and I look forward to meeting with you soon in one of our forthcoming ICSSPE activities! I wish you pleasant and enjoyable reading, and If you want to contact me, please don't hesitate to write to uschaefer@icsspe.org.

Yours in friendship



Dr Uri Schaefer
ICSSPE president

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Welcome New Members

ICSSPE welcomes the following new members:

D063-3
Benemérita Universidad Autónoma de Puebla
Mexico

D156-21
University of Hull
United Kingdom

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FEATURE

Introduction

Suresh Harihar Deshpande

It gives me immense pleasure to present this special feature of the ICSSPE Bulletin, dedicated to the Science of Exercise and in Times in Ancient. The earlier issue of 2014 was dedicated to 'Traditional Sports and Games' that inspired me to touch the current theme. Ancient civilizations, especially of Greece, Rome, India, China, Japan and others like Egypt, Mexico, etc. had glorious history of human development. Ancient society was well versed in arts, science, literature, architecture, philosophy, sports, pastime, education, festivals, religious rituals, agriculture, etc. Greek and Roman history reveal interesting record of periodical organisation of sports festivals popularly known as 'Olympic Game's having contests in various sports like wrestling, running, throwing of javelin, discus and many more. Athletics, gymnastics are the words having their origin in Greek antiquity. The human statues, idols and images of ancient period excavated are the specimen of excellent and proportionate body build behind which there might have been hidden science of exercise and coaching. The science of medicine developed in India centuries ago known by 'Ayurved' discusses thoroughly about various aspects of the science of exercise. Yoga-ancient philosophy and science of spiritual development also deals with maintenance of health by following to yogic poses and application of cleansing processes called 'Shuddhi-kriyas'. Review of ancient texts and findings of research studies have prompted me to propose the current theme for bringing out special edition of this journal. The Editorial Board of the journal has kindly considered and approved it. The attempt is made here to collect the information about philosophy and science of exercise of the ancient world.

To the appeal made from the platform of ICSSPE for contributing informative and research oriented articles, encouraging response is received from our worthy contributors for which the editor is grateful. My special thanks to Prof. Henning Eichberg of Denmark, despite his health problem, on our request, he sent his valuable article - Gliding Body - Sitting Body explaining ski and yoga tracing review of historical development of the two. Jamie Acutt from UK has presented his research work on how the medieval European Martial Art was based on Aristotelian Science. The article throws light on both: the scientific approach of Aristotle to view the object or study the theory. Science of exercise of ancient Greece might have been based on such principles. Information of medieval European martial art is reflected in the article. Jamie Acutt has found during his research, the basis of European Martial Art in the Aristotelian science.

There are other articles throwing light on 'Ayurvedic theory and scientific principles' on which science of exercise of ancient India was based. Samiran Mondal, Dr. Madhuri Wagh and Suresh Deshpande (all from India) have in their contributions highlighted elaborately the science of exercises as reflected and described in ancient texts of Ayurved. The science was useful in maintaining health, increasing longevity and fitness; and its therapeutic uses. Dr. Sushil Yanpallewar (India) present's theory of application of Ayurvedic principles to identification of talents in sports. It is a new approach and certainly food for future research scholars. There is wide scope of research in this field.

Attention of our readers is also invited to the article contributed by Dr. Krzystof Stec from Poland who has done intensive research with revealing findings on the effect of Dynamic Surya-Namaskar (DSN) on various physiological parameters. DSN is a mode of exercise consisting of a chain of various yogic poses developed in ancient India.

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He has taken review of ancient Indian Texts and traced the originality of DSN in Indian antiquity; whereas Manmath Gharote (India) briefed in his valuable article the philosophy and science of Yogic exercises. He also refers to scientific work out carried in India at 'Kaivalyadham' during the last century for knowing the effect of yogic practices on physiological parameters and also the changes in internal system during the practice. In this respect he refers to the pioneer work of Swami Kuvalayananda - the visionary with scientific attitude and founder of Kaivalyadham.

Adequate information is available about ancient Olympic Games. Archeological excavations and literary researches have brought into light the status and details of these games which lasted for about one millennium years - quite a long period in sportive history. Efforts are needed to focus our attention towards other civilizations to uncover the hidden history of sports and science of exercise. This special of ICSSPE online feature Bulletin may be the step forward to the desired direction. Research workers, historians and sports lovers, if getting inspiration from this issue for undertaking further studies, the purpose of bringing out this special number will be fulfilled. I hope, our worthy readers will welcome this special issue as usual.

It may be brought to the notice of all our worthy readers that the theme of this special issue is "Exercise and Science in Ancient Time ", as such the articles received from some of our contributors contained references of ancient authors and their texts, written long back in the history. They are transmitted through the manuscripts and now available in the book form edited and translated by modern researchers and editors. Some of our contributors have followed the pattern of citing numbers serially in the texts and accordingly, corroborating those numbers, arranged their bibliography.

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Aristotelian Science behind a Medieval European Martial Art

Jamie Acutt

Abstract

Science has a strong legacy in European history. It has characterised the development of many topics and established a firm basis for the world-view which we hold today. One such topic in which it was a recurrent theme was Fencing. The golden age of the scientific study of Fencing is generally considered to be the Renaissance, the period in which the method applied is recognisable as being 'modern'. For this reason perhaps, the sources which document the Science of Fencing prior to the Renaissance are often excluded from consideration. In the following paper, I will appraise the wider world-view of the medieval period, using the lens of Aristotelian Scholasticism, and apply such an intellectual backdrop to the theoretical foreground of Fencing. This paper attempts to demonstrate strong correlation between the principles of a medieval martial art, as documented in the corpus of Johannes Liechtenauer (15th century), and the concepts discussed by Aristotle in his books on Physics.

The science[1] of exercise is indeed a large topic, and so we shall do well to limit the scope to concentrate upon a particular aspect of it. In this paper, we shall focus specifically upon the application of science to the development of martial arts (*Fencing*[2]) in Europe, in this case within the 15th century.

Our modern view of historical masters of Fencing has been informed largely by the commentaries they made upon their own teachings. The self-facing volume of contributions to scientific dialogue[3] on martial arts was substantial, and suggests that science was intrinsically linked to the physical culture of combat, so much so, it was perhaps a defining aspect of it. There was clearly a growing push to translate tacit knowledge into explicit and codified knowledge. Later masters in the Renaissance claimed Fencing was a science like any other. They wrote tomes as proofs, and their primary language was Geometry[4]. Around 150 years earlier, we find a more ancient example of the science of Fencing, but the scientific basis, perhaps because it predates the establishment of 'modern science', seems to have been generally overlooked.

A Medieval Science of Defence

It is single combat, what Florius calls the "…abridged form of the war", which is of most interest to us here. Single Combat is perhaps more consistent with how we perceive "martial art" today, than the industrialisation

1 "The intellectual and practical activity encompassing the systematic study of the structure and behaviour of the physical and natural world through observation and experiment" (Oxford Dictionary, http://www.oxforddictionaries.com/definition/english/science, accessed 9th July 2016).

2 It should be clarified that Fencing during the medieval period was quite far removed from what modern scholars might recognise as sport Fencing. The German Art of Fencing (Kunst des Fechten) was far more comprehensive than the modern three-piece suite of weapons. It involved wrestling, single and two-handed swords, ambidextrous weapons, heavy shields, staves, pole-axes et al. Medieval 'fencing' was therefore much closer to Far Eastern martial arts, such as Koryu Bujutsu, than the modern sport of Fencing.

3 To paraphrase Di Grassi, it is a teacher's role to distil much scientific knowledge into a package which is capable of being digested by those who do not take pains to investigate that said science. For this reason, their works might not be termed 'dialogue', in the modern manner of reaching consensus, as most of their work might be observed to have been 'monologue' propounding a particular view, even if it was one based upon observation and experiment.

4 Masters were regularly featured in their frontispieces with callipers and other scientific artefacts (see Anglo (2000, 24, 26, 63, 67, 74-75, 83, 85, 191)). Consideration of these masters would require a paper in its own right. To represent them, take for example one famous Spanish master, Don Jeronimo de Caranza, who was founder of the scientific approach in Spain. Caranza's sentiments echo the kind of philosophical approach to the world which affected the early Renaissance. He believed that true "science is in things" and therefore it, "…is but a reflection of the real thing. Yet possible truth and error are not the object, but on the subject. Truth is the natural property of being connected with understanding, which inevitably refers to the universal, not the particular, and as such resides primarily in God."

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and multiplication of combat into warfare. Efficient battlefield activity is in the unit, or more appropriately, the collective acting as a single organism. But our interest is in interpersonal conflict, involving no more than two people. Moreover, it is this particular form of combat which arguably became the catalyst for the development of formal combat systems in the medieval period.

In ancient Europe, the *ars dimicatoria,* or *ars palaestrinae*, were associated with Mars[5] and were cultured by the classes of men who made it their role in society to be warriors[6]. The training of warriors was itself based upon a far wider exercise science (despite being outside the scope of this present paper)[7], and attracted many members of bourgeois society.[8]

According to one 15th century Italian Master of Combat, Phillipo Vadi (c1480, De Arte Gladiatoria Dimicandi (MS Vitt. Em. 1324), Biblioteca Nazionale Centrale di Roma.)[9], one should "…find your trust in science, [since] fighting is born from geometry" and therefore science contributes towards understanding how to fight. He continued (originally in Italian verse):

> "If someone intends to know with discernment,
> if Fencing is an Art or a Science,
> I shalt inform you of my judgement,
> consider well my sentence.
>
> It is truly a Science not an Art,
> As I shalt describe with succinct eloquence,
> how geometry divides and separates into parts,
> Into infinite numbers and measures,
> and fills Science her papers,
> Such that the sword is a child within her care."[10]

5 The word "Martial", though being first used in English by Chaucer in the 14th century, was a word used to describe war-like people. It made reference to the activities or behaviours akin to the Roman god Mars, similar to the terms "mercurial" (akin to the god Mercury), or "saturnine" (akin to the god Saturn). The compound noun "Martial Arts" was never used in the West until the 19th – 20th centuries.

6 Plato was perhaps the first to record the observable division inherent in society. Society, so he recalled, was made up of [in Latin translation] Oratores (Speakers), Bellatores (Warriors) and Laboratores (Workers). The Romans also later defined their society in this way, noting that there were Senatores (Clergy), Equites (or Ordo Equestii, Knights), and Plebs (Workers): Elias Ashmole (1672, 3) In his Anglo-Saxon translation of Boethius' On Consolation, King Alfred added the consideration that the kingdom was comprised of "geberdmen, fyrdmen, weorcmen" (Men of Prayer, Men of War – "fired men", Men of Work – "work men"). This statement was to continue the influence of the tripartite society noted in Greece well into the period now referred to as 'The Middle Ages'.

7 Exercises were grouped as the Quinquertium ("Five Arts", or quinque-ars, Greek: Pentathlon), listed as running (cursus, δρόμος), throwing of the quoit (discus, δίσκος), stone and Javelin (jaculatio, ἄκων), jumping and leaping (saltus, ἅλμα), wrestling (lucta, or πάλη), boxing (Pugilatus, or πυγμή), the pancratium (pankratium, παγκράτιον), and dancing (ὀρχήσις). This was attested to by Mercurialis in his De Arte Gymnastica (v7, 123), and cited regularly by chivalric instruction such as Castiglione (1528), translated by "Sir Thomas Hoby The Courtyer of Count Baldessar Castilio." Von Gunterrodt (1579), a Martial Arts historian, cited Galen and the origin of the martial arts in the ancient Greek Palaestri. Likewise, Mercurialis wrote in his 1569 work De arte gymnastica (On the art of gymnastics), similarly citing classical sources. In fact, for hundreds of years, the model prescribed by Galen for the preservation of health, was the foundational instructions for anyone pursuing physical education.
Rabelais (1494–1553) also referred to the arts of Fencing. Hans Sachs (1494-1576), a celebrated German inheritor of the troubadour movement (Meistersinger) also cited (1545, "fechtspruch" evidently paraphrased in places from Rabelais, and himself later paraphrased by Rösener).

8 As the Fight-master Hans Talhoffer (dated to 1459, 8r) cited "no one likes to be publically insulted (lit: "loudly cut up with words")" (daz jm nymant gern sin Eer laut abschniden mit wortten), and so it was the nobleman's right to restore his 'honour' and offense to his character by the ancient entitlement to duel. The sanction of Duelling, at least at Swabian Hall was brought to an end on 18th May 1523.

9Translation is my own.

10 Vadi, Philippo di. (c1480); De Arte Gladiatoria Dimicandi (MS Vitt. Em. 1324), Biblioteca Nazionale Centrale di Roma.

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Vadi continued to argue that to defend one's life is perhaps the most noble of all pursuits, to guard against the threat of death, there truly cannot be a more valuable subject. But Vadi was perhaps not the first to make use of science, and to make it explicit within the topic of Fencing.

Before Vadi, there was the German master, Johannes Liechtenauer. Liechtenauer was a master attributed to a systematic coverage of combat, and might well have been an early example of the application of science within Fencing. Indeed, his work is confirmed as one of the earliest still to exist[11]. Hils (1985, 19) tells us how the attributed master may be discovered with such regularity in fencing and wrestling literature that these topics were "inextricably linked" with him. So much so, "his name is in a sense a distinctive trademark of fencing manuscripts" (*ibid*). He is the single authority (*Autorität*) on the topic, cited routinely to the point of ritual. Even in anonymous manuscripts, the citation of verses derived from Liechtenauer may be found with such honour and esteem as to have lasted for nearly two hundred years[12]. Hils furthers that Liechtenauer is rightly framed as being "legendary" (*legendären*) in every sense of the word, but especially to the extent that he is historically elusive (Hils, 1985, 105). Despite his fame, we still know very little about him, as he remains untraceable.

Liechtenauer's approach was preserved in a verse (*zedel*, notes, *schedulae*) of around 170 couplets, and commented upon (glossed) by other masters within a set of German language manuscripts collectively known as the Liechtenauer corpus[13].

This corpus entered historical records around the beginning of the 15th century (yet according to some, it appears around 1389[14]). Although records do exist of much older practices (I.33 for example, c.1320-1330[15]), the Liechtenauer corpus represents the most intriguing body of work describing medieval combat skills as practiced by the aristocracy. And the fact that it was set in verse makes it all the more compelling.
The martial art is clearly developed from the dueling format described in contemporary Tournament books (*thurnierbuechern*). These sources describe two forms; to the Death (French: *à outrance*; German: *Ernst*), and "for play" (French: *à plaisance* "for pleasure", "pleasantry" German: *Schimpf*). In the former, we consider Judicial Duels and trials by combat, and in the latter we consider tournaments and tests of martial skill as recreation, and potentially as preparation and habituation for the former.

Structure of a Medieval Martial Art

When it came to science, as Castle (1885, 8) reasoned, the necessary concepts of "time, distance, proportion" were perhaps the earliest theoretical grounds to be understood by masters. Certainly, even at this early stage, Liechtenauer's notes suggest that he had a firm grasp of these concepts, which I argue were via the lens of Aristotelianism.

In terms of Time the Liechtenauer corpus described the moment before an action (*vor*), the moment of the action (*indes*) and the moment of the spent action (*nach*). In terms of Motion, he composed his system upon the basis of the mechanics of his primary weapon of choice (the means through which he epitomised his system); the Sword.

11 There are fabled masters who preceded him, but the works of those masters are not known to exist today.
12 Indeed, such a pre-eminence is noted by Hils as being an observation of other scholars such as Ukert & Jacobs (1838, 107), Jahns (1889, 368) and Massmann (Serapeum, 5: 52).
13 By the word "corpus", we mean a given set of texts, which relates back to the original meaning of this word: "body" (corpus in Latin).
14 This is believed to be the dating of the HS3227a. This dating was proposed by Lotte Kurras to be around 1389, based upon a calendar beginning from Christmas (Wiehnachtsfest) 1390 – 1495. Though it is feasible that this calendar was based upon the stipulation of its owner, perhaps both as future calendar, and as reference for past events in the owner's life. Moreover, the document is a hausbuch, compiling many sources together. Using one item from the compendium to measure the others is of course a method not without its flaws.
15 This dating is dubious, with scholars unable to agree. See http://www.handschriftencensus.de/7745.

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In which case, it could be reduced to gross mechanics; the weak (*schwach*) und strong (*stark*) based upon the proximal distance of the weapon from the lever of the hand[16].
Also there was the consideration for pressure at blade contact, or engagement (known as binden – binding – or *am schwert* – on the sword – or *Treff* – meeting). These were known as high resistance (*hart*, literally "hard") and low resistance (*weich*, literally "soft").

Furthermore, his system was based upon three 'ranges' of combat. The moment of the entrance to combat was the *zufechtens*, literally "to-fighting" implying "to enter", or the "approach". This moment was the period in which one enters into reach, most often with an *oberhau* (descending cut), or a *zornhau* (scorn action). This latter technique was designed to be the most powerful action with the human body, to end a combat quickly and effectively, to terminate further risk at the first instance (in the approach). Should this technique fail, one should instantly seek the opponent's sword in order to adhere and seek control of this weapon.

Already, we can see sober application of mechanical principles within the approach of the Liechtenauer corpus. We have impetus to ask: what could have been the source for Liechtenauer's concepts, and does that source explain some of Liechtenauer's nomenclature?

One of the most famous sources to inform the medieval world-view was the work of Aristotle. Within those works, it is not surprising that we discover a text on Physics, potentially having the highest relevance to the topic at hand. Let us take a look at this work.

De Physica

Aristotle's books on Physics (*De Physica*) were not widely available in the Latin West. Scholars and prestigious translators (such as Boethius) were more often concerned with matters relating to Theology, so works on Physics were largely supplementary rather than a core part of scholarship.

De Physica was organised into eight books. Book I was concerned with the elements of matter and forms; Book II outlined the types of Cause studied by the Physicist. Movement was demonstrated in Books III-VII, leading ultimately to the discussion in Book VIII of 'The Prime Mover' (*primus motor*), based upon an initial observation that "everything that moves is moved by something", and taking that affirmation in *reductio*, asking recursively penes quid *attenditur* ("on what does it depend?").

Physics is a term derived from the Greek word *phusis*, meaning "nature" and in Book I Aristotle confirms the topic to be studied as "nature..." which "...is a source or cause of being moved (*motus*) and of being at rest (*quies*) in that to which it belongs primarily" (Aristotle, 1.192b21). This principle was rooted in an underlying concept of Change (*mutatio*). This concept was part of Aristotle's explanation as to why Time exists: because Change happens. The extent of Change is measured over Time. Physics treats "…of the invisible causes of visible things" (St. Victor, Taylor 1961, 153), and was treated as one of the three mechanical sciences of philosophy (St. Victor, Taylor 1961, 71), alongside ethics and logic. The basis of change, according to Aristotle, was Motus - or 'motion'.

16 Even this polarity, in itself is fairly rudimentary in comparison to later Renaissance masters of the Science who, like Caranza (1582), outlined up to 12 degrees of difference between the flaqueza (weak) and fureza (strong) of the blade.

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Motus

It is clear that the audience who used Liechtenauer's verse in combat were scholastically aware. In the HS3227a manuscript (c.1389-1420, *Germanisches Nationalmuseum* Nuremberg, – the earliest glossation of Liechtenauer's verse), we find the rhyming couplet (*reimpaaren*) which affirms the supreme importance of this Latin term:

> *Motus*: that beautiful word, is fighting's heart and crown - It forms the entire Art of fighting with all pertinence and articles which form its foundation (HS3227a, 17v).

The concept mentioned with the Latin term *Motus* is therefore postulated as perhaps the most important physical principle. The use of this term in this gloss offers potential confirmation that the scribe had been informed by a Latin translation available at that time, as well as recognising that only the upper classes and educated (theologians, clerics) were familiar with Latin. *Motus* was a significant term to Aristotle and his Medieval interpreters (the Aristotelian Scholastics), as it represented the basis for the physical world.
Motus was considered to be one of the three core forms of change (*mutatio*), which were:

1. Generation (*de generatione*, coming to Be (manifest), esse, in the context of Anima (biology), to be born[17]) of Substance,
2. Corruption (*de corruptione*, coming to Not-Be, or in the context of *Anima* to die[18]) and
3. Motion (*motus*)[19].

To the Medieval mind, Motion was suitably interpreted using the Categories (*praedicamenta*, predicates) of Aristotle, in terms of Quality (alteration, or alteratio), motion in Quantity/number (increase or decrease, or *augmentatio et diminutio*), and motion in Place ("local motion", or "locomotion". Greek: *phorà*; Aquinas, V Phys. Lect.2). It is of course, the latter form of Change which we are interested in for our discussion.

Aristotle tells us that Motion is "the act of being in potentiality insofar as it is potentiality" (*motus est actus entis in potentia, prout in potentia*). Of course, this isn't helpful, because from this definition we derive two other terms which we must understand: the act of being (*actus entis*) and Potentiality (*potentia*). Action and Potency were contrast opposites, such that the "infinite" represents a hypothetical (*in potentia*), and potential "to be", but the Action was categorical (*in actu*) and in a state of "being" (*esse, ousias*), or "manifesting"[20].

The Properties of Locomotion

Aristotle tells us that the contrary of motion is a state of rest (*quias*), wherein a Substance is not in motion, it is said to be at rest, and the reverse is also true. Furthermore, we might imagine that the course of a motion is performed through Space, and that course Aristotle is able to describe by means of describing the place from which it begins (A), and the place at which it ends (B).

17 Note the ubiquitous use of the phrase 'hebt sich an' as an introduction to many, not just Fencing, manuscripts - it's meaning is derived from Aristotle's coming-to-be, to arise, to manifest, to occur, lit: "arises-of-itself"

18 Only Nature herself had Potentia Aboluta (the ability to create Being, and destroy Being), later interpreted by Scholastics as evidence of "God's will to annihilate a Body and create a void".

19 A good way to visualise these forms might be to imagine a depth such as the ocean – 'coming-to-be' would be like rising to the surface of the ocean, whilst 'coming to Not-Be' would be like sinking beneath the surface. Movement on the surface would be like Aristotle's physical motion (motus). The ocean is Physical reality, your life is a boat on the ocean, whilst the depth is a state of death or non-existence - change of position of that boat represents a state of 'Being' or existing. To continue our analogy, it is akin to moving around in physical reality.

20 According to Aristotle, the universe is comprised of potentiality and actuality. The part of the universe he referred to as potentiality was conceptual, covered by his Metaphysics. The world of actuality, of form, and of substance was encountered in his book on Physics, and de Caelo. Evidence of the physical world's relationship with the conceptual realm was proven in his teachings on Form.

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Let us imagine that a cutting or stabbing motion takes the course A-B: A being a position of rest (a guard, leger or "lying", Latin *quies*[21] - Folz (1479, MS Q566, 147v) described how "the first is the guards and holds the entire foundation of technique"[22]), and B being the target upon which Force (*vis*) will be exerted. This motion from A to B will take place in a certain amount of time, the volume of "absolute time" which is relative to the ability of the person/body carrying out the motion. Aristotle states that because A is the initial place, and B is the ending place, that all Locomotion may be defined as having a "starting-point" (*terminus a quo*), and an "finishing-point" (*terminus ad quem*) (Aristotle 5.1, 5.5-6). It is this concept of "starting-point" and "finishing-point" which will define time.

This is particularly interesting because Liechtenauer defines these positions within his Schedule as "stops", "halts" (*halt*), or positions of rest. So when we read 'leger' or '*huten*'[23] we should recognise a Place of rest. He also exploits his use of verbs to discern between an action which affects an opponent's potential motion (a parry against his starting-point, versetzen) and his actual motion (*absetzen*).

A motion moving away from its natural Place was termed Violent, or 'Violating' (*violens*) the natural law of Place, whereas those which effected by a motion was said to be in a state of reaction (*reactio*). The term 'Violent' (Violent) uses the same suffix as that used in 'Agent' (Ag-ent), or Movent (Mov-ent).

Descending[24] and Ascending[25] Motion

Downward Motion of an object was a natural course for its position in Place. Being lifted was considered an unnatural motion, one which violated the natural law (of what we now call "gravity", or according to Aristotle, the natural tendency for an element to seek like-element). It therefore requires effort. This doesn't mean to say that downward motion was the most natural for any substance, since Aristotle described how upward motion was natural for the element of Fire. Motions which were *violens*, were also considered based upon the model of *fatigibilis* (subject to fatigue[26]).

So let us take a practical example: the sword is a heavy object, and to exert force effectively upon another body, it must be lifted and dropped like a hammer. It is also the natural logic of force that a guillotine is dropped to exert force, not lifted. In order to lift, the swordsman exerts his energy against the weapon's Natural Place, and therefore his lifting is subject to fatigue. Prior to his motion, he stands in *potentia*, with the potential to move upwards. With the sword low, he cannot move the sword lower than the ground, and therefore it has more potential to move upwards when in a low position. Likewise, a high position may be predicted to move downwards by the logic of its position (since all actions in martial arts are convergent to a target). At the very extremes of motion, the highest can only get lower, whilst the lowest can only move higher[27].

21 Mair uses the term Habitus, from the Greek Hexis meaning a State, Attitude or Disposition at any given time. Mair also makes use of the word 'Guard' (Latin: Custodia).

22 „daz erst ein hut vn grunt fest alle stuk das and stuk ??? fechtn" Just as arable farming forms the entire basis of the feudal system, so too do the guards form the entire basis for combat – such analogy perhaps suggests why Liechtenauer's basic guards make use of farming terms for their nomenclature.

23 Liechtenauer's lyings (positions of rest) are identified using arable terms intuitive to a farmer or landworker. There was Vom tag (By day), Ochs (Ox), Pflug (Plough) and Alber (to grow). The final translation may well be contested by mainsteam scholars of this topic.

24 ictum supernum, oberen hauen/stichen (mucronem)

25 ictum inferiorum, unteren hauen/stichen

26 Humans have a free-will (voluntas, liberum arbitrium), the decrease of force due to inertia was termed fatigatio (fatigue), in which the celestial bodies never tire in their motion and perpetually move, being infatigabilis.

27 This is very similar to the sentiment expressed in the Far East, for example: "That the weak overcomes the strong, And the soft overcomes the hard, Everybody in the world knows, But cannot put into practice;" (Tao te ching, Chapter22, Chapter78). The Law of Contraries is universal, and so too is its observation.

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This stationary position before and after motion is called Leger (Lying, or "to rest"), or if the weapon is in defence of a part of the body (it obstructs the opponent's trajectory to a target), it is termed *Huten* (Guard). These phases of Rest before (*vor*) and after (*nach*) motion were therefore an opportunity itself for action.

> ...we have upward locomotion and downward locomotion, which are contrary lengthwise, locomotion to the right and locomotion to the left, which are contrary breadthwise, and forward locomotion and backward locomotion, which too are contraries. (Aristotle Bk. V. Ch.5).

Perhaps the most pre-eminent descriptions of motion are derived from the upward and downward directions: the *oberhauen* (downward blows) and *unterhauen* (upward blows).

Aristotle reminds us that "every sensible body is in Place and the kinds or differences of Place are up-down, before-behind, right-left". Aristotle later unifies these concepts as extremes of certain planes which he names the Three Dimensions; (*tria diaireton*) "length (*mekos*), breadth (*platos*) and depth (*bathos*)[28]. From each extreme of these we can find an up and down (*length*), a right and left (*breadth*) and a Before and Behind (*depth*).

Now this is where it gets interesting, because Liechtenauer separates the human body into four parts (the vier *theil/quartier* or *blossen*), which is observably based upon Aristotle's concept of dimensions. Liechtenauer names Superior (*ober*), Inferior (*unter*), Left (*links*) and Right *(rechts*), yet does not explicitly take into account of the Anterior (*vor*) and Posterior (*hinter*). We might assume that because we face the opponent, that we should have no need to discern the rear of an opponent into aspects. This partitioning and dividing of the body is quite Aristotelian in nature, wherein we are told the logic for such division by Aristotle himself[29].

Despite being outside our subject area, the existence of motion between rests was suitably described later by other masters, most succinctly perhaps by Viggiani in his book *Lo Schermo*[30].

28 Aristotle (Book IV, chapter 1). In Book 3, Aristotle mentioned "every sensible body is in place, and the kinds or differences of place are up-down, before-behind, right-left".

29 "Now since the left and the right sides are symmetrical, and these opposites are moved simultaneously, it cannot be that the left is moved by the right remaining stationary, nor vice versa; the original must always be in what lies above both. Therefore, the original seat of the moving soul must be in that which lies in the middle, for of both extremes the middle is the limiting point; and this is similarly related to the movements from above [and below,] those that is from the head, and to the bones which spring from the spinal column, in creatures that have a spinal column." Aristotle, (Part 9)

30 Viggiani, Lo Schermo which forms part of a dialogue between scholars: "the philosophers have proven that prior to a body moving itself it will remain at rest, and ceasing its motion again remains at rest; so that a motion (provided that it be single) will lie in the middle of two rests...In the Seventh and Eighth Physics Aristotle proved it;....before you throw a mandritto, a rovescio, or a punta, you are in some guard; having finished the blow, you find yourself in another guard; that motion of throwing the blow is a tempo, because that blow is a continuous motion [motus frequens]; thus the tempo that it accompanies is a single tempo; when you rest in guard, having finished that motion, you find yourself once again at rest; it is therefore a tempo, a motion, which instead of calling a "motion", we call a "tempo", because the one does not abandon the other; and the guard is the rest and the repose in some place and form.
In conclusion it is as much to say "tempo" and "guard", as it is to say "motion" and "rest". Whereby it is necessarily so, that as between two motions there is always a rest, and between two rests there is interposed a motion, apparently between two thrown blows, or two tempos, or two motions, is found a guard. And between two guards, or rests (as you wish to say) are interposed some blow and tempo...
CON: I believe that I understand it now, when you say to me that between two blows is found a guard, and between two guards a blow; whence perhaps derives that which you say, that each blow gives rise to a guard, and that each guard gives rise to a blow.
ROD: Thus it is, more or less saying that following each blow one finds oneself in some guard, and that following the guard, the blow succeeds it. And as the rest of a particular motion is different from the rest of another varying motion (since these are the natural dispositions which they desire) thus a guard is apt to generate a particular blow commodiously and not another;"

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Timing (tempŏrē)

A major aspect of Aristotle's Physics is the definition of 'Time' and how it is a Quantity of Change. Therefore, Time and Motion are one and the same. So when we say, 'time' we also mean 'motion' and vice versa. This definition is crucial because with it we realise that principles defined by Liechtenauer using the terms '*vor*'[31] (before), '*indes*'[32] (now), '*nach*'[33] (after) are actually relative to motion.

So when Liechtenauer says 'before' he means before a motion has come-to-be, i.e. that the motion remains '*in potentia*'. This theoretically means that we predict the opponent's motion because he is in a state of rest.

Yet not all states of rest (*guards*) were made equal. And this is crucial to understanding Aristotelianism applied to combat. Applied to Swordsmanship, we note that a high guard and a low guard are biomechanically and functionally different in performance. Because of the very nature of Natural Place, a state of rest in its Natural Place must undergo 'violation' (*violens*) in order to return it to a position from which it may be dropped again[34].

According to Aristotle, the sword's Natural Place in on the ground, and must have human intervention to lift it away from its Natural Place. Thus, a resting position on the ground is merely a position requiring to be raised, whereas a resting position up-high is a position expecting to fall. Therefore high guards are particularly functional for attacking, whereas low guards are functional for sweeping strikes away (*aufstreichen*), or for seeking an engagement (*binden*). Aristotle's Natural Place therefore defines high guards as most dangerous, and thus not all Places of Rest are made equal[35].

If the opponent is already in a state of rest, then he can either remain in a state of rest, or come into a state of motion. Either way, at the present moment, the opponent exists in a state of '*in potentia*' and we remain safe in this knowledge. This is the perfect time to attack because in the absence of motion, there is absence of force. We exploit this principle by acting 'in-the-before' whilst the opponent remains still, predicting what he might intend to

31 HS3227a (17r, 17v, 20r-21v, 23r, 28r, 29v, 38r-38v); Wallerstein 5r; Liechtenauer stemma (Rome Cod.44.A.8, 11v-12r; Kal KK5126, 106v;), Lew Stemma (Cod.I.6.4°.3, 4v; Ml.29, 11v-12r; Germ.Quart.202, 9v; Mair 82v; Cod.10825, 72v); Ringeck Stemma (Dresden C.487, 14v-15v); Mair (Cod.10825 1.23v, 35v, 72v f., 104v, 121v; partes priores, 1.57r; partes primae, 1.104v; praevenire, 1.149r); Meyer 1570 1.24v, 32r, 51r, 54v, 56r; 2.3v, 99v; Lecküchner (Cgm 582, 1v); Wittenwiler Cgm 558, 126v

32 HS3227a (17r, 18v, 20r-20v, 22v-23r, 23v, 33r, 38v); Wallerstein 6r; Ringeck Stemma (Dresden C.487, 38r-39r; MS E.1939.65.341, 13r); Lecküchner (Cgm 582) 1v, 216v; Mair (Cod.10825, 1.5r, 74r; velocitas, 1.83v, 95r; crebri ictus, 1.94v; subito, 4v; interim, 1.62v; inde, 1.48v, 179r, 2.141r; interea, 1.41v, 99r; promptissime, 1.3v; mora omni remota, 1.103r; in ipso articulo, interim, 1.3v); Meyer (1570 1.24v-25r, 45v; 2.103r; 1.47v, 1.51v, 1.53r; 1.53r, 2.33v.1, 100r); Augsburger (Cod.I.6.2°.2, Cgm 3711, MS E.1939.65.354, Cgm 3712, Cod.Guelf.38.21 Aug.2°).

33 HS3227a (17r, 17v, 20r-22v, 23r, 28r, 29v, 38r-38v); Liechtenauer stemma (Rome Cod.44.A.8, 11v-12r; Kal KK5126, 106v;), Lew Stemma (Cod.I.6.4°.3, 4v; Ml.29,, 11v-12r; Germ.Quart.202, 9v; Mair 86r; Cod.10825, 73r); Lecküchner (Cgm 582, 1v); Wallerstein 5v; Mair (Cod.10825, 1.31v, 35v, 72v-73r, 121v; sequi, 1.149r); Meyer (1570 1.24r, 1.54r, 46r; 2.15r, 27v, 56r, 103r; 3.40v); Gladiatoria (37r-v, 39v, 43v); Wittenwiler Cgm 558, 126v.

34 Spanish masters later also characterised their movements (movimientos) with Aristotle's terms: Violento – an ascending movement; Natural – a descending movement; Remisso – a retractive movement, like Liechtenauer's guards, or Mixto – any sequence of the above.

35 An English author, George Silver offered a more refined example of this principle, discriminating and demarcating between a 'lying' (or state of rest) and 'lying spent', as a high guard and low guard respectively. Using this terminology, we can clearly see the Aristotelian advantage of a high guard over a low guard. George Silver (1598), Chapter 3 "four actions, the which we shall call bent, spent, lying spent, and drawing back"- the use of the term 'action' is telling in this case as Aristotelianism. In Chapter 38, he described the same movements as "four times or motions". The four actions describe the cycle of pulling back and extending forward as part of making a blow. See also Sloan MS. No. 376, Chapters 7, 8, 14. Arguably, the earlier English sources also make use of the term 'wasted' which might potentially be correlated with the concept of 'sturtz' or 'plunge' – as described by Medel, and other Commonplace Fencing sources. Needless to say, the 'four actions/motions/times' are phasic components observable in the performance of all martial arts.

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do and cutting it off before he can do it. Logically speaking, it is far easier to stop a blow whilst it is being pulled back (drawn back) than to act against an established momentum[36].

If the opponent is in a state of motion, then we must react 'in-the-moment' or literally 'in-the-motion' to exploit an advantage. In this, we realise a correlative concept with Asian combat systems which dictate removing conception of before, after or during a fighting, but simply learning to be 'present' in-the-moment, and allowing the-moment to dictate one's actions. Concepts such as *Wu-hsin/Mushin* (no-mind), *Wu-wei* (non-action) are found within Liechtenauer's framework if we read the commentaries within that context. The principle is summarised in the Latin word 'tempŏrē' (Greek: καιρός, *kairós*), which means 'at the right or fitting time' and was especially described by Aristotle as meaning 'spontaneous', and as a 'decisive point' (Aristotle, Nicomachean Ethics, 1:4). It was further explained by the Sophists as being applied to archery, weaving etc, and captured by White as like the 'aperture through which the archer's arrow has to pass' (White 1987, 13). With this, although modern perspective of the concept, we may recall the particular description of blows conceived as if like a thread or cord being pulled through the eye of a needle to the aperture presented on the opponent.[37]

The account writer Nicholas Augsburger later described that one should,

> Notice that 'feeling' (*fühlen*) in swordsmanship, and that word "*Indes*", are the greatest Art. And if someone is a master of it, or wants to be, yet he cannot feel that sense, and therefore does not accept that word "*Indes*" - then he is especially not a master, but he is a buffalo of the sword. So before anything else, these two things must be learnt well.[38]

With 'indes' and '*fühlen*', we discover the attempt on behalf of the fencer to 'interrupt' the continuum of performance. According to Aristotle, 'continuous' means 'divisible' wherein, we state that we cannot discern that "no continuous thing is divisible into things without parts" (Aristotle, Book VI:1) He continued:

> it is plain that everything continuous is divisible into divisibles that are infinitely divisible: for if it were divisible into indivisibles, we should have an indivisible in contact with an indivisible, since the extremities of things that are continuous with one another are one and are in contact…
> Moreover, if that which is continuous is composed of points, these points must be either continuous or in contact with one another: and the same reasoning applies in the case of all indivisibles. (*ibid*)

36 Because of this very basic physical principle, Liechtenauer established a set of action which had geometric dominance. As Hooke observed (1678, ut tensio, sic vis), as with the extension, so the force, Liechtenauer's masterful actions were designed to prohibit extension. He referred to them as the five 'master cuts' (funf meisterhau), but were commonly referred to by early scribes as the 'secret strikes' (verborgen hau). Each of these guard positions could be forestalled or prohibited using bisecting cuts, which were as follows;

1. *Bisect Vom Tag – Zwerchhau, "transverse" or "dwarf" cut*
2. *Bisect Ochs – Schielhau, "Coy" or "shy" cut*
3. *Bisect Alber – Scheitelhau, "scalp" or "skull" cut*
4. *Bisect Pflug – Krumphau, "twisted", or "crooked" cut*

Due to the fact that fencers ignorant of Timing in this manner simply cut with vertical or horizontal cuts, great reverence was given to the ingeniousness of bisecting trajectories.Such devised skills were based upon the concept of the convergence of strikes, and that all blows with the sword must converge into a target. By identifying the path to the target, we may bisect that trajectory and ensure that we forestall his action.

37 HS3227a (1420, 13v-14r). "Vnd get of das aller neheste vnd kors körtzste / slecht vnd gerade czu / Recht zam wen eyn° eyne hawen ader stechen welde / vnd das man im deñe eynen vadem ader snure an seynen ort ader sneyde des swertes bünde / vnd leytet aber czöge dem selben ort ader sneide off ienes blössen den her hawen ader stechen selde / noch dem aller nehesten / kortzsten vnd endlichsten / als man das nür dar bregen mochte"

38 Nicholas Augsberger. gloss "merckh das im schwertt das fullen vnd das wortt Indes die grösten kunst ist vnd wen ain maister ist vnd sein wil vnd kan er das empfinden nit fullen vnd vernimpt darzu nit das wort Indes so ist er nit ein maistr~ sunder er ist ein biffel des schwerts darum so soltu vor allen sachen die zwai ding wol lerne machñ"

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With this in mind, we should consider the words of HS3227a which similarly note the division in which motion takes:

> "Here note that continuous motion (*frequens motus*) holds the 'beginning', 'middle' and 'end' of all combat according to this Art and teaching, as such one is to rush; initiation, means and completion without delay and without any hindrance from any opposing fighters by not letting him come to blows; when often that goes the two words "Before", "After" - that is the Starting (Before-) strike and the Finishing (After-)strike… [39]

Aristotle further adds meaning to this later in Book IV:1 (and reinforced, parts 3-4):

> And since every motion is in time and a motion may occupy any time, and the motion of everything that is in motion may be either quicker or slower, both quicker motion and slower motion may occupy any time: and this being so, it necessarily follows that time also is continuous. By continuous I mean that which is divisible into divisibles that are infinitely divisible: and if we take this as the definition of continuous, it follows necessarily that time is continuous.

When we juxtapose this with the descriptions offered by the HS3227a, we bear witness to the concept of timing as it defines fighting being brought into sharp focus:

> …and do as is previously written: since this is the foundation of fighting: that one is ever more in motion and doesn't rest, and it comes to you then upon that "Feeling", *ut supra apparuit* (as it becomes apparent). And whatever you deliver and start, so certainly have Moderation and Measure, as if you have won the Before-strike. [40]

With this comment, the Latin phrase determines that the concept is about 'the moment' (*indes*) that something becomes apparent, or can be 'sensed'/'felt'.

With action, we discover assignment of role based upon timing, the acting and the acted upon. This is the basis of Aristotle's principle of 'Agency' and 'Patiency'.

Agency and Patiency

We find the underlying principle for Liechtenauer's assignment of actor roles within Aristotle's discussion regarding Change caused by Force (Aristotle, Physics Book 3:3). It effectively defined a formula for relative motion: that an Agent (*ab agente*) is said to be in a state of action, and that whoever is acted upon is a Patient[41] (*in patiente*) and is said to be in a state of passion.[42]

39 HS3227a (1420, 17v). "Hie merken das / frequens motus / beslewst in im / begynnis / mittel vnd ende / alles fechtens / noch deser kunst vnd lere / alzo das eyñ yn eyme rawsche / anhebunge / mittel vnde endunge / an vnderlos vnd an hindernis synes wedervechters volbrenge / vnd ienen mit nichte lasse czu slage komen / wen of das geht dy czwey wörter / vor / noch / das ist / vorslag vnd nochslag"

40 HS3227a (1420, 22v) "… vnd tu als vor geschrebñ ist / wen das ist der grunt des vechtens das eyn man vmmer mer in motu ist / vnd nicht veyert vnd kömpt is deñe an das fulen / zo tu / ut supra apparuit / Vnd was du treibest vnd begiñest / zo habe io moße vnd limpf / als ab du im den vorslag / gewiñest"

41 Skeat (1888, 335) tells us that the modern term "patient" means "to suffer", allied with pathos (emotion, grief, yearning), from Old French patient, the present participle of pati, Latin patientia.

42 Of course, given that things should act, and be acted upon, Aristotle was concerned with explaining what causes such motion. There were four causes for Bodies to change: materialis (material), formalis (formal), efficiens (efficient) and finalis (final, purpose; Greek: telos). Change exerted against resistance: Force (vis, potentia), resistances (resistentia) and velocity (velocitas).

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An Agent acts, causing a change (*mutatio*) upon the other body by means of Force (*vis*), who is defined as a "Patient" for that reason. The change is therefore a quality within the Patient, the degree of which will be relative to the level of resistance (*resistentia*, or what later became known as *inertia*) to change. If the Patient reacts to this change, causing a change in the original Agent, then the Patient in the first interaction becomes the Agent in a new interaction. This is Aristotle's fundamental basis for Causal change (Aristotle, Physics Book 3:3).

This kind of exchange is important because it becomes the very definition of behaviours in Liechtenauer's system, to act and react to resistance.

An action which meets resistance is repeated (dupliert, Latin: *duplex, duplicatio*) to a Place (an opening, Bloss, Latin: *nuditate*) which will not meet resistance. This is therefore the definition of Duplieren offered by Commentators on Liechtenauer's corpus.[43] In the case that the action is affected in its course by resistance, the original action becomes a Patient in a new interaction. In which case, an original stroke of a sword (hauen) converts (mutiert, Latin: *mutatio*) to a thrust with the point. So *Duplieren* refers to an action which is repeated by changing course because of meeting resistance, but the action (whether cut, stab or slice) in the first technique is the same as the second. Thereby the direction changes, but the orientation/angulation of the blade does not. With *Mutieren*, the action is converted into another action because of resistance, such as a cut converting into a stab without altering its direction. Thereby the direction doesn't change, but the orientation of the blade does. [44]

Four Types of Locomotion

Aristotle was certainly familiar with the concept of biomechanics, as he described the application of mechanical principles are they may be observed in the movement of animals. For example, in his book 'On the Motion of Animals' he described the mechanical forces involved in motion and rest, akin to Newton's Third Law of Motion:

> "And further the force of that which initiates movement must be made equal to the force of that which remains at rest. For there is a definite quantity of force or power by dint of which that which remains at rest does so, just as there is of force by dint of which that which initiates movement does so; and as there is a necessary proportion between opposite motions, so there is between absences of motion. Now equal forces are unaffected by one another, but are overcome by a superiority of force." (Aristotle, On the Motion of Animals *De Motu Animalium*, Part 3).

43 (Rome Stemma 16r, 19v, 20r, 23r, 28r, 32r, 36v; Ringeck Stemma 24r; Lew Stemma 17v, 21v, 30v; Mair (V3) 2.150r; Mair (V) 1.6v, 20v, 33v, 75r-v, 124r-v, 128v; Egenolph 19v; Meyer 1570 1.19r, 60r)

44 Averroes (S.III, q.5, f 40vb, l.20-36) suggests,

(1) … motion can be considered in two ways: either in itself and absolutely or in comparison. (i) if in the first way, since motion is nothing other than a continuous succession, if it is considered insofar as a succession, then it is in the category of passion. For every succession is caused by a resistance, and every resistance is primarily and essentially in the category of passion. It is considered insofar as there is continuity in that succession, In this way it belongs to the category of quantity, but this Is accidental, since the continuity of motion derived from that of the magnitude. (ii)But if we speak of motion in comparison, it is therefore either in comparisons to that thing from which it derives, and in this way it will be in the category of action, or it is in comparison to that this to which it is directed, and this is twofold: either essentially or accidently. In the first way motion is only in four genera, in the second way it is in all ten. If, moreover, motion is considered in comparison to that thing in which it is, that is, to the mobile thing, this is also twofold: either essentially, and this it is again only in four genera, or accidentally, and thus it is in ten.

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Moreover, Aristotle's demonstration was quite prescriptive of how forces are created by the body, and how animals are capable of generating energy or motion (kinesis) by means of articulations. Aristotle also likened the grip on a stick (potentially used as a weapon) as a form of articulation. [45]

Aristotle stated that there are four kinds of Locomotion "pulling, pushing, carrying, and rotating" and further affirmed that "All forms of locomotion are reducible to these" (Aristotle, Physics Book 7:2). In compliance with Aristotle's theory of Motion, we may witness only four forms of motion, and those four forms are a persistent theme throughout all martial arts literature.

Pushing (*stossen*[46]*, Stich*[47]*, schnell*[48]*, drucken*[49]*, impulse* (Aristotle, Physics Book 7:2) and **Pulling** (*trahire/ retrahire, zucken*[50]) are defined as any motion which "is causing motion away from itself follows up that which it pushes and continues to push", whilst continuing that "which may be a motion either away from the pusher or away from something else, while pushing together is pulling, which may be a motion towards something else as well as the puller". Thomas Aquinas explains the meanings of Aristotle's rather confusing description of Pulling, helpfully by using swordsmanship as an example.[51]

> And thus pulling is defined here as one body pulling another such that that which is pulling is moved together with that which is pulled. (Thomas, K. W. (trans.)(2003). Commentaries, Book 7, item 903, pp.461).
> For natural pushing is always from the pusher, and natural pulling is toward the puller. (Thomas, K. W. (trans.)(2003). Commentaries, Book 7, item 904, pp.461).

45 "However, that which first moves the animal organism must be situate in a definite original. Now we have said that a joint is the beginning of one part of a limb, the end of another. And so nature employs it sometimes as one, sometimes as two. When movement arises from a joint, one of the extreme points must remain at rest, and the other be moved (for as we explained above the mover must support itself against a point at rest); accordingly, in the case of the elbow-joint, the last point of the forearm is moved but does not move anything, while, in the flexion, one point of the elbow, which lies in the whole forearm that is being moved, is moved, but there must also be a point which is unmoved, and this is our meaning when we speak of a point which is in potency one, but which becomes two in actual exercise. Now if the arm were the living animal, somewhere in its elbow-joint would be situate the original seat of the moving soul. Since, however, it is possible for a lifeless thing to be so related to the hand as the forearm is to the upper (for example, when a man moves a stick in his hand), it is evident that the soul, the original of movement, could not lie in either of the two extreme points, neither, that is, in the last point of the stick which is moved, nor in the original point which causes movement. For the stick too has an end point and an originating point by reference to the hand. Accordingly, this example shows that the moving original which derives from the soul is not in the stick and if not, then not in the hand; for a precisely similar relation obtains between the hand and the wrist, as between the wrist and the elbow. In this matter it makes no difference whether the part is a continuous part of the body or not; the stick may be looked at as a detached part of the whole. It follows then of necessity that the original cannot lie in any individual origin which is the end of another member, even though there may lie another part outside the one in question. For example, relatively to the end point of the stick the hand is the original, but the original of the hand's movement is in the wrist. And so if the true original is not in the hand, be-there is still something higher up, neither is the true original in the wrist, for once more if the elbow is at rest the whole part below it can be moved as a continuous whole." Aristotle, (On the Motion of Animals De Motu Animalium, Part 8)

46 For example: HS3227a (1420 35v,37v,); Rome Cod.44.A.8 (1452 16r,20v,20v,22v,25r); Schwabenspiegel Codex (1462 126,129,); Die Meisterlieder des Hans Folz (1479 143,144,); Fechtbuchleinn (1500 6r,8r,8v,8v,9v,10r,10v,); Hans Medel Fechtbuch (1539 37v,38r,38r,38r,-38v,38v,39r,39r,40r,41v,42v,);

47 HS3227a (1420 14v,16r,17r,19r,19v,20r,20v,21r, 22v, 23r, 23v, 24r, 25r, 28v, 29v, 32r, 32v, 34r, 34r,34v,34v,34v,36v,36v,-36v,37r,37r,37r,37r,38r,);Rome Cod.44.A.8 (1452 12r, 12v, 13r, 13v, 14r, 14v, 15r, 15v, 16v,17v,18r,21v,22v,23r,23v,24r,-26v,27r,30r,30v); Schwabenspiegel Codex (1462 125,126,127, 128,129,); Die Meisterlieder des Hans Folz (1479 143, 144,145,146,147, 148); Fechtregeln (1500 13r,); Fechtbuchleinn (1500 2r,2r,2v,3v,3v,4r,5r,7r,7v,8v,9r,11r,12r,12r,12v);

48 Very quick pushing. For example: Rome Cod.44.A.8 (1452 27r); Lew (45v); Egenolph 31r; Meyer 1570 1.35v, 37v, 38v, 46r, 48v, 49v, 50r, 50v, 51r, 51v, 55r, 61r; 2.33v, 34r;

49 Prolonged pushing. For example: HS3227a (1420 ,25r,36v); Rome Cod.44.A.8 (1452 12v,13r,13v,19v,25r, 30r); Die Meisterlieder des Hans Folz (1479 145,); Meyer 1570 1.5r, 19v, 36r, 61v, 62v; Egenolph 12v; Cgm 3711 35v-36r; Cgm 3712 129v ff;

50 Latin: retrahitur (as cited by Mair); Contemporary English: rake; For example (not a comprehensive list): HS3227a (1420 29v,29v,35r,); Rome Cod.44.A.8 (1452 12v,13r,22r,23r,25r); Die Meisterlieder des Hans Folz (1479 143,143,143,143,146,); Fechtregeln (1500 6v,-11v,15r,15v,16r,); Fechtbuchleinn (1500 6r,8v,); Hans Medel Fechtbuch (1539 38r,38r,38v,39v,39v,39v,40r,40v,40v,41v,42r,42v,);

51 Simplicius (Book 7, Item 1056, Hagen 2014, pp.31-33) also references and explains the concept in this way.

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> And similarly 'striking' [*spathesis*] is pushing, and 'combing' [*kerkisis*] is a pulling. For '*spathe*' in Greek means either a sword or a spatula. Hence '*spathesis*' is the same as '*spathatio*', that is, striking with a sword, which occurs by pushing. (Thomas, K. W. (trans.)(2003). Commentaries, Book 7, item 905, pp.461)

Aristotle further recognised that all motions performed by the body are examples of pushing and pulling ("inhaling is a form of pulling, exhaling a form of pushing"). The ancient poets maintained that "Pleasure attracts each man" which was again considered an example of the kind of 'attraction' or 'pull' toward 'Natural Place'.

Carrying (*tragen, abtragen*, (Meyer 1570, 1.18v, 30v, 43v); hebt sich, *fahren auf*[52], *nieder*[53]) is united with the others, and may well be related to the others because the "carried" is in contact with a pusher, or puller "... for that which is carried is in motion accidentally, because it is in or upon something that is in motion, and that which carries it is in doing so being either pulled or pushed or twirled; thus carrying belongs to all the other three kinds of motion in common." Carrying is the act of interrupting something's natural place, which is of course the requirement of holding a sword. All actions wielding a sword are forms of Tragen. This potentially explains how the term 'tragen' does not generally occur within the Schedule. However, terms which define types of carrying, such as lifting (*hebt sich, über sich*), lowering (*nieder, unter sich*), extending (*fahren*) and retracting (*zucken, abziehen*) occur in the *Glosa*.

Rotation, or torsion (lit: 'Twirling'[54], sometimes translated as 'Whirling'[55] German: *Winden*[56] {*einwinden, auswinden*}, *torsio {intorsio, extorsio}*) is described by Aristotle as a "compound of pulling and pushing...", because it is made up of both in succession of Time, "...for that which is twirling a thing must be pulling one part of the thing and pushing another part, since it impels one part away from itself and another part towards itself".

These terms were used by Aristotle to define the kinds of Locomotion which take place in the physical world. In which case, all physical bodies are subject to these kinds, especially the human body. When we consider the human body in motion, and specifically in physical conflict with another human body, then we may recognise Aristotle's terminology and classifications as highly useful.

They are not therefore strictly limited to the arm, or body, or the turning motion experienced by pivoting on the foot. We have seen that these principles may be translated to apply to any form of motion using any gross or specific body part, not just a weapon.

It is of special note that pushing, pulling and whirling also figures in works on wrestling[57], a context which supports the translation as found above (though given the proximity and relationship, "wrapping" or "enveloping" may also suit). In fact, the term "stossen" has led scholars to suggest that it may mean "jabbing attacks with a blunt surface" (Forgeng 2006, 28), evidently because it's easier to push with an object with a blunt edge than a sharp edge (i.e. because a sharp object, 'stich', 'sticks in' its target).

52 "Fahren", to reach or extend in the context of fencing: Occurs 19 times (in the form of "var" and "varn") in HS3227a, in the context of reaching the arms, edge, blow, sword, and pommel. Occurs 22 times in Rome Cod.44.A.8. "Far auf" extend upwards, occurs in the form "far auff mit den armen" (14 times in Lew, 22 times in M.I.29, 27 times in Dresden C.47, 10 times in Glasgow, inclusive of both "extend up with the left arm", "~ right arm"), and also in the form of "far auff mit dem swertt" (5 times in Lew, 4 times in M.I.29), and "far Im mit dem knauff" (3 times in Lew, 4 times in M.I.29).

53 Used principally in the context of lowering the sword, lowering the hands, but also in lowering the foot.

54 Translation preferred by Hardie R. P., R. K. Gaye, Retrieved May 27, 2016 https://ebooks.adelaide.edu.au/a/aristotle/physics/.

55 Translation also offered by R. P. Hardie and R. K. Gaye (ibid);

56 HS3227a (1420 17r,18v,,22v,23r, 23v,27v,28r,29v,34v, 35r,36v,37r,39v,40r,); Rome Cod.44.A.8 (1452 12v,13r, 13v,14r, 14v, 15r, 15v,-16v,17v,18v,19r,20r,24r,25r,30v); Hans Medel Fechtbuch (1539 38r, 39r 41r, 41v,); Ringeck (41v); Rome Cod.44.A.8 (31v); Meyer 1570 1.19r, 34v, 60r; 2.6v, 30v, 34v, 39r, 71v; 3.28v f., 38r;

57 (Wurm (1507, 15); Glasgow (38v); Durer (24r-b); Liegnitzer's 2nd wrestle; Paschen 5; Fiore (Getty 6v-b; PD 4b-b; Paris 39r-b))

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Alteratio (wechseln)

To make a change in the trajectory of the blow (i.e, its angle) without changing the Quality of the blow (i.e. to change the trajectory of a stroke, but not convert into a stab or slice), Aristotle would use the term *Alteratio*, which means 'alteration'. In the Liechtenauer corpus, we find this concept in the form of 'wechsel'. Meyer tells us that Wechsel means to change an action from the right to the left and vice versa - in effect, it operated on the x-axis (Meyer 1570, 1.14v.1). Mair confirms its used in the y-axis, moving upwards and downwards.[58] The term becomes explicit in the '*wechselhau*' (altered cut), and the '*durchwechsel*' (altering or shifting whilst converging). Alteration therefore means to change the angle of the action, but not to change the Thing (its characteristics, or *qualitas*) itself.

Mutatio (mutieren) - Conversion of one Action (Wunder) into Another

Whereas *Alteratio (wechseln)* denoted change in the direction of motion, but not change in its application, *Mutatio* (*mutieren*) was a true change in the quality (*qualitas*, or performance) of the motion itself. To convert a stab into a cut, a cut into a slice etc requires real Change, conversion, in Greek: *Metamorphosis*, which in Latin is rendered as *Mutatio*, and further in German vernacular is termed '*mutieren*'. In most circumstances, the choice of technique should be accurate commitment to an action. Therefore, the credible change of an action into a different form of action would be caused by an Agent acting against our motion. Therefore, as we launch a blow we are the Agent, but when the opponent acts to defend, he becomes the Agent in this new scenario. As a reaction to the opponent's defence, the blow is displaced, but converts into a stab and continues the flow of motion into the opponent's body. We should also be mindful though, how mutation can occur using volition, and does not always depend upon hitting the opponent, but (as Meyer suggests), we can change without contact.

We see an example of the German application of this mechanic in the HS3227a (18v-19v). Here we are given an initial instruction upon the required geometry of the sword, and how its straight form allows it to be manoeuvred and manipulated on a number of different angles, planes and trajectories. Depending upon the angle or trajectory used, and the part of the weapon applied, we may discern technique.

Conclusion

Although historically speaking it might well be entirely impossible to 'prove' beyond all doubt that Liechtenauer applied the Aristotelian world-view to his understanding of combat, the terminology he uses and the way in which they are used suggest that Aristotle's Physics were indeed applied.

The presence of these terms in Liechtenauer's German vernacular may be argued to be beyond mere coincidence, and given that such a verse permeated educated and high-born social structures, it may be significant therefore that Liechtenauer may have been an interpreter of contemporary science into a combative application.

Liechtenauer's verse makes use of commonly used expressions within Aristotelian Scholasticism, itself a conceptually loaded framework, and their appearance with such regularity and consistency, and to such high volume of correlation, points strongly toward a formal understanding of Aristotle's Physics. Even the structure of Liechtenauer's verse shows thorough modelling of 'information architecture', and one which could not be possible without the application of intellectualism.

58 Mair ("Zwen schnnidt vonn oben vnd von vnden", C93, 39r; 10825, 18r; Cod.icon.393, 35r;)

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Describing motion in terms of descending (*ober*) and ascending (*unter*), as planes particularly declined toward Natural Place (*hängen* – which is why they are 'hanging', not inclining), of mechanical actions such as pushing (*stossen, stechen*), pulling (*zucken, ziehen*), turning or rotating (*winden, wenden*), as well as more complex concepts based upon temporal conditions (*nachreissen, oberlaufen, versetzen, absetzen, binden*), spatial conditions (*an, auf, durch, um et al*) and further upon concepts of collision and resistance (the definition of hard/soft, weak/strong biomechanics - and operational conditions such as altering trajectory (*wechseln*), continuing (*duplieren*) or converting (*mutieren*) motion due to resistance also correlate strongly with Aristotelian Physics.

In accordance with our definition of science being the '…intellectual and practical activity encompassing the systematic study of…the physical…world…" we might rightly observe, and remark how, the aforementioned evidence demonstrates with high probability and credibility that Liechtenauer's approach to martial art in 15th century Germany was, and its corpus remains, evidence of Exercise Science in the Ancient World.

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Gliding Body – Sitting Body
From Ancient to Modern Knowledge of Ski and Yoga

Henning Eichberg

Introduction

Abstract

Bodily play has deeper meaning than modern sport science normally recognizes. It can have religious undertones, and in modern societies, it is sometimes related to the building of national identity. This study compares two cases of body culture. Norwegian ski has its "temple" at Holmenkollen, has a relation to friluftsliv (outdoor activities) and ecosophical philosophy with religious undertones and is highly significant for Norwegian identity. Indian yoga is related to the traditional ayurveda medicine and to Hindu spirituality, and has played an important role in the process of anti-colonial nationalism, with Gandhi as father figure.

Along with further cases of body cultures, ski and yoga show a complex connection between "ancient roots" and modern transformations of identity. The significance of ancient traditions for modern human life is a "will to roots".

And both cases cast light on the building of knowledge upon the basis of bodily play. Gliding on skis, sitting and breathing in yoga, as well as flying in the air, exercising in rank and file, kicking a ball, moving to the rhythm of the drum… – all make up a broad spectrum of human bodily potentials on which people have built religions and identities of their collective "we".

A Holy Mountain in Norway – Ski and Yoga

High above Oslo, there looms Holmenkollen; embedded in a landscape of green – or seasonally snow-white – nature, of wood and ski slopes, the ski jumping hill with its dynamic design in concrete points high into the sky.

The tower is a practical installation for ski jumping. Once it was a simple ski hill, which in 1907 was extended with a minor stone raise, in 1913 with a nearly ten meters high construction, later rebuilt with a functionalist design, and step after step adapted to the standards of international sporting competition and record production (Slagstad, 2008: 201-288).

However, Holmenkollen is more than a sport facility. In 1920, the Swedish paper *Svenska Dagbladet* characterized the iconic significance of the place:

> "Just as the Olymp in Greece does not only consist of the mountain of this name, but denotes the whole divinity, so we can understand the Holmenkollen in Norway in the same way. It is the name for the national sport, the national hill, the national day. It is a holy mountain…"

Indeed, Holmenkollen as an annual ski event in the month of February is a sort of national day, competing with the Norwegian national day of May 17. At the side of the monumental jumping tower stands a statue of Fridtjof Nansen, the father of the Norwegian ski movement, presenting the image of a national saint. And a museum of Norwegian ski sport offers a rich collection of historical ski equipment, documents from polar expeditions, pictures of legendary ski sportsmen, as well as prize cups and other trophies, including a "wall of fame". The

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museum claims to present 4000 years of ski history, hereunder the prehistorical rock engraving of the Rødøy man on ski from 2000 BC and the oldest preserved ski from 600 AD.

The history of Holmenkollen can be written as a story of Norwegian nation building. The modern nation of Norway, as it presents itself in this "temple" of ski, has religious undertones. Nationalism is often – also in other national cases – expressed by religious metaphors, but maybe all this is more than metaphorical. What is religion, and what is national identity?

When studying phenomena more in depth, a comparison is always enlightening. For a deeper understanding of Norwegian ski, we'll here compare Indian yoga as an art of body culture (Hauer, 1922; Eliade, 1958; Deshpande, 2013). Yoga has likewise religious undertones and a particular connection with modern nation building in India.

When analyzing cultural connections between bodily practice and religions or nationalist ideas, one often proceeds top-down, letting arguments run from some high ideas to peoples' down-to-earth practice. First one develops the idea of nation building, which is expressed by religious metaphors, and then it finds a concrete application in sports – this history of ideas has determined the perspective in the Norwegian case. Likewise, Indian body culture has been described as a way from philosophy via educational programs down to physical education, as a way from mind, emotions, and psychology to the body, from doctrine and thought to techniques.

This way is enlightening, indeed. And yet, the anthropology behind this approach – that the human being first thinks and then acts – can be doubted. An opposite way could hence be an analysis bottom-up, which takes bodily practice as basis. From bodily play and exercise, the study can lead to the levels of health knowledge – here: Nordic *friluftsliv* and Indian *ayurveda* – and education and further to the levels of national and religious ideas. Let us try this way.

Forward Movement versus Static Posture – and the Art of Flying

Basic for both Norwegian ski culture and Indian yoga culture are different forms of bodily movement, the art of gliding on one hand and the art of sitting and breathing on the other. Both phenomena have deep roots in human practice. In winter time, children like to glide on a self-made ice track or down a snow-covered hill and in summer time enjoy the chute on playgrounds. Deeper in evolution, we know this type of play from animals. Crows may use a sort of saucer, gliding down a snow-covered roof and repeating this playful activity again and again – a sort of snowboarding.

And, quite differently, children may play at standing on one leg – how long can I hold it? Or they play with their breathing, as I myself have done as a school child. We inhaled and exhaled deeply and stopped breathing – in order to faint afterwards, being safely caught by one of our comrades. This was a playful way of attaining an altered state of consciousness. Gliding, play with postures, play with breathing – on bases like these, the cultural practices of skiing and of yoga have unfolded.

However, the two cases show deep differences. Gliding on snow creates a movement dynamic, which contrasts with the static postures of yoga. Though Indian people since ancient times have practiced a rich diversity of movements, games, play, and exercises, among these especially martial arts and dancing, it was the positional art of yoga, which became iconic for Indian body culture – *asana*, the way of sitting and *pranayama*, the art of breathing. It was in the lotus position and other forms of sitting that the self-hypnotism, concentration, and control of the senses could develop.

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Norwegian ski contrasts by its temporal-spatial configuration. There is a contrast between bodily moving through time – and bodily being here and now.

The temporal dynamics of gliding and especially of ski jumping can furthermore be understood in connection with the desire of flying. The wish and imagination to fly is deeply rooted in human myths and dreams. In different cultural forms, human beings have developed play and games to conform to this desire. Some of these have been technical, such as the Montgolfier balloons of the late eighteenth century and the airplanes of the early twentieth century. Others were imaginative, such as the flying of shamans and witches. And others again have used the self-bodily potentials of human movement.

On the self-bodily basis, especially certain forms of jumping have been developed. With laughter and pantomimes, Inuit people jump high on a walrus skin, which is held by their fellows. Gymnasts jump on the trampoline. From the geometrically designed art of "cubistic" jumping in Renaissance entertainment, there goes a line to the leaps of circus acrobats. Leap-frog and other jumping exercises are practiced in gymnastics, and high jump, long jump, and pole vault in competitive sport.

Not least, some forms of dance with their wild and ecstatic leaps and jumps have cultivated the human art of flying, as well as some dance-like forms of martial arts have done. Seen in connection with children's play of swing and see-saw, a whole class of play appears which Roger Caillois (1958) labelled as the play of *ilinx* and vertigo, of frenzy and high.

Temporal and Relational Differences

In this context, Norwegian ski and Indian yoga are on the one hand comparable as making people "fly". On the other hand, however, one flies in very different ways – by gliding or by meditative or ecstatic exercise. Norwegian ski cultivates forward movement and speed, which through the patterns of acceleration and progress historically could open up towards modern sport. However, the streamlining of ski by competition and records, by technology and the quantification of results makes up only one part, while the art of gliding as an outdoor activity is enjoyed by the broad masses of the people.

The case of Indian yoga with its pattern of bodily silence and spirituality, meditation and ecstasy, breathing and postures, has kept much more distance from modern sport. It cannot – like Norwegian ski – be subjected to the Olympic principle of *Citius, altius, fortius*, though there nowadays exist championships on line with bodybuilding. The yoga concept of strength, *bala*, is different from the strength, which is measured in sports. Surely, also in sports the concept and practice of *fortius*, "stronger", is not uniform. In high-performance ski jumping, conditioning exercise with strength apparatus is an important ingredient of training. And yet, ski is not foremost a strong-man activity, and it is not the strength of the jumper as such which is measured, as in heavy athletics. In ski jumping, the human body is rather cultivated as a streamlined projectile. The different forms of practice produce different forms of knowledge.

The aspects of temporality also determine the historical place of the practices. While ski, in spite of at least 4000 years of history, is clearly a modern sport, yoga continues much more of the ancient tradition, from Vedic times (2000 to 1000 BC). And yet, it was in modern times that both ski and yoga obtained their current forms and became iconic for national cultures.

Further differences are visible in the social relations of the activities. Ski is mainly a youth activity and has a "young" image. This corresponds to the youth image of modern sport more generally. – Yoga, in contrast, is historically

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rooted particularly in practices of elderly people. In the Indian partition of the life cycle, documented since the Epic period (1000 BC to 200 AD), the third *ashrama* or period of life represents the "old age", the stage of *vanaprastha* or forest dwelling. Between the ages of 50 and 75 years, men were expected to retire from their activities in family, power play, and professional life, and to start a new life in the woods. In their sylvan brotherhoods, the yogic practices were developed as a way of spiritually unfolding one's personality in the environment of nature and seclusion. Though yoga was and is also used for educating young people, *brahmacharya*, it is characterized by its relation to elderly life.

Further differences of social relations appear under the aspect of social class. Ski had its origin in the practical use of common people in the Norwegian countryside and was in the process of nationalization and sportization "raised" from the rural "lower" classes to urban bourgeoisie. But the activity kept its social profile of being "for all". Ski for all, sport for all, Norway for all – here we recognize the "religion" of Scandinavian welfare society. – This equality contrasts the class division of Indian culture. Among the four varna, the brahmins (priests and teachers) and the *kshatriyas* (warriors and rulers) had a different relation to yoga than the *vaishyas* (farmers, artisans, and merchants) and the *shudras* (service people). Itinerant and mendicant yogis and fakirs played a certain – and contradictory – role for the transmission of traditional yoga to modern yoga during the nineteenth century, but yoga was by tradition no "workers sport". – This class differentiation may help to understand the difference of knowledge: Ski has not developed an ancient literature of the type, we know from Vedic yoga.

From Bodily Practice to the Superstructure of Knowledge

The revealed differences would be misunderstood, if they were evaluated as either positive or negative, as more or less useful. They are neither "outdated", nor are they just "up-to-date". Instead, they show how broad the range of human potential is, which constitutes the deep roots of human cultural diversity.

What the cases have in common is the connection, which goes from bodily practice and play to emotions and atmospheres and further to the intellectual superstructure of explicit knowledge: ideas, beliefs, myths, and rationalizations. On the basis of skiing and along with walking, mountaineering, camping, and other activities in the outdoors, Norwegians have developed the concept of outdoor life, the "primitive" or Nordic *friluftsliv*, literally translated as free-air-life. It bridges from concrete bodily practice to deeper feelings and sentiments – and furthermore to an over-all understanding of the human in the world.

Friluftsliv is related to ecosophy, the deep-ecological philosophy, which was strongly inspired by the Norwegian philosopher Arne Naess (1976). According to Naess, each living being is dependent on the existence of other creatures in the complex interrelations of the natural world. This was inspired by Gandhi's philosophy and practice of non-violence (Galtung & Naess, 1968). Furthermore, Naess pointed towards a relation between the wisdom of nature and democratic life. He became prominent in the Green party of Norway and participated in actions of ecologist protest, which he sometimes connected with mountaineering practices. Especially through this ecosophical connection, *friluftsliv* as a human relation to green nature and white nature obtained undertones of political cultural critique, of philosophy of life, and of a religion of nature.

In yoga, there is an ancient connection between bodily practice and sun worship. Since ancient times, there was a connection between the exercises of *asana, pranayama*, facing the rising sun, stretching the hands upward to worship the sun, and bowing down while repeating the *mantras*. Thus, Yoga was connected with nature, too.

Yoga is furthermore connected with *ayurveda*, the traditional Indian medicine, which date back to 5000 BC and Vedic times, the authoritative manuscripts being from the sixth century AD, i.e. from Epic times. Traditional

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ayurveda included surgical techniques and toxicology as well as the treatment of spirit possession, rejuvenation, and aphrodisiacs. Yoga exercises of sitting (*asana*), hand positions (*mudras*) and breathing (*pranayama*) were a part of this *ayurveda* treatment, contributing to self-cultivation.

However, the ancient yoga tradition was transformed in the process of colonization and modernization. The first Western observers of *hatha* yoga practitioners were, in the seventeenth to the nineteenth centuries, puzzled by millions of itinerant yogis and fakirs in the streets of Indian cities, showing "unnatural postures", often dirty, mendicant, and of bad reputation. When, in the second half of the nineteenth century, yoga was "rediscovered" by Western Indologists and Indian intellectuals both distanced themselves from those "black magicians" and "frauds" and from their bodily hatha practice. Yoga should – in the view of both Swami Vivekananda and the Western Theosophists – be understood as science, as a "holistic" and spiritual science competing with modern Western science.

In the years after 1900, however, yoga met with the new Western "physical culture", which now anew inspired an interest in the bodily hatha aspects of yoga. Yogis studied not only Western alternative medicine, which had Hippocratic, Rousseauean ("Back to nature!"), and German nature-curative background, but they came also in contact with YMCA gymnastics, body building, Lingian Swedish and Danish gymnastics. This new holistic healthism lead to a reinvention of yoga as practical bodily naturopathy, which is widespread today and unites the ancient Indian tradition of self-cultivation with the modern culture of strength, physiological benefits, and health – and gave a prominent place to the asanas as fitness exercises (Alter, 2006; Singleton, 2010).

This fusion – connected with the names of Swami Kuvalayananda, Tirumalai Krishnamacharya, and Sri Yogendra – was, however, much more than just a modern "invented tradition", as some critical historians have tended to express it, but a part of cultural change. In Germany, yoga was integrated into an alternative vitalistic subculture of "building the new human being". In America, the new yoga expanded as a means of relaxation and stress reduction; in the 1960s, it received strong impulses from the hippie counterculture and entered later into the commercial fitness industry. And in India, yoga became an ingredient of anti-colonial nationalism – strengthening the youth for national liberation.

Body Play and the Building of Modern Identities

The new nationalist dynamic of yoga was connected with the broader phenomenon of national identity building, which in the process of modernization obtained a new significance in the life of the people. The quest of identity and liberation movements created the cult of certain personalities who represented the respective national peculiarity. For Norway, Fridtjof Nansen became such a "national personality". The zoologist Nansen obtained fame by his polar expedition in 1888, when he crossed the Greenland interior on ski and came closer to the North Pole than any expedition ever before. His book *On ski through Greenland* (1890) had great impact on the growing ski culture in Norway. Nansen was also early to launch the concept of *friluftsliv* (1921), which was near to the spirit of vitalism of that time and had undertones of cultural critique. Politically, Nansen was engaged in the decoupling of Norway from Sweden, which was finally realized in 1905, and for Norwegian national self-determination. For his engagement for the refugees of the First World War, Nansen earned international recognition and was awarded the Nobel Peace Prize in 1922. And he became acknowledged as a "father" of the Norwegian nation.

In India, at the same time, Mahatma Gandhi became the "father of the nation", *Bapu*. He combined a personal ascetic lifestyle with anti-colonial liberation nationalism. And more than this, he became a sage and saint of world-wide fame. Gandhi's life-style was characterized by practical karma yoga – asana and pranayama – which he connected with sitzbath, celibacy, vegetarian diet, fasting, interest in hand-on healing, and the attention to

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hygiene and nature-health matters. He experimented with Western nature cures alongside the Indian tradition (Alter, 2000). But Gandhi used these personal practices and experiences of self-restraint not just for his own individual development, but for developing a new wisdom of public health and for a liberation-nationalist culture of the body. He supported the erection of modern gymnasiums and schools of physical education – such as in Amravati – and in these connections hinted to the mythical Lord Hanuman:

> "May you therefore be like Hanuman of matchless valour born out of your brahmacharya and may this valour be dedicated to the service of the Mother Land" (Alter, 2000: 16).

On this basis of body culture, Gandhi developed revolutionary ideas of national liberation as being more than a shift of power. Nationalism implied grassroots democracy on the village level, self-rule (*swaraj*), self-sufficiency (*swadeshi*), and non-violence (*ahimsa*) as both a practical, political, and spiritual principle. This was transmitted in the form of quotes such as:

- "There is more to life than increasing its speed."
- "Hate the sin, love the sinner."
- "The best way to find yourself is to lose yourself in the service of others."
- "In a gentle way, you can shake the world."
- "A nation's culture resides in the hearts and in the soul of its people."
- "The greatness of a nation and its moral progress can be judged by the way its animals are treated."
- "Be the change you wish to see in the world."

The Ancient and the Modern

Gliding, sitting and breathing, along with other bodily practices such as exercising in rank and file (as in Danish gymnastics), flying (as in the tower jumping of Vanuatu), drumming (as in Inuit drum dance), pulling (as in Scottish Highland Games)… – all this is more than just "body techniques", which are applied for some useful purpose. The bodily practices exceed the limits of work and health care, they are creative play, as a poetical approach to the world.

Most studies in this field have been punctually focused on the one or other game or play. The comparative approach, however, shows larger dimensions of the relations between bodily play, bodily knowledge, cultural identity, and spirituality. Where a certain comparison was tried, it often tended to simplify the phenomena along lines such as "East" versus "West", or what critically is called Orientalism. But there is much more diversity in human existence, and this requires a phenomenology bottom-up.

Another problem in many studies is the relation between ancient traditions and modern identity building. On one hand, people have tended to claim "ancient roots" of certain phenomena – and of their own identity. And on the other hand, critical research often reacted by overstressing the modern "construction" or "invented tradition". However, the comparison of cases shows that there is no reason to overemphasize the contradiction between "tradition" and "modernity". History is always changing, and human practices have always been transformed, in premodern times as well as in modern societies. It was especially modern identity building that reacted against colonialism and other forms of alienation: by focusing on "one's own" ancient roots and traditions and their significance for present life. The "will to roots" is modern.

From bodily play and bodily knowledge, an anthropological way opens towards the understanding of religion. Humans are god-builders by their poetical and ritual practices, by playing sacred celebrations at holy times and holy places, by forming practical-ritual communities. Modern sport science has mostly overlooked the connection

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between bodily practice, bodily knowledge, identity, and religion. The analysis of bodily practice was reduced to the measurement of achievement (in sport) or of other physical parameters. Science reduced the knowledge of the human body to "physical activity", i.e. something derived from physics.

This reductionism can be criticized from out a materialistic phenomenology of knowledge, science, identity, and religion, where the body makes up the material basis of human existence. By its practice, the body tells our story: Who am I, who are we? The idea that bodily practice and interaction bring human sociality into being, was already launched by the young Karl Marx (1845), before he later on narrowed his original understanding of bodily practice to work and production, and focused on the economic field. But gliding on ski, sitting and breathing in yoga, as well as flying in the air, exercising in rank and file, kicking a ball, moving to the rhythm of the drum… all make up a broad spectrum of human bodily potentials, from which sociality and cultural nationalism have been developed. On the basis of bodily unfolding – practice and experience – people have built religions and identities of a collective "we".

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Dynamic Suryanamaskar: Technique and Application in the Context of the Science of Yoga

Krzysztof Stec

> "Yoga has a complete message for humanity.
> It has a message for the human body.
> It has a message for the human mind,
> and it also has a message for the human soul."
> *Swami Kuvalayananda (1933b)*

The millennia-old system of yoga has developed a great variety of procedures and techniques, which at times are quite complicated and hard to master. Many of these techniques are even today made known only through an oral tradition and are taught only to initiates. Even the better known practices often vary greatly from school to school, and there is an obvious need for a unified, systematic description and classification of the variations. One well-known and important technique within the yogic curriculum is *Suryanamaskara* [Suryanamaskar]. It comes to us from time immemorial, although its origins are unknown. There are records of it in yogic manuscripts which describe the form in which we see it practised today. Suryanamaskar is ancient and serves as the cornerstone upon which the science of yoga rests. Through the unique combination of asana, pranayama, and meditation, Suryanamaskar aids the attainment of a powerful mental focus. Without bringing the mind to a state in which it can push the body through the various stages of yoga practice, students cannot be certain either of gaining the full benefit or of avoiding injury.

Vedic Origins

The earliest writings containing references to sun worship are in the *Rig Veda*. They have been dated to the 3rd millennium B.C., though a more precise date is still a matter of dispute. There are numerous references praising the sun for the provision of good health and prosperity. Some of these Vedic hymns were incorporated into *Nitya Vidhi*, the daily routine, obligatory for Hindus, intended to secure the well-being of the individual through the performance of salutations to the sun. This daily ritual was termed Suryanamaskar, literally 'sun salutations'. Physical prostration to the sun while showing complete surrender to God is the main aspect of this practice. The forms of Suryanamaskar practised today vary from region to region and from school to school. Two such popular forms are *Trucha Kapla Namaskarah* and *Aditya Prasna*.

Trucha Kalpa Namaskarah has its origins in the Rig Veda. Each mantra (chanted syllables or words) in the Veda is called a *rucha*. A group of three rucha is called a *trucha*. *Trucha Kalpa Namaskarah* is a method of performing Suryanamaskar using three *ruchas* from the Veda.

Aditya Prasna, on the other hand, uses verses which are taken from the first chapter of the *Yajur Veda*, that is the *Taittiriya Aranyakam*, which is also referred to as the 'Suryanamaskar' chapter. It remains a popular practice in South India. There are 132 *anuvakas* (sayings or sections for reciting) in this chapter and it is the practice to recite each *anuvaka* in turn over a period of time and perform sun salutations with prostrations after each recitation.

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Puranic Origins

Aditya Hridayam is another ancient practice involving Suryanamaskar. It is that procedure of saluting the sun which was taught to Shri Rama by the sage Agastya before Rama's fight with *Ravana*. It is described in the *Yuddha Khanda*, canto 107 of the Ramayana. In total, there are 124 names praising the sun in the whole practice. An example from the 15th verse is, "The resplendent among the splendid. Oh! God, appearing in twelve forms, salutations to you". The names in verses 10 - 13 are given below:

> "Aditya, Savita, Surya, Khaga, Pushan, Gabhastiman, Suvarnasadrisa, Bhanu, Hiranyaretas, Divakara, Haridasva, Sahasrarchish, Saptasapti, Marichiman, Timironmathana, Sambhu, Twashta, Martanda, Ansuman, Hiranyagarbha, Sisira, Tapana, Bhaskara, Ravi, Agnigarbha, Aditiputra, Sankha, Sisiranasana."

Early English publications also make reference to some of the ancient ways of sun salutation. In *A Catalogue raisonnée of oriental manuscripts*, the Rev. William Cooke Taylor noted that a book with *Tricha calpa vidhi* from Aditya *Puranam* was preserved. He describes the *vidhi* as "Modes of rendering homage to Sun, with praise and spells, the object being health or delivery from disease". He further notes the presence of *Arghya Pradana*, *Surya Stotaram, Aditya Dvadasa Namam* – the twelve names of the sun according to the monthly signs of zodiac, *Surya Narayana Cavacham, Saurashtacshari mantram*, and many other rituals as the part of the *vidhi*. He also mentions a shorter version called *Laghu tricha kalpa vidhi*.

Tantric Tradition

Tantric yogis use Suryanamaskar practice along with energizing breathing to absorb solar energy into their bodies. There is a whole branch of tantric science known by the name *Surya Vidya*. An advanced form of such a tantric version of Suryanamaskar involves a direct experience of the unity of the sun that is held to exist both outside and inside our bodies.

Suryanamaskar and Exercise

The practice of Suryanamaskar, as a complete and perfect compound of body movement, breathing and concentration, was and is used in many Indian schools and ashrams. It was considered by the ancients of India to be a form of *kriya* (both body oblation and purification), which would provide an abundance of health, vitality and spiritual upliftment. The fact that some authors call it a *kriya* indicates its strong quality of purification (Malshe, 2005, 2007). The routine to be followed differs greatly in different parts of India with respect to pace of movement, number of repetitions, sequence of asanas, and attitude to the practice (i.e. whether as partly religious ritual or as simply physical exercise). In 'ritual' form, the movements are accomplished very slowly, with devotion and with mantra repetition, and the central pose is the *Ashtanganamaskar*. The 'exercise' version requires a high number of repetitions (more than 200) to be performed in quick succession (at under 20 seconds per round).

Swami Gitananda from Ananda Ashram reported seventeen such distinct Suryanamaskar routines (Gitananda, 1975); other sources mention the number of fifty. Over the years, especially when they were performed as a part of a ritual, these routines were renamed, and now such names as *Chandra-namaskara*, *Guru-namaskara, Hanuman-namaskara*, etc. can be found (*Bhavanani*, 2011; *Gitananda*, 1975; *Raghavendra*, 1977, 1980;). These routines may differ with respect to body movements, but the main idea of the original Suryanamaskar remains intact.

For example, in the introduction to his book *Guru Namaskara*, *Swami Raghavendra* says that "Suryanamaskar is a method of worshipping the Sun, whereas Gurunamaskar is a method of worshipping Shri Maruthi [Guru Hanuman]

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… It is also an ancient method of *sadhana* [means of realisation] as Suryanamaskar" and "our ancient Rishis called it *upasana* or worship and founded an integral system that included those physical exercises also such as *asana* and *pranayama*. The practice of both Surya and Guru Namaskar provides harmonious exercise to the entire body of the *sadhaka* [practitioner]. In addition, this practice provides the spiritual growth also, as it includes a system of worship which is supplementary to devotion, faith and spirituality" (Raghavendra, 1977).

Swami Gitananda in his book on Suryanamaskar discusses five styles: the Simple Suryanamaskar (11 movements) that goes back to the Vedic times; a system as taught by the late Yogiraj M.R. Raja Rao (15 movements); the Rishikesh Series, propagated by the disciples of the late Sri Swami Shivananda and which was first expounded by Shrimant Balasahib Pandit Pratinidhi, BA, the late Raja of Aundh (14 movements); the Three-Part Suryanamaskar (21 movements); and Chandranamaskar (19 movements). He concludes, "The oldest form of worship on this planet would have to be the worship of the core of our natural existence, the sun, the great star" (Bhavanani, 2011; Gitananda, 1975).

After their morning meditations and ablutions, yogis would toss water towards the sunrays, do pranayama, recite mantras, and gesticulate and genuflect to the sun, which they considered to be god. These mantras would contain the *Gayatri Mantra*, which is dedicated to the sun god Savitur:

> Om Bhur Bhuvah Svaha,
> Tat Savitur Varenyam,
> Bhargo Devasya Dhimahi,
> Dhiyo Yo Nah Prachodayat
> *Rig Veda III.62.10*
> Let us meditate upon
> The glorious effulgent light of the Cosmic Sun
> May it illuminate our minds
> And protect our actions

Most of the *asanas* in the procedure have themselves been documented in ancient literature. *Sashtanga dandavat* [lying prostrate on the ground with arms stretched out towards the object of devotion] which is the central asana of Suryanamaskar, was practised in India from ancient times, as a way of showing respect and complete surrender to god (Raghavendra, 1977; Satyananda, 2006; Bhavanani, 2011; Stec, 2012). *Bhujangasana* was described as one of the thirty-two most important asanas in the *Gheranda Samhita* (c.1650 C.E.), which describes the yoga then prevalent in North-East India (Kuvalayananda, 1933a; Digambarji & Gharote, 1978; Jois, 2002; Muktibodhananda, 2006). *Adhomukh Swanasana* was described in the old text on wrestling, the *Mallapurana* (c.1750) (Jois, 2002, 2005). *Sarpasana (Bhujangasana), Gajasana (Adhomukha Swannasana), Uttanasana*, and the series of postures done in tandem, which are similar to Suryanamaskar, are all described in the Sritattvanidhi (https://cittavrttinirodhah.wordpress.com/tag/sritattvanidhi). The latter was written by the order of Krishnaraja Wodeyar III (1799-1868) in an attempt to capture the Hindu knowledge of his time (Pratinidhi & Apa, 1989).

The use of Suryanamaskar for physical exercise is also not modern. In the book *A Short History of Aryan medical science,* published in 1896, Bhagavat Simhaji says, "There are various kinds of physical exercise indoors and outdoors. But some of the Hindoos set aside a portion of their daily worship for making salutations to the Sun by prostrations. This method of adoration affords them so much muscular activity that it takes to some extent the place of physical exercise" (Sinh Jee, 1896).

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It is a still widely held as well as old historical belief that, in the state of Maharashtra, Shivaji Maharaj, sage Samarth Ramdas and the Marathas performed Suryanamaskar as a physical exercise in order to develop strong and able bodies (Singh et al., 2008). Ramdas was known to perform daily 1200 Suryanamaskars. This should not be surprising since *vyayama* (physical exercise) has traditionally been influenced by spirituality. It is considered that many physical practices have an ingrained spiritual value. Indeed, spiritual training has been considered a part of physical training in India since ancient times.

The benefits of a Suryanamaskar practice have been considered to be so wonderful and so manifold that, for example, in the late 1940s, Shrimant Bhavanrao Pant Pratinidhi (1868-1951, Raja of Aundh 1909-1947) made Suryanamaskar a compulsory part of the physical training programme in his kingdom's schools. He helped to popularise Suryanamaskar as a simple physical exercise for the all-around development of the individual (Pratinidhi, 1928, 1938; Pratinidhi & Apa, 1989). Similarly, P.K. Bhattacharia, the director of the Department of Physical Education at Shri Aurobindo Ashram, says in his booklet (2007) that "a complete cycle of Suryanamaskar consists of ten or twelve movements ……through which one gets a good stretch and thorough exercise of the whole body. The body thus becomes strong, supple, agile and healthy. Suryanamaskar is a system of exercise for a common man". In fact, some experts, including ayurvedic physicians, consider Suryanamaskar to be "the crest jewel of exercises". It is so highly regarded that entire books have been written on this single practice (Pratinidhi, 1928, 1938; Shrinivasrao, 1928; Gitananda, 1975; Raghavendra, 1980; Pratinidhi & Apa, 1989; Jois, 2005; Satyananda, 2006; Bhattacharia, 2007; Modak et al., 2010; Bhavanani, 2011; Nimbalkar, 2012; Stec, 2012).

The wide application and versatility of Suryanamaskar make it one of the most useful and complete methods for bringing about health and vigour, while at the same time preparing an adept for the deeper processes of yoga (Jois, 2005). It is based on three elements: rhythm, energy and form. Form is evident in the twelve or so postures that are always performed in the same sequence. Such steady and continuous performance of postures, which are coordinated with the breath, activates the subtle energy called *prana*. This steady and rhythmic flow reflects the rhythm of the universe, which includes the biorhythms of the body. In the past an attempt to encapsulate these rhythms on a large scale was expressed in the system of the twelve phases of the zodiac. The rhythmic superimposition of the form and energy of Suryanamaskar on the psychosomatic organism is held to be a transforming force, since it activates the psyche in a way that is completely different from anything that is possible in a modern sport or game (Satyananda, 2006).

Levels of Suryanamaskar Practice

There are several levels of practice. For example, *ayurvedic* guidelines refer to three methods of practice, each one of which emphasises one of the three *doshas, vata, kapha,* and *pitta* [bodily humours] (Stiles, 2007). Yogic guidelines, however, suggest four levels (*v. inf.*) (Stec, 2012).

A beginner should start learning the sequence slowly, paying a great deal of attention to each posture and its salient features. After assuming each posture, it should be maintained for several breaths before moving on to the next one. During that time, a conscious check should be made through the body and any discrepancies resolved before moving on to the next one. This is the first and introductory level.

The second level starts when all the postures have been memorised, the breathing can be co-ordinated with each posture, and the flow of the practice is smooth and free from any jerky movements. At this level, the practice should gradually develop to a point where major adjustments are no longer needed and only small adjustments may be required.

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The third level starts when all the movements and co-ordinated breathing have become so automatic that all of the attention can be focused on mantras and chakras [psycho-energetic centres]. There are *bija* [seed] *mantras* or special solar *mantras*, which can be repeated silently during the third level practice.
The fourth level of performance requires each round to be performed in approximately 7.5 seconds, resulting in forty rounds being completed in five minutes. According to a newly discovered scripture entitled *Asanayoga-Hathabhasyapaddhati* by *Kapalakurantaka*, this level of practice should be maintained for at least several hundred rounds. More advanced *sadhakas*, however, have been known to increase the number of rounds performed in this way to several thousand (Devnath, 2006).

For those who regarded yogic practices as a means to personal, spiritual or religious development, Suryanamaskar would never be treated as a mere physical exercise, or as something incidental which simply preceded yoga asanas. Before beginning, the practitioner would pray to Surya to bestow the good fortune of having only good thoughts, of hearing and speaking only good words, and of attaining a sound and strong body. The purpose would be both to live a healthy life and to achieve a state of identification with the *Paramatman* [supreme Self]. One of the better-known teachers of the past century, T. Krishnamacharya, used to suggest the following greeting to be repeated inwardly in the heart before a Suryanamaskar practice would start, "I honour the Divinity of my heart with all the warmth and cordiality of my mind" (Jois, 2002). A more formal invocation, which is frequently used to begin a Suryanamaskar practice, is a hymn from the *Upanishads*:

Asatoma sat gamaya
Tamaso ma jyotir gamaya
Mrityorma amritam gamaya
Om, Shanti, Shanti, Shantihi
Brihadaranyaka Upanishad I, iii, 28
O Lord, the essence of Light
Lead me from the unreal to Real
From darkness to light
From death to Immortality
Om, Peace, Peace, Peace

Physical activity is one of the most basic aspects of human life. Its essential value has been emphasised in a variety of ways throughout the ages. It is worth noting, however, that the World Health Organization has also included the component of Spiritual Health in its definition and guidelines for maintaining the overall health of workers (Chuengsatiansup, 2003; Ullman, 1989;). The millennia-old system of Yoga seems to provide a positive and convincing means of meeting this need.

Yoga in its essence is neither a religion nor a cult; it does not contain a system of dogma (Kuvalayananda & Vinekar, 1966; Taimni, 1961). It is, on the contrary, a practical and experiential system based upon human experience of long-standing. In that way it can be considered to be beyond any concept of religion, nationality, or culture, etc. In its secular and universal aspects, it is akin to physical education or to the medical sciences, being based on real experience and on repeated observations by ancient "intuitive scientists" (Romanowski et al., 1973). Indeed, in recent times some yogic techniques have finally found a place in physiology and medical textbooks (Betany-Saltikov & Paz-Lourido, 2012; Gore, 1980;; Khalsa, 2012, 2016; Malshe, 2012).

The recent work of neuroscientists and neuro-cardio scientists, working in collaboration with eminent Buddhist teachers and yogis, has thrown some light on the mechanisms involved in the practice of meditation and on the subject of human consciousness (Lazar et al., 2005: Johnstone et al., 2008). For example, Dr. J. Kabat-Zinn

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(1991) has been responsible for the recognition of the role that can be played by yogic techniques and yogic approaches in the management of pain and stress. Dr. D. Ornish has developed a way of treating coronary blockage through a series of life-style changes in which yoga plays a crucial part. The staff running the yoga part of Dr. Ornish's Program for Reversing Heart Disease have given credit to Suryanamaskar as "the most beneficial yogic practice" for their heart patients (Ornish, 1996).

Recent research has found that in the case of the specialised version of Suryanamaskar, called Dynamic Suryanamaskar, the four stages of which were described above, performance at the advanced level can provide stimulation of the cardiovascular and respiratory systems to an extent similar to or even greater than that obtained during a maximal dynamic ergocycle load (Stec, 2012; Stec, 2014). Indeed, performance has been observed which is unheard of in other forms of physical activity (Stec et al., 2016a). It is clear that, at the very least, Suryanamaskar can be considered an extremely effective means of training to increase physical performance and fitness (Stec et al., 2016b).

Thus the transforming power of Suryanamaskar, and yoga in general, as so pithily expressed by Swami Kuvalayananda all those years ago, is gradually being rediscovered by the modern world.

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Vyāyama-Vigyāna in Ancient India (Science of Exercise in Ancient India)

Suresh Harihar Deshpande

Prologue

The Science and Technology developed in different areas like architecture, Industry, Metallurgy, Agriculture, Textile, Civil-Engineering etc. also included the vital areas of healthy life style and medicine in ancient India. "*Āyurveda*" was the term used for the science of health and medicine. The ancient texts written centuries ago on the subject of "*Āyurveda*" and some of the scriptures in the form of "*Purānas*" deal thoroughly with the science of Medicine and health including the science of exercise or "*Vyāyāma Vigyāna*". Object of studying the science of medicine or "*Āyurveda*", was to know the procedure of maintaining equilibrium of the body elements which contribute to the health of the individual. Health had received great significance in the life, because, it was firmly believed that without health and strength one cannot discharge one's duties in life.[1] The greatest endowment in one's life was one's health.[2]

The science of *Āyurveda* has two important purposes to serve: firstly, the preventive and restorative aspect of health, and the second one, the curative."[3] The first one was for the promotion and preservations of health and strength in the healthy and the second one was for the elimination of the disease in the ailing and afflicted[4].

This paper deals with the first purpose of *Āyurveda*, since it discusses the science of positive health and exercise. This science covers the entire life span. From the pre-natal stage of the child to geriatric stage of life, instructions about maintenance and care of health are found given.

Classified Periods

The medical authorities of the past had classified human life mainly into three periods according the growing age of the individual';[4]

1. *Bāla vaya*- Childhood stage
2. *Madhya vaya* - Middle age
3. *Vridha vaya* - Old age

Further divisions of each stage are given along with description of the special features of each stage: (Table 1.)

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Table 1: Classification of Age groups and their Special features

Sr. No.	**Bāla-vaya (Under 16yr.)**	**Madhyavaya (17 to 70 Yrs)**	**Vridha-vaya (70 Yrs. onwards)**
1	0 to I Yr. (Child fed on milk)	16 to 20 Yrs. (Period of growth)	Period of decay. Ageing effect speedily appears; efficiency decreases with increasing rate.
2	1 to 2 Yrs. (Fed on milk and food)	20 to 30 Yrs. (Period of Youth)	
3	2 to 16 Yrs. (fed only on food)	30 to 40 Yrs. Period of full growth 40 to 70 Yrs. (Period of decline)	

Child Care & Motor Education

During infancy, proper care of the child was expected from the mother and also members of the family. The medical authority[5] suggests that the child should be placed in clean and purified chamber. Ample sleep in day time and sun-bath in the early morning in the open air was recommended for child's health and physical growth.[6] Instructions were given to the parents and guardians for not to handle the children roughly, not to scold them too severely, and not to rouse them from sleep. The child should be fondled and given coloured toys and other apparatus of play for its amusement.[7] *Charaka* has clearly stated that the child should be given such toys as are well coloured, productive of sound, delightful, light not having pointed ends, incapable of being swallowed, not destructive of life and incapable of exciting fear; but capable of stimulating sense activities. *Charaka* recommends such toys and playthings for infants and children to amuse themselves through games during the Pre-school period.[8]

Bāla-Kridanakāni

The art of bringing up, handling and playing with children called *Bāla Kridanakāni* has been mentioned by Vātsyāyana[9] in his list of 64 *Kalas*, which were taught to the students during their education; instruction to children through physical activities (play way method)? is recommended in the *Garuda-Purana*.[10] A careful study of ancient Text reveals that a number of sport activities were practiced by the children. With the nature and type of these activities, they could be classified into following categories:

1. Imitation or Mimetic play.
2. Competitive Sports or minor games.
3. Aquatic Sports.
4. Combative Activities.
5. Dancing & rhythmic type.
6. Other activities.

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It is revealed from the authentic information that the children were looked after carefully and their needs of play were recognized and met with. Abundance of terracotta figurines, animals, ram-carts, balls, and wheel-toys, musical instruments discovered at the excavations show that small children used to play with these toys'.[10]

The age between 8 and 16 years of the child was considered as the most adaptive, flexible and soft. It was during this age that the children were given training of habit formation and character development. The discipline of '*Brahmacharya*" (Celibacy), the daily performance of '*brahmakarma* (religions rites), the simple way of living, and the teachings of *Yogic Yama* and *Niyamas*, etc. made permanent impact on the behavioral pattern of the child. Right from the time of admission to educational institution upto his completion of education, the student had to undergo a course of moral, mental, physical and intellectual training. By leading a life of austerity and strict discipline throughout his studentship, the virtues like self-respect, self-reliance and self-restraint were gradually developed in him at appropriate age. Development of physical fitness, cultivation of healthy habits, moral and ethical character and academic studies were simultaneously attended to during the ageof studentship at his '*Guru-Āshrama*" (hermitage of the teacher).

Swasthavritta – (Health Education)

Āyurveda critically discusses the ways and means to promote and preserve positive health of the individual. For the prevention of diseases and preservation of sound health, detailed instructions are issued by the medical authority-Accordingly one should resort to daily brushing of teeth, scrapping of the tongue, washing of the face, care of the mouth, hair, nails and beard, oiling of the body and limbs, bathing, correct items of food, proper timings of meals, regulation of the hours of rest, sleep and exercise, right clothing, etc.[11] For the preservation of mental health and prevention of mental disorders attention was also directed to the avoidance of certain harmful factors such as rash thinking, uncontrolled passions, excessive display of emotions, sexual over-indulgence, bad company and steeling.[12] Encouragement was given to the cultivation of contacts with the wise, noble, knowledgeable & virtuous people &resort to moral exercise.[13]

Vyāyama Vigyāna (Science of Exercise)

Vyāyāma is a *Sanskrit* word for physical exercise. It is defined as the activity of the body, which is meant to increase its firmness and strength.[14]

Bala:
The strength called *'Bala'* is considered in *Āyurveda* as a basis of health and physical development. According to *Āyurvedic* concept *"Bala"* is the finest essence-the superfine luster-called '*Oja*', which is created in the body in the process of transformation of food into tissues, blood, muscle, fat, bone marrow and semen.[15] By the acquisition of strength each internal organ, the heart, brain, lungs, liver, Kidneys, the external senses, the eyes, ears, faculty of speech and the touch of the skin, and the limbs, and muscles of the chest, back, abdomen, thighs, pelvic region etc. are able to perform their functions without any fault or disorder.[16]

Thus from physiological point of view, the strength or the finest essence called '*Oja*' has a very essential purpose of keeping the various organs and parts of the body efficient and fit and to cause the uniform and balanced development of the functioning organs. Bala is considered "*Karma Sadhana Shakti*" the power to perform work, which is to be deduced from *vyayama.*[17]
From the physio-therapeutic angle '*Bala*' has been classified into three main types, viz. '*Sahaja', 'Kālaja'* and *Yuktikrit*'.[18]

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'Sahajabala' is considered *prākrita* or natural or genetic and it exists frombirth.[19] It is said to increase with the growth of Dhatus and does not depend upon any other cause. It comprehends both sharira and *sattva* (Mind).[20]

Kālajabala is stated to be influenced by seasonal traits and the age of the person.[21] *Yuktikritbala* - This type of *sharibala* refers to the induction of body's resistance against disease by resorting to appropriate nutrition, physical exercise, rest etc. in keeping with seasonal needs.[22]

That is why *Āyurveda* had gone deep into the science of *Vyāyāma* (Exercise) and *Āhāra* (diet). It had laid down the rules regarding practice of *Vyāyāma* based on the principles of anatomy, physiology, dietetics, climatology and anthropology. Moreover, *Āyurveda* had also visualized the *Vyāyāma* as a therapeutic agent and used it in treating several diseases. In view of its specific physio-pathological effects *Vyāyāma* has been contra-indicated in some diseases. Observations are also made about the diseases that are caused due to lack of exercise; similarly ill effects of over exercise are noted and the diseases caused due to over-exercise had been studied in detail.

Biological Principles of Vyāyāma

Āyurveda has laid down some pertinent biological principles for the practice of exercise. They are grouped under specific categories.

I. Exercise and Age

1. Exercise should be practiced according to one's own age, strength and physique.[23]
2. It should be taken in right measure.[24]
3. Children below sixteen and old people (after 70 years) should not indulge in vigorous exercise.[25]

II. Exercise, Body-Strength and Season

It has been observed that the natural strength of the body is greatly influenced by the seasons. It shows fluctuations according to seasonal cycle- ***Bala*** is stated to be dissipated and at its lowest ebb in the ***Ādānakāla***, corresponding to ***Shishir***, **Vasant** and ***Grishma ritus***, which represent the hotter seasons of the year. On the other hand, bala is stated to be conserved and at its highest optimum level in the ***Visargakāla*** corresponding to ***Varshā***, ***Sharada*** and ***Hemant*** which represent the cooler seasons of the year. (Graph 1)

Graph 1: Seasonal variations and period of exercise

(Presuming that the bodily strength shows ascending trend in Winter and that it descends during the Summer, as per Āyurvedic principle, it was observed in one of the research studies that sport performances recorded by

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*the athletes of tropical counties like India, during competitions of Summer season (March to August) show lesser than those recorded by the same athletes during competitions held in Winter seasons (September to February.)**

This fluctuation in bodily strength as per change in season should be taken into consideration and correct estimation of one's own strength be made before resorting to ***Vyāyāma***.[2]

III. Exercise, Strength and Body-Type

5. Of the three types of bodily frames, viz (i) the ***Sthula*** or Obese (ii) The ***Krisha*** or thin (iii) the ***Madhya*** or middle type, some individuals with thin frame process more strength whereas those of obese are found weak in strength. Therefore, **Bala** or strength does not depend upon fatty or thin frame; but it is to be estimated by observing the solid structure of the body and measuring the capacity for doing ***Vyāyāma***.[27]
6. The capacity for doing *Vyāyāma* is to be judged by the capacity for work.[28]
7. According to the proportion of the ***Doshik*** elements, the body is classified into four main types (i) ***Vāta*** (ii) ***Pitta*** (iii) ***Kapha*** and (iv) ***Sama*** or balanced type. The persons with equipoised position (Homeostasis?) of three ***doshas*** enjoy sound health and remain free from diseases. Those with preponderance of any one dosha are susceptible to vitiation because of faulty diet and regimen. From the movement of conception, some men are equi-balanced as regards the three *doshas*, some have a preponderance of ***Vāta***, some of Pitta and some of Kapha. For proper functioning of the three doshas the four factors Viz. diet, age, constitution and season are considered to be of vital importance. The ***Āyurvedic*** authorities have laid down certain dietary principles and prescribed regimens for creating congenial surrounding for the effective functioning of the three ***doshas***. In view of the characteristics of each type of the body and considering the dietetic and seasonal influences on these, it was suggested to regulate the degree of ***Vyāyāma*** so as to suit the requirement of each of the body types.[29]
8. Individual differences in physique or body types be taken into consideration before prescribing ***Vyāyāma***.[30]

IV. Exercise, Diet and Season

9. Food and season of the year, so also, the physical nature of the country are the factors to be considered before one begins to take ***Vyāyāma*** as otherwise it might cause some disease.[31]
10. Diet consisting of emollient food (i.e. food rich in protein)should be given in all seasons especially during winter and the spring, to the person who takes regular physical exercise.[32]
11. Such persons consuming heavy and fatty diet (abounding in protein matter) should resort to physical exercise during winter and spring to the half of one's own strength and during other seasons should reduce the rate of physical exercise.[33]
12. One should not exert physically so long as the food would remain undigested in his stomach.[34]

*Tarzen, K.A. *'Effect of Seasonal Variation on Performance Level of Athletes' Nagpur University Nagpur* Ph.D. Thesis. 1986.

13. Exercise should not be taken during Summer (***Grishma ritu***).[35]
14. One should avoid exercise in river water during rainy season.[36]
15. During winter (i.e. ***Hemant & Shishir***) one should resort to wrestling with the wrestlers and then massage his body.'[37]
16. During spring (***Vasant ritu***) one should resort to morning and evening walk.[38]
17. On the advent of spring one should resort to ***Vyāyāma***.[39]

V. Suitable time

18. The day time is divided into four parts. One should take physical exercise during the first part of the day; after the lapse of the first part one should not perform physical exercise.[40]

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VI. Measure of Exercise

19. Exercise should be taken inrightmeasure[41] and shouldbeincreased gradually.[42]
20. During winter and spring one should resort to physical exercise to the half of one's own strength, and during other seasons one should reduce the rate of physical exercise.[43] Exercise should be taken to the half of one's own capacity.[44]

    Appearance of perspiration on the nose, axilla, forehead, and the joints of the hands and the legs and dryness of the month are the symptoms which indicate that one has taken the exercise to the half extent of his capacity, i.e. called ***Balārdha***.[45] That amount of exercise which makes the Prana Vayu come out through the month, is known as the ***Balārdha exercise***.[46]

VII. Full Measure of Exercise

The appearance of perspiration, increased respiration, lightness of limbs and feeling of oppression in the cardiac region indicate the full measure of Physical exercise.[47]

2I. One should not indulge in an excess of physical exercise, even if he is accustomed to such practice.[48]
22. One should avoid all violent activities and should carefully preserve his vitality.[49]
23. Exercise should be discontinued before the onset of fatigue.[50]
24. One should neither strain limbs and organs to an extreme limit nor should be too soft to then.[51]

VIII. Exercise & Breathing

25. While performing feats of strength, such as running with top speed or bending and fixing the string of the heavy bow, pulling the string of the heavy bow, etc. one should restrain his breath.[52]
26. Deep breathing after exercise should not be restrained.[53]
27. One should not bathe in cold water soon after having done exercise and come out of his gymnasium.[54]
28. After exercise body should be thoroughly massaged without causing any discomfort.[55]

Benefits of Exercise

Vyāyāma gives complexion to the body, strength and shape to the limbs and organs of the body distinctly, keen appetite or stimulation of ***agni*** of different systems of the body; lightness of the body leading towards agility, dexterity and quickness of movement; it wards off laziness and gives the power of enduring hard work, mental strain, thirst, cold or heat" old age does not encroach upon such a man easily who practices physical exercise- The power of enduring fatigue and weariness, disease free state and pleasant appearance are some of the benefits attributed to the practice of exercise.[56]

***Vyāyāma* - A Pathogenic Factor**

Vyāyāma, according to ***Āyurveda***, is no doubt an effective means to build up physical fitness when practiced in right measure observing the principles of diet, season, physique and age; but violation of these principles and exceeding the measure of exercise may lead to severe pathological conditions. In such cases, ***vyāyāma*** becomes one of the major pathogenic factors threatening health of the individual. ***Ati-vyāyāma*** (over exercise) or ***A-Vyāyāma*** (lack of exercise) both of these conditions lead to bring imbalance of ***doshas*** thereby causing pathogenic conditions. several examples are cited of the feats of over exercise like-to lift heavy loads, to fight with stronger man, to swim across great rivers, to run along keeping pace with swift horses, to perform violent feats of high or long jumping, to dance much and at a rapid pace.57

***Vyāyāma* - A Therapeutic Agent**[58]

The ***Ayurvedic*** physicians seemed to have found out the therapeutic values of ***vyāyāma***. While suggesting line of treatment for many of the disorders, Vyāyāma was one of the measures and used as mode of treatment.

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According to *Āyurveda*, treatment is of two types, namely i) *Samtarpana* or *Brihana* (ii) ***Apatarpana*** or ***Langhana***. That which aids to strengthen the body is ***Brihana***; whereas the one which aims at making the body light or thin is called ***Langhana***. It is further divided into two types : 1) ***Shodhana*** and ii) ***Shamana***. Aim of ***shodhana*** is to root out the intrinsic ***dosha*** of the body, whereas ***shamana*** aims at bringing the deranged *dosha* to its normal stage. It is of seven different types in which one is ***Vyāyāma***. Indications and contra-indications of ***Vyāyāma*** are also fully described by the medical authorities.

Epilogue

Thus, the medical texts of ancient India have discussed the scienceof exercise. It is not possible to give full account of ***Vyāyāma Vigyāna*** of ancient India in such a short paper; however, a documentation of topics, that are discussed in *Āyurveda* and that have direct bearing on ***Vyāy ā ma-Vigyāna*** would not be out of place here to estimate its spread and the significance it had gained in the medical science of the past.

I Topics Regarding Physical Exercise

1. Definition & Concept of Exercise.
2. Physical & Physiological effects of exercise.
3. Principles of the Practice of Exercise.
4. Over exercise & its ill effects.
5. Under exercise & its ill-effects.
6. Diet & Exercise.
7. Therapeutic use of Exercise.
8. Indications/Contra Indications of Exercise.
9. Physical Exercise & Massage.
10. Types of heavy exercise.

II Topics regarding Physical Development and Strength

1. Types of body build or somato-types
2. Body strength & its types
3. Climate & body strength
4. Physiology of strength
5. Physical Anthropometry.
6. Ideals of body development.

III. Topics Regarding Health

1. Definition & Concept of Health.
2. Symptoms of Healthy Individual.
3. Principles of Health & Hygiene.
4. Rules of good Conduct & behavior.
5. Health & Brahmachrya (Celibacy)
6. Health & Physical Fitness.
7. Health& Longevity,
8. Health & Diet.
9. Climate & Health.
10. Body types & Health.
11. Mental health & its Maintenance.

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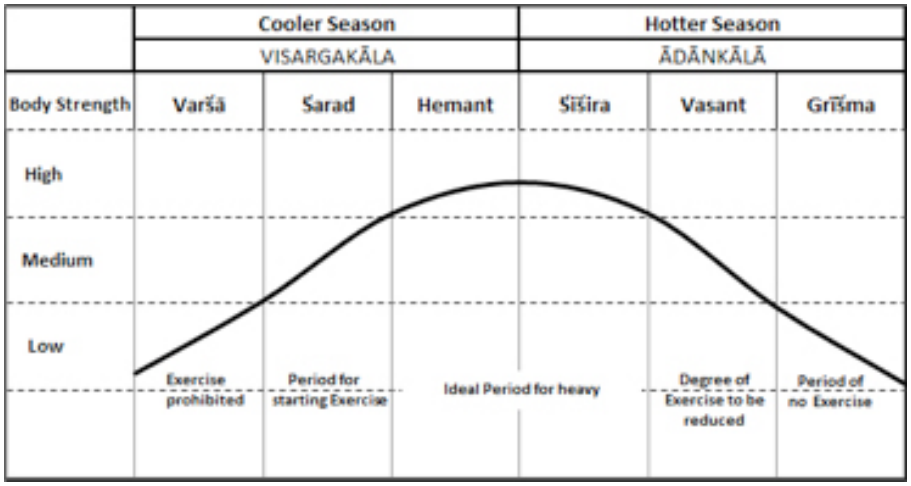
This long list of the topics clearly indicates that there is enough evidence of the existence of the science-of exercise in ancient India and that further investigations are needed to find out its relevance in the present context by the medical authorities as well as Sports Medicine experts of today.



Graph 2: Period of exercise according to English calendar

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Application of Ayurvedic Principles for Talent Identification in Sports – A Hypothetical Review

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Abstract

Recent studies have suggested the importance of evaluation personality traits and assessment of physical ability and skill level in talent detection, also called talent identification, in early phases of sports development. These tests are believed to be useful particularly for predicting the future ability/success of young prospects. The main purpose of this article is to draw attention to a new approach, based on Ayurvedic Principles, in this process. In general, children are left to select a sport stream based on their desire rather than the one that is suitable to their body potentials. The present review represents analysis and interpretations of ancient Ayurvedic Sanskrit Texts to identify the sport talents at a young age in order to fully utilize the individual's potential. It includes discussion on underlying Ayurvedic Principles that can help in identifying talent as well as predicting and ensuring future success. Furthermore, an attempt has been made to develop standard methods of talent selection on the basis of existing scientific principles of Ayurveda. The review also includes a section on how we can use this knowledge in practice by discussing development of easy to use practical methods to help sports trainers and sports counselors in talent selection and in ensuring future success. It is also been explained that with the help of Ayurvedic methods of investigation we can identify the sports talent among children's and students very much earlier, without any costly equipments. Sports participation and success is likely to be increased many fold if children are guided properly to select a right sport as per their future adult physique and sports potentials.

Introduction

Talent identification in sports has been used with varying degrees of success. It is not been entirely reliable in predicting the future success of juniors due to factors such as varying growth patterns and its dependence on other varying factors as technique, tactics and psychological factors. Therefore, being an elite athlete in a particular sport is a result of a multiple factors that can be unpredictable and difficult to test for. Additionally, factors such as motivation, determination, resilience, positive attitude, and resistance to injury, ability to learn and perform skills can all be important. Availability of a scientific testing methodology can, therefore, provide an overview of person‘s basic strengths and weaknesses. This in turn can help us to match individuals to a particular sport type thus making the best use of their strengths.

Using scientific criteria can reduce the time required to reach high performance by identifying and promoting individuals who are likely to succeed in a particular sport-type at an early age. It helps to reduce a high volume of work, energy, and talent on the part of the coach. The effectiveness is also enhanced by training primarily those athletes with superior abilities. It increases competitiveness and the number of athletes aiming at and reaching high performance levels as a result, there may be a stronger and more competitive national team capable of better international performance.

Historical Perspective

The importance of early talent detection to ensure success in sports has been recognized for decades. The determination of an individual's athletic performance has historically been an important and challenging field of study not only for sport sciences but also for sport organizations, sponsors as well as authorities. Following examples represent some of the evidences that highlight the importance and necessity of early talent identification.

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1. It has been historically believed that potential talent often is overlooked due to poor methods of identification. Keeping this in mind various sport authorities in 1960s, started adopting some sort of talent identification methods (Bompa, 1994). As a result, it is believed that 80% Bulgarian medalists in the 1976 Olympic Games were successful due to use of thorough talent identification process. Similar results were demonstrated by Romanian and East German athletes in the 1976 and 1980 Olympics; successes.
2. In early talent identification methods, (Regnier, 1987) young individuals were screened on objective tests of ability (height, running speed, endurance, coordination, ability in game situations) based on the premise that early detection and innate performance are the main determinant for elite performance. However, it soon became clear that the success is also dependent on other variables such as environmental factors. It also became evident that there is need to distinguish between determinants of performance and determinants of potential/skill acquisition (Regnier, 1993).
3. (Montpetit, 1982) suggested that, initially, profiles of elite athletes based upon conventional physiological testing procedures are determined. The stability of these variables then should be verified through longitudinal testing and only then these variables should be applied to younger populations. Along similar lines (Bompa, 1985) developed a conceptual model of talent detection. His model emphasizes three types of performance determinants- (1) motor capacities (2) physiological capacities, and (3) morphological attributes. Detection is based on the direct comparison of physiological and morphological profiles from younger performers to those of elite athletes.
4. The age at which an individual specializes in elite-sport programs varies depending upon the sport. Early specialization is very common in the Soviet Union. The earliest specialization occurs in women‘s gymnastics, swimming and figure skating, with selection occurring at ages 4 to 5 years of age. Individuals involved in specific sports at this age are unlikely to adapt to the changes in required fundamental movement skills if transition between the sports is required (Jefferies, 1986).
5. More recently, genetic factors have been associated with athletic performance. While more than 20 genetic variants have been associated with elite athletic status, two gene variants, ACE I/D and ACTN3 R577X, have received considerable attention. They have been consistently associated with endurance (ACE I/I) and power-related (ACTN3 R/R) performance (Guth & Roth, 2013). Given this importance, a genetic test for ACTN3 was developed in only a year after (Yang et al., 2003) first described its potential connection to sport performance. Genetic testing is becoming more popular as a means of talent identification.

Talent Identification: A Multidimensional Approach

WHO in 1971 has defined physical fitness simply as “The ability to perform muscular work satisfactorily” The Presidents Council On Physical Fitness And Sports in the United States has offered one of the more widely used definitions describing physical fitness as the “Ability to carry out daily tasks with vigor and alertness, without undue fatigue and with ample energy to enjoy leisure time pursuits and to meet unforeseen emergencies” (page 20). While level of physical fitness is a useful initial measure, it does not necessarily reflect talent identification and future success. A primary challenge when attempting to identify talent and predict an individual’s athletic performance is its multi-factorial nature. Each sport has its own unique physical characteristics and these requirements differ dramatically between sports. The physical and mental characteristics required for success in gymnastics are not the same for that in tennis. Therefore, any talent identification process must consider the multidimensional nature of performance components for the sport of interest. Recognizing this need nearly all methods for early talent identification and better performance in sports follow a multidimensional approach that takes into consideration-

1. Physiological capacities such as strength and power.
2. Motor capacities such as perceptual abilities, motor skills and endurance,
3. Morphological attributes- physical and mental fitness,
4. Genetic Characteristics- gene variants associated with physical performance and elite status.

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All of these measures require skilled medical and sport personals for identification of these qualities in young individuals with lot of expenses, experience, infrastructure and time. While talent identification programs assist coaches, athletes, and authorities in identifying the talent, they have not been entirely successful in predicting future skill development and sport performance (Cote & Lidor et al., 2009). These facts stress the need for additional methods for talent identification, determination of type of sport that is most suitable and prediction of future elite sports performance. In this scenario, adapting an approach based on principles of Ayurveda can be an effective additional strategy that can enhance the success of existing talent identification methods and programs. In the ensuing paragraphs, a detailed discussion is presented on 1) How Ayurveda defines different personality traits, 2) How these principles can be applied to the process of talent identification and 3) How these Ayurveda based attributes can be exploited to identify talent and match an individual with a particular sport to ensure future performance.

Ayurvedic Approach

The literal meaning of Ayurveda is the Science of life. The fundamental and applied principles of Ayurveda have been organized and practiced from thousands of years in Asian subcontinent. One distinguishing aspect of Ayurveda is its well-defined conceptual framework that advocates an integrated approach towards health and quality of life. This is unlike other systems that are based mainly on treatment of disease (Ravishankar & Shukla, 2007). Ayurveda represents a versatile health system that encompasses principles underlying not only physical but also psychological, social, philosophical and spiritual well being of an individual. Given that elite sports performance is dependent on physical, psychological, technical and tactical competencies (Buekers, 2014), it appears that Ayurveda is well-suited to offer an additional and better approach for talent identification process. Until now Ayurvedic principles have been applied for promotion of healthy life and treatment of diseases, it is need of time that we consider how these Ayurvedic principles can be applied to identify specific traits to ensure successful talent identification and elite sport performance.

Identification of Sports Characteristic Traits Based on Ayurvedic Principles

This universal and holistic approach in Ayurveda emphasizes the importance of positive health and performance that is similar to the WHO's concept of health (Mishra, 2004). The American college of sports medicine has defined health related physical fitness as, "A state characterized by an ability to perform daily activities with vigor and a demonstration of traits and capacities that are associated with low risk of physical inactivity. In Ayurveda, the concept of physiological capacities consisting of strength, and power is denoted as Bala. Sushruta at su. su. 1/37,2/3,5/6 (Council & Research, n.d.) mentioned that for good quality of life you must have good strength i.e. Bala (vital force) which in turn indicates the ability or capacity of a person to perform all types of physical activity without any fatigue. Bala basically comprises of two aspects- Karmasamarthya and Karmasadhana Shakti. While Karmasamarthya as the vital power, capacity, energy or force of life indicates innate physical abilities, Karmasadhana Shakti indicates the ability to perform and excel at physical activities that forms the basis of health and physical development. Together, Karmasamarthya and Karmasadhanashakti, help the uniform and balanced development of the functional organs such as muscles or the capacity to work or think helps an individual to achieve strength. While the need of Bala for survival and defense against diseases is well understood, the similar Ayurvedic principles may be applied for identifying gifted athletes at young age and developing athletic capabilities in achieving elite sport performance.

From a physiotherapeutic angle, Charakasamhita at ch.su.11/33 (Council & Research, n.d.) classified Bala into three types i.e. Sahaj, Kalaj and Yuktikrut Bala.

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Sahaja Bala, The Bala which has been acquired from birth is known as Sahaja Bala. As per Ayurveda, these people are genetically strong and healthy by body and mind. They exhibit more strength, endurance, vital force and power. These persons have a well-built body, natural resistance to disease and more stable, strong mind. In modern and sports terms, these individuals have genetic characteristics that make them excel at sports.
Kalaj Bala, indicates variations in Bala due to age or season. As per Ayurveda, Bala of individuals is strong in early morning, spring season, and in younger age than in evening, summer and old age.
Yuktikrit Bala, indicates strategies to improve Bala. As per Ayurveda, Bala can be developed by resorting to appropriate nutritional diet, Vyayam or physical exercise and physical trainings. It also refers to the induction of resistance against the disease.

Pertinent Ayurvedic Concepts in Literature

Dalhana commenting on Sushrutasamhita Chi.11/11(Council & Research, n.d) highlighted personality traits that are required for achieving elite athletic status. Gajarohana (elephant riding or racing), Ashvarohana (horse racing), Tula(weight lifting), Rathacharya (chariout racing) Padacahrya (running), Dhanurakarshana (archery), Niyuddha (boxing), Parikramana (walking), Astra Shastra (sword fight) were the some of the types of sports practiced at that time as elaborated in Dhanurveda,. Thus, Dalhana explained the basis of physical strength, stamina and vigor that were required to excel at these sports.

Physical exercise is stated to contribute to well-formed, broad and rotund limbs, lightness of the body, agility and dexterity in the performance of work, healthy appetite and slimming due to the reduction of the body fat. Since the function of Mansadhatu in the form of Kandaras (tendons), is to cover the body the effect of Sthiropachitamansata bestows well-formed, broad and rotund limbs. The utility of Kandaras in the contraction and relaxation to effect the voluntary movements of the body in relation to physical exercise Kapha in the Mamsadhatu is so fashioned as to impart natural stability and capacity of strenuous work involved in locomotion, manual labor etc.

Karmasadhanashakti is dependent on well grown musculature (Sthiropachitamansa) and enables the performance of work under conditions of stress. Dalhana explains Sarvacheshtasas the functions of body, speech and mind. Additionally, he has stated that Karmasadhandshakti is deduced by physical exercise and interprets karma as the function of voluntary musculature. According to Chakrapani at Charakasamhita Vi. 8/16, Mansa (muscles) pertains to the performance of observable activities which again indicates the voluntary musculature of the body and capacity of the body to work. Fitness testing is primarily used to determine an athlete‘s strengths and weaknesses, so as to design the most appropriate athletic training program. Likewise, these Ayurvedic concepts indicate the individual’s capacity to excel at the athletic training programs. Chakrapani also introduced the concept of Apratighata to denote power that counteracts and overcomes such forces as gravitation. The term Bharaharanadishakti indicates the forces which counteract the weight etc. In modern terms, this is indicative of individual characteristics that are required for sports such as weight-lifting etc.

Assessment of Bala

For assessment of bala in an individual, Charaksamhita at Vi. 8/94 (Council & Research, n.d.) employ 10-point assessment system. A person is evaluated on the basis of following factors 1) Prakriti (constitution), 2) Sarata (excellence of tissues and organs), 3) Samhanan (built) 4) Praman (Girth), 5) Satmya (dietary habits) 6) Satva (mental abilities) 7) Aharshakti (dietary abilities), 8) Vyaayam Shakti (physical abilities), 9) Vaya (Age), 10) Kala (seasonal influence). All these factors are indicative of physical fitness as well as vital power, immunity and overall health status of the individuals. Among these factors prakriti, And sarata are indicative of physical fitness and performance in sports. Details of assessment criteria for these attributes are as follows.

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Prakriti or Constitution

Every individual has unique constitution. Ayurvedic scholars have postulated a classification of human beings based on the characteristics manifested due to the predominance of one or other somatic humor. These differences are stated to be natural to the human beings and are termed as Prakrti. Sushrutasamhita sha. 4/78, (Council & Research, n.d.), highlighted that prakriti of an individual never changes and has its origin in the material elements of the body. Recent research (Asthana, 2016) has also confirmed that Prakriti represents the genetic characteristics of the person. Ayurveda has classified Prakriti based on predominance of any one of basic humors of body (Vata, Pitta or Kapha) and three Gunas of mind (Satwa, Raja or Tama). As such there are 7 different prakriti types and status of Bala is believed to be strongest in Kaphaprakriti and poor in Vataprakriti. In the following table, Prakritiwise characteristics of the individuals are summarized, as per Sushruta sha. 4. (Council & Research, n.d)

Table 1 (Subramanyam, 2000)

Attributes	**Vataprakriti**	**Pitta prakriti**	**KaphaPrakriti**
Body	Greyish or dusky white complexion, small/ under weight, Marked with prominent veins, Tendons/musculature and calf muscles, Tall and weak, Extremities are rough and fissured, Rough, grayish and split hairs, nails and teeth, Rough face.	Delicate, fair complexion, Ugly and loosely shaped, Copper colored nails, eyes, palate, tongue, lips, soles and palms, Warm body and face, Loose and flabby joints and flesh, Excessive sweating and fetid odor all over the body, Many moles, spots and pimples, Early scanty soft and tawny hair.	Complexion ranging from fair to dark resembling the colors of lotus or gold, saffron, a blade of steel, stem of Sara grass, blue lotus, sword, green soap nut or ox bile, Handsome, with gloss smooth, plumb, rounded, firm, well knit, stable and strong body, With pleasing appearance and delicateness, Strong extremities, Broad chest, and forehead. Hair:-Curly, black and plenty. Pattern of Physical activity-Slow in action or in initiation, Lack of intensity of hunger, Thirst, Perspiration and Heat.
Eyes	Unstable, Dull, Grayish or Slightly reddish, Round, Lusterless, Not completely closed even while asleep, Unstable.	Unready, With meager lashes, Desirous of cold touch but immediately turn reddish due to anger liquor or sunlight.	White with slight red tinge in the corners, Bright, Large, and clear with Black lashes.

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Attributes	Vataprakriti	Pitta prakriti	KaphaPrakriti
Joints	Light, Inconsistent but movement is fast, Makes noise while moving.		Firm and compact with firm well developed musculature, Non slippery and stable gait with the entire sole of the feet pressing against the earth- but not flat feet.
Voice	Long drawn, Dry, Low, Broken, Obstructed and hoarse But very talkative.		Deep and resembling the rumbling of a rain cloud, A roar of a lion or the sound of a Mridanga.
Physique	Unstable eyebrows, Jaws, Lips, Tongue, Head, Shoulders and Legs, Less Pitta, strength, span of life, Procreation and sleep, Eat less.		
Diet	Uses habitually sweet, pungent and hot food, Quantity is less,	Excessive thirst and hunger, Consumes excessive quantity of food and drink, Likes sweet, astringent bitter and cold foods, Dislikes hot atmosphere and food, Strong digestive power.	Eats less and drinks less, Likes sweat, bitter, astringent, hot and dry foods.

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Attributes	Vataprakriti	Pitta prakriti	KaphaPrakriti
Psychological behavior	Intolerant of cold. Unsteady mind, Dishonest, Jealous, thievish, ungrateful, inconsistent behavior, short tempered, timid, atheist, unsteady in friendship, talkative but incoherent, always wakeful, grinds teeth in sleep and dreams of scaling the skies in sleep, tendency towards destruction, killing etc., interested in music, humor, gambling and hunting, quickly affected by fear, likes and dislikes quick in the onset of morbid manifestation often afflicted with cold, shivering and stiffness, not liked by women, unable to conquer passions.	Valiant, possessed of self respect, intelligent, scholar, good orator, clean habits, hood conduct, vigorous, envious, irritable temper but cools down very soon, good retentive memory, inability to face difficult situations, irresistible in battle, never over-powered, with fear nor bends before a powerful antagonist, Moderate, knowledge, dreams in sleep of such things as meteors, lightning, flashes, fire and red flowers.	Forbearing, self controlled, grateful, unselfish, humble, faithful, thoughtful, careful, not jealous, never greedy, never speaks harshly, no talkative, sleepy, sedate nature, slow in getting irritated, true to his word, excellent knowledge, good memory, not hasty to form any opinion, exhibit Satvaguna, fast in enmity, unflinching in friendship, obedient to preceptors, respectful to superiors, capable of sustaining pain, makes large gifts, slow in morbid manifestations suffers no vicissitudes of fortune possesses good strength, knowledge, vitality gentleness and long life. Dreams of large lakes decked with myriads of full-blown lotuses swans and geese.

As per Ayurveda, *Kapha prakriti* person possesses good strength, wealth, knowledge, vitality gentleness and long life. Among three humors, *kapha prakriti* is the best. Many Ayurvedic scholars believe that the *kapha humour* or *dosha* represents the actual power or strength of the individual. For example, *Kapha* is *balakrit* i.e. it confers strength to the body in two ways. 1. *Karmasadhanashakti* and 2. *Ojas* (essence of all *dhatus* or body tissues). While *Karmasadhanshakti* denotes physical abilities, Ojas represent *Vyadhikshamatvashakti* i.e. the power to gain strength, resist and overcome the forces or factors which bring about disease and decay. In the present context, *Kaphaprakriti*, therefore, represents individuals not only with natural abilities at sports but also ability to train well and excel in sports.

Sarata

In *Charakasamhita* Vi. 8 *Sarata* examination is the specially recommended for assessment of *Bala*. It means essence, excellence or purity of body tissues. Dhatusarata is the base of physical strength where as *Satvasarata* is the base of mental strength. There are 8 types of *sarata* based on individual characteristics. Among them, following 3 types indicate maximum *Bala* or Strength (Council & Research, n.d.).

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Mansasarata – In *Charakasamhita* Vi. 8/96-105 it is stated that, Because of stable firm & pleasant *Mansadhatu* these persons have good Bala and having long life. Individuals having the excellence of the *Mansadhatu* or muscle tissue are characterized by stability, heaviness, beautiful appearance and plumpness of temples, forehead, nape, cheeks, jaws, neck, shoulder, abdomen, axillae, chest and joints of upper and lower limbs are well covered with muscular tissues. Such Individuals are endowed with forgiveness, patience, no greediness, wealth, knowledge, happiness, simplicity, health, strength and longevity (Council & Research, n.d.).

Asthisarata – As per *Charakasamhita* Ch.vi 8/107, Due to firm and stable quality of *Asthidhatu* these persons have more active have strong *Bala* and able to bear any type of work or activity. Individuals having the excellence of *Asthi* or boney tissue are characterized by robust heels, ankles, knees, fore-arms, collar-bones, chin, head, joints, bones, nails and teeth. Such individuals are very enthusiastic and active, and are endowed with strong and firm bodies as well as longevity. Such individual shows good tolerance for excessive workout or physical activities comparatively for long period (Council & Research, n.d.).

Majjasarata – According to *Charakasamhita* Vi. 8/108 individuals having the excellence of *Majja* or marrow are characterized by softness of organs, strength, unctuous complexion and voice and robust, long and rounded joints, such individuals are endowed with longevity, strength, learning, wealth, knowledge, progeny and honor. Such individuals show better *stamina* and strength (Council & Research, n.d.).

Additonal Criteria to Assess Bala

Vyayamshakti – According to *Chakrapani* on *Charakasamhita* Su.7/31 *Vyayamshakti parikshan* is a good criterion to assess *Bala*. How long one can do the specific exercise like step up and down, skipping, Harvard step, walking etc. From performing this type of exercise you can decide the strength or capacity of a person. While modern talent identification methods use the same methods to identify the individuals with superior abilities to excel at sports, the concept of *Vyayamshakti* indicates that these methods were already described in ancient *Ayurvedic texts* (Council & Research, n.d.).

***Praman* (Physic of Body)** – It is the Symmetrical development of body. *Charakasamhita* Sha. 8/51 & *Sushrut Samhita* Sha.5 both have described the ideal of body development during ancient period. The units of measurement was ones own finger breadth i.e. Swangulipraman. Thus, all parts of the body have specific measurement. *Acharya Charaka* stated the importance of having 84 *Angulipraman*. This measurement of the body parts in the *Swanguli* unit indicates strong *Bala* and long life (Council & Research, n.d.).

***Satva* (Mental Status)** – It is considered on the basis of three *Mahagunas* which are *Satva*, *Raja* and *Tama* and a person who possess more of *Satvaguna* characteristic are called *Satvik* person and having good *Bala*. According to *Ayurvedic principles*, condition of mind is equally important to assess *Bala* because if a person is physically strong, has good height and weight but a poor *Satva*, then he may not able to adapt to pain or stress of advanced physical or psychological training that is required for elite status in certain sports.

Taken together, all these factors that make up *Bala* are indicative of physical and psychological fitness as well as vital power, immunity of the individuals. After assessment all these aspects, an individual is categorized into one of three types. 1) *Pravara* (maximum) – person having good strength and *stamina*. 2) *Madhyam* (medium) – average strength and stamina, 3) *Avara* or *Hina* (poor) – person having poor stamina and strength. This may help us to identify individuals that are likely to succeed in a particular sport type and provides an additional mean for success of existing talent identification methods.

Practical Considerations

We have earlier discussed the *Ayurvedic* principles as they apply for sport performance and also discussed different personality traits based these principles that can help to match an individual to particular sport type. Given that the characteristic *Bala* of an individual based on our analysis of *Prakriti* and *Sarata* stays the same for

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the life of an individual, application of these *Ayurvedic principles* could aid the early talent detection and future elite performance. Having considered these aspects, we now discuss how to actually identify and evaluate these characteristics for an individual.

Fig. 1 Showing actual method of pulse taking (Lad, Quanci, & Humphreys, 1996)

***NadiPariksha* (pulse reading or examination)** – is a tool for identification of *Prakriti* of individuals. Pulse reading needs persistent, prolonged practice. To identify *Prakriti*, as shown in the figure, press the right or left radial artery with three fingers (index, middle and ring) strong enough to cut off the radial pulse. Release slightly till the pulsation returns. Then feel the pulse of blood flow when released. If it is felt at index finger first, it is an indication of *Vataprakriti*. Feeling of pulse at middle finger indicates of *Pittaprakriti* and at ring finger indicates *Kaphaprakriti*. While it helps to identify *Prakriti* of an individual, it is highly subjective and therefore accurate pulse reading needs persistent, prolonged practice (Lad, Quanci, & Humphreys, 1996). It should be done by experienced *Ayurvedic* doctors. *Alternatively*, one can use few software programs or optical sensor based tools developed for objective assessment of *Pakriti* can also be used for this purpose.

Software for Prakriti Evaluation – While Android application (Health & Fitness, 2014) is useful to analyze *Prakriti* of an individual, it is always better to involve *Ayurvedic* physician to analyze *Prakriti* and *Sara* of individuals to reduce errors.

Characteristics and Recommendations According to Prakriti

Table 2

Prakriti	**Vata**		
Sara	**Mansa**	**Asthi**	**Majja**
Physical and psychological attributes.	Good in drift and quick action, low stamina, Low strength, Tall and thin body, Cannot perform muscle stretching, Rough and dry skin, hairs, Poor flexibility, Can not tolerate stress, Poor patience.	Good strength, Low stamina, Tall and thin, Good power, Strong ligaments.	Good memory, Good motor and communication skills, Tall and thin.
Sports where they may perform well	Long jump, High jump and Speed run.	Short put and Throwing events.	Foot Ball, Major Games

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Table 3

Prakriti	**Vata**		
Sara	**Mansa**	**Asthi**	**Majja**
Physical and psychological attributes.	Intelligent, Good strength Moderate stamina, Power And Patience.	Intelligent, Good strength and stamina, Strong, More power, Can perform excessive workout, Good tolerance to physical activities.	Good memory, Intelligent, Good motor skills, Good in learning.
Sports where they may perform well	Kabbadi, kho-kho, Indian Games	Wrestling, Combating	Rhythmic activities

Table 4

Prakriti	**Vata**		
Sara	**Mansa**	**Asthi**	**Majja**
Physical and psychological attributes.	Excellence of strength, Stamina, Vigor, Patience, Masculine body.	Strong body, Good vitality, Gentle, Good in strength, Stamina, Power, Tolerate excessive workout, Can perform for long time.	Good in communication skills and motor skills, Power, Vigor, Learning, Progeny, and Stamina.
Sports where they may perform well	Decathlon	Wrestling, Swimming	Group games

Ayurvedic principles also stress that it is fallacious to consider an individual to be strong or weak either from his emaciated body or from the large or small size of his body. Some people having a small sized and emaciated body can be strong in certain aspects. They are like ants that have a small body and look emaciated but can carry too heavy a load. Thus one should examine the individual with reference to the excellence of his body tissues as described in *Ayurveda* to ensure success in sports.

Conclusions and Future Directions

Despite various levels of success, current methods for talent identification and predicting sport performance are not with out limitations. There is an immense pressure on sports organizations, sponsors and authorities to identify young athletes to be elite sports competitors. Various physiological, anthropometrical and psychological tests on young athletes have been developed to identify and train future champions (Anshel & Lidor, 2009). Though significant progress in our understanding of sports physiology and psychology has been made, we still do not precisely know what it takes to make a champion. Therefore every effort aimed at improving our understanding on this phenomenon is of great importance. Under this scenario, this review emphasizes the need to apply *Ayurvedic* principles in the process. The importance of *Ayurveda* for physical and mental well-being is well understood and established, its importance for sport performance, on the other hand, has not been explored till date. This review article represents first attempt to identify utility of fundamental *Ayurvedic* principles in talent identification in sports and predicting/ensuring the future performance. It should be noted that its currently in the hypothesis stage. We have included the relevant *Ayurvedic* principles, explained their basis and provided the basic initial framework for identifying talent and matching the sport type. It is expected that future studies will test, investigate and refine this hypothesis with results from clinical/human, real world settings.

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Clarification about queries by experts

1. As there are no special guidelines in APA style of Bibliography for ancient Sanskrit texts on Ayurveda where every verse is indicated by special no, so with the permission of Editor Hon. Deshpande sir above style of citation where exact location (Sthana or group of chapters) of verse is given by particular abbreviation followed by chapter no./ verse no. is used. This is commonly used by all standard research journals published on Ayurveda.
2. Abbrevations used for citation of particular section of Sanskrit texts
3. Su. - sutrasthana
4. Sha. -sharirsthana
5. Vi. - vimansthana
6. Chi. - chikitsasthana
7. All italic words indicate special Ayurvedic terms taken as it is from Ayurvedic Sanskrit texts for better understanding.
8. Bibliographic and Typographic corrections are made accordingly as per remarks by experts.
9. As there are many translations of ancient Sanskrit texts Charakasamhita and Sushrutasamhita by various publishers and authors is available in the market shows textual errors and changes in verse numbers so for avoiding confusion; standard, corrected, edited, and official versions of these texts are published by Central Council of Research in Ayurvedic Sciences, Govt. of India in the form of E-book Cds. These E-books are used for reference for convenience of international readers which are also available online and is used while citation in the above paper.

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Exercise in Health and Disease: Brief Review of Ancient Indian Ayurveda Perspective

Madhuri Hemant Wagh

Abstract

Modern technological amenities have certainly reduced the need for physical labor for a vast section of population. The resultant decline in the level of the physical activity of the masses is probably the principal reason behind the rise of the so called lifestyle diseases like Metabolic Syndrome, Diabetes, Hypertension, Ischemic Heart Disease etc. Ayurveda, the ancient Indian Medical & Healthcare Science, the subsidiary Veda of AtharvaVeda, representing the wisdom of over 5000 years, provides numerous valuable insights into the role of exercise in the human health & disease. These insights could be grouped on the basis of authorship or nature of thematic conceptualization, which this brief review elucidates balancing these two approaches. It gives us not only the definition of exercise, but also very valuable information about the benefits of properly performed exercise, the quantum of exercise to be done, the criteria for identifying the appropriate levels of exercise, conditions in which the exercise is prohibited, relationship between the time of day, seasons of year & exercise and the complex relationship between the exercise & human diseases. Ayurved declares as its motto "the Protection & Promotion of the Health of the Healthy and Amelioration of the Diseases of the Sick", embracing thus both the preventive & curative dimensions of treatment and goes on to define emphatically the cardinal characteristics of health as "the Balance of the Dhatu(s), Agni(s), Dosha(s), MalaKriya(s) and the presence of a pleasurably calm, tranquil, contented frame of mind"; thus antedating the WHO definition of Health by 2500 years.

Introduction

Before the advent & spread of the modern means of transportation, communication & machine tools for production, the men & women alike were perforce required to work using physical energy. This expenditure of bodily energy, although more out of necessity than liking, probably kept them in better health. Today we often hear a clamour that the life-style diseases like metabolic syndrome, diabetes, hypertension, ischemic heart disease, many attributed to obesity, due likely to the reduced expenditure of bodily energy because of greater amenities, are fast emerging as the first amongst the adult diseases. Ayurveda, the ancient Indian medical & healthcare science, represents ancient Indian wisdom from over 5000 years. It contains many important insights pertaining to the role of exercise in the human health & diseases.

Ayurveda - The Ancient Indian Medical & Healthcare Science

Ayurveda, the subsidiary Veda of Atharva-Veda, is one of the finest jewels bequeathed to mankind by the sages of ancient India. Ayurveda literally means 'science of life'; life is the period for which the conjunction of the body and the soul exists, and, the science which understands, studies and protects it (this conjunction) is Ayurveda (Bhavprakash, Purva-Khanda: 1.4).1 Ayurveda represents experiential collective cumulative wisdom of the sages, scholars, physicians who belonged to quite a remote time in the prehistory of India.

Charaka, the Indian sage from pre-historical period who is credited to have written the first authoritative text of Ayurveda that survived for more than 3000 years, defined Ayurved, saying, "The corpus of knowledge which informs what is beneficial & harmful, invigorative & distressful, ethical and unethical to life is called Ayurveda"(Charaka-Samhita, Sutra-Sthana: 1.41 & 30.23)2 . 'Bhavprakash Nighantu' written in 15th century by Bhav-mishra, an

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important authority from medieval period, clarified further by including "ways of diagnosis and amelioration of diseases inclusive of their causes"(Bhavprakash, Purva Khanda, 1.3)3 in this definition. Charaka considered 'the promotion, protection of the health of the healthy and the amelioration, cure of the diseases of the sick,' as the purpose for which Ayurved exists (Charaka Samhita, Sutra-Sthana, 1.41).4 Ayurved thus embraces and integrates both the preventive as well as curative dimensions of treatment.

Sushruta was first to introduce reconstructive surgery and wrote a text known as Sushruta-Samhita, the oldest known surgical text which also contains details of what today is recognized as plastic surgical methods especially rhinoplasty.

Vaagbhata wrote AshtaanngHrudayaSamhita, translated subsequently in many languages, which details eight sections of Ayurveda viz. internal medicine, surgery, gynaecology and paediatrics, rejuvenation therapy, aphrodisiac therapy, toxicology, and psychiatry or spiritual healing, and ear, nose, throat & eye diseases. He also wrote Ashtang-Sangraha. Charaka-Samhita, Sushruta-Samhita and Ashtang-Hrudaya together constitute the Greater Trinity of Ayurveda. There are many important authors, apart from these, from historical antiquity of India, although not mentioned here for the sake of brevity. Ayurved contains many valuable and varied insights into ancient Indian conceptualizations about the importance of exercise in human health and disease, from an essentially medical perspective. To say briefly it gives us not only the definition of exercise, but also very valuable information about the benefits of properly performed exercise, the quantum of exercise to be done, the criteria for identifying the appropriate levels of exercise, conditions in which the exercise is prohibited, relationship between age, sex, physiological state, the seasons of year & exercise and the complex relationship between the exercise & human diseases. Some of those insights are summarized and reviewed below. These insights could be grouped on the basis of authorship or the nature of thematic conceptualization. Following elucidation tries to balance these two approaches.

1. **Definition of exercise:** "Ashtanga-Hrudaya" defines exercise as "the willfully performed controlled physical bodily activity which induces a feeling of tiredness in the body, (Ashtanga-Hrudaya, Sutra-sthana: 2.3,4)"5 & elaborates its numerous benefits. Activities like walking, running, jumping, bending body, swimming, horse riding, wrestling, have been mentioned in Ayurveda as exercise activities. Modern definition of exercise as a physical activity that is planned, structured and repetitive, for the purpose of conditioning any part of the body is surprisingly similar. And so are the uses enunciated by modern science namely to improve health, maintain fitness & as a means of physical rehabilitation.
2. **Benefits of exercise:** Exercise has been recommended routinely by numerous ancient authorities in India. Charaka,(Charaka-Samhita, Sutra-Sthana: 7.31,30) 6 emphatically says that exercise increases, in the body, lightness, work capacity, resistance to varied stresses, digestive, assimilative capacities and the balances the Tri-Dosha(s). Charaka emphasizes the nature of activity is pleasing to the mind of exercising person and is for strengthening the body. Sushruta especially mentions that exercise imparts alertness, retentive memory & keen intelligence(Sushruta-Samhita, 24.42 to 50)7 . Ashtang-Hrudaya states that exercise makes body light, swift, increases efficiency of body for work, increases digestive capacities, helps strengthen the organs of body & makes them distinct. It reduces excess fat. (Ashtanga-Hrudaya, Sutra-Sthana: 2.10)8 Bhavaprakash emphasizes benefits of exercise saying, "Exercise induced feeling of lightness, swiftness in the body & increases capacity for bodily hard work. By virtue of exercise, every organ in the body is invigorated & it helps each organ to be distinct from each other. It increases the digestive prowess & ameliorates the increased Dosha(s) (BhavPrakash, Purva-Khanda: 5. 57,58)"9 . It further says that those who have made their organs in the body strong and distinct, thereby making their bodies shapely, by regular exercise, do not suffer from diseases; they are able to digest food more completely & quickly even though the food may be heavy, hard, hot & incompletely ripened. Their bodies do not slacken easily. They are very late in getting affected by Vardhakya i.e. the old age. It emphasizes that there is no better remedy than exercise to reduce obesity.

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3. **Extent of Exercise:** Both Bhavprakash & Ashtang-Hrudaya recommend that the exercise be done up to the half of the bodily strength & elucidate the indicators of such a half strength exercise. Bhavprakash says, "When the Pranavayu (the breath of life), which ordinarily resides in the heart, travels to mouth, breathing becomes laboured, mouth felt drying up; when the perspiration starts beading up on the forehead, nose, armpits & the folds of the joints, be thus understood that the half strength exercise stage has been reached. (BhavPrakash, Purva-Khanda: 5-62)"10 Ashtang-Hrudaya recommends that the active exercising be ceased when sweating appears onto the forehead and armpits. (Ashtanga-Hrudaya, Sutra-Sthana: 2.11)11
4. **Abhyanga (oil massage) & Exercise:** Ashtanga-Hrudaya recommends Abhyanga that is oil massaging before commencement of exercise, as exercise enables the oil to enter the body completely and exert its beneficial effects. It also recommends post-exercise Abhyanga.(Ashtanga-Hrudaya, Sutra-Sthana: 2.12)12 Bhavprakash clearly recommends post-exercise Abhyanga, which should be gentle, slow & pleasurable medicated oil massaging of the entire body and bath thereafter.(BhavPrakash, Purva-Khanda: 5.73, 74)13
5. **Prohibition of Exercise:** Ayurveda texts contain unequivocal instructions as to who/when should not exercise. Ashtang-Hrudaya instructs that those having Ajeerna (indigestion), Vata-Vyadhi, PittaVyaadhi, should not exercise.(Ashtanga-Hrudaya, Sutra-Sthana: 2.6).14 Children under 16 years need not exercise as their level of natural, spontaneous activity is high & their body organs immature. (Ashtanga-Hrudaya, Sutra-Sthana: 2.7)15 Elderly above seventy years of age should not exercise as the Vata Dosha is dominant in this age-group & their organs might lack the strength & are already tired. (Ashtanga-Hrudaya, Sutra-Sthana: 2.8)16 Bhavprakash says that those suffering from injuries, cough, asthma, tuberculosis, fever, RaktaPitta & Shosha i.e. emaciation and those who are weak should not exercise (BhavPrakash, Purva-Khanda: 5.64).17 It also prohibits exercise immediately after the meals but advises slow walk (Shat-Pawali i.e. one hundred steps) post-meal to assist digestion (BhavPrakash, Purva-Khanda: 5.197, 226).18
6. **Adverse Effects of Excessive Exercise:** Apart from the benefits, the ancient Ayurveda texts instruct clearly about the adverse effects of excessive or inappropriate exercise. Charaka says that Excessive Jumping, Swimming, Walking in a very improper manner causes 'Vata Vyadhi (Charak-Samhita, Vata-Vyadhi Chikitsa Adhyaya: 28.15).19 Repeated minor trauma to joints causes joint diseases, says Modern Medicine. So avoid Extreme, Improper Exercise & Resort to Controlled Proper Exercise to Prevent & Treat VataVyadhi. Ashtang-Hrudaya warns that excessive exercise beyond bodily strength is harmful (Ashtanga-Hrudaya, Sutra-Sthana: 2.5).20 Bhavprakash clearly informs that excessive, improper exercise may give rise to cough, asthma, vomiting, fever, extreme exhaustion, tuberculosis, heart disease, Pra-tamak-Shvas and Rakta-Pitta (BhavPrakash, Purva-Khanda: 5.65).21
7. **Exercise & Diet:** Ayurveda Perspective- Dietary factors have been considered by Ayurveda in relation with diseases. In the context of exercise, diet and health/disease, Bhavprakash emphasizes that those regularly eating Snigdha (i.e. fat rich) food must exercise as it is very beneficial (BhavPrakash, Purva-Khanda: 5. 60).22 It announces lack of exercise and regular excessive consumption of 'Kapha' causing foods as causative of Prameha i.e. diabetes; and further advises persons suffering from Prameha to avoid/minimize consumption of alcohol, oils, Ghee, jaggery, sugarcane juice/products, milk, curd etc. The food articles it recommends to these persons are mostly devoid of lipids (BhavPrakash, Uttar-Khanda: 38:1,41,42).23 Likewise it emphasizes that lack of exercise along with eating sweet tasting, oily and Kapha causing foods causes MedoRoga that is obesity. It advises along with exercise, avoidance of precisely those foods and recommends fat-free, protein rich, carbohydrate containing foods (BhavPrakash, Uttar-Khanda: 39.1,14,22).24 Diet, nutrition constitutes a very vast area of discourse in Ayurveda the details of which are beyond the scope of a brief article and could be the subject of treatises and detailed research.
8. **Age and Exercise:** Ayurveda recommends exercise mostly for adults, both male & female. It advises elderly above 70 years to avoid exercise as Vata is dominant in this group & their organs are tired (Ashtanga-Hrudaya, Sutra-Sthana: 2.7).15 Exercise in Childhood: Exercise is generally considered as not necessary in childhood due probably to high levels of natural, spontaneous physical activity of the children & immaturity of their bodily

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organs. (Ashtanga-Hrudaya, Sutra-Sthana: 2.6).14 Kashyap-Samhita also known as Vruddha-Jeevakeey-Tantra clearly mentions in Phakka-Chikitsa Adhyaya, special exercises for paralyzed children. The Phakka-Ratha, PaangulGaadaa, the three wheeled support vehicle has specially been mentioned as recommended for exercise to enable the affected child to learn walk properly. (Kashyap-Samhita, Chikitsa-Sthana, Phakka-Chikitsa).25

9. **Exercise in Pregnancy:** Kashyap-Samhita says that the pregnant women desirous of healthy progeny should move around cautiously, carefully; avoiding excessive forward or backward bending, lifting heavy objects suddenly or for prolonged periods, prolonged excessive laughter and getting hurt with injuries (Kashyap-Samhita, Garbhini-Chikitsa:1.66).26 This avoids miscarriages & ensures health of both the mother & the fetus.
10. **Time of Day, Seasons of Year & Exercise:** The ancient texts of Ayurveda very lucidly inform us about the extent of exercise in relation to time of day & the seasons of year. Of course, these instructions may be construed as related to the seasons as experienced in India and may only cautiously be applied globally because of the climatic differences. Morning is best period for exercise, as, after night's rest everyone is fresh, without much stress, after emptying bowels exercise is easier & surroundings are pleasant. If morning exercise is impossible, do it in evening, avoid exercise in noon & night. BhavPrakash clearly emphasizes the highly beneficial effects of exercise during the period of winter & spring (Shishir & Vasant Rutu(s)); however, it also recommends half strength exercises during other periods (BhavPrakash, Purva-Khanda: 5.61, 65).27 Thus it recommends full strength exercise during winter and spring. Ashtang-Hrudaya & Ashtang-Sangraha informs that the period of Shishir & Hemant Rutu(s) is Visarga Kala, the period of accumulation of the Kapha and is very appropriate for exercise. It mentions the period of Greeshma, Varsha & Sharad Rutu(s) as Adana Kala, the period of Sanchaya (accumulation) & Prakopa (agitation) of Vata and hence recommends that during this period the intensity & duration of exercise be reduced. It also elaborates that the human bodily power is greatest in winter months (Sheeta Rutu(s) of Hemant (from mid-November to mid-January) & Shishir (from mid-January to mid-March), is least in the summer & rainy seasons (Greeshma (mid-May to mid-July) & Varsha (mid-July to mid-September)) Rutu(s)), and is medium in the Sharad (mid-September to mid-November) & Vasant (mid-March to mid-May) Rutu(s); therefore the exercise in summer & rainy season be less than the half strength exercise of the winter (Ashtanga-Hrudaya, Sutra-Sthana: 2.9; Ashtanga-Sangraha, Sutra-Sthana: 3.19,27,48).28
11. **Exercise and Disease States:** Ayurveda, of the ancient time of India,, was not content with elaboration of the importance of exercise for only the healthy people. It has also detailed the relationship between exercise and many human ailments. Presented here are some of those features, under three broad categories.

A) Ameliorative Role of Exercise in Diseases

Broadly speaking, the diseases in which exercise plays an ameliorative, therapeutic role, as enunciated by Ayurved include Madhumeha i.e. diabetes, UruStambha i.e. sciatica, Madya-Atyadi Vyadhi (alcohol dependence), Vata-Vyadhi, VaataRaktaVyaadhi (gout), AmlaPitta (acidity), Arsha (piles), MedoRoga to mention some common ailments.

1. **Diabetes** was known to ancient Indians as Madhumeha, Ikshu-meha, Prameha. Ashtang-Hrudaya. Ayurveda very clearly states that sitting without physical activity, daydreaming, eating non-vegetarian food in excess, along with derivatives of sugar causes diabetes or Prameha (Ashtanga-Hrudaya, PramehPeedikaAdhikar: 38.1).29 Charaka-Samhita emphasizes, along with other remedies, different types of exercises (Vyayama-Yoger-Vividhai) by virtue of which, the diabetes is rapidly destroyed or just does not occur (Charaka-Samhitaa, Prameha Chikitsa: 36.50).30 Ashtang-Hrudaya recommends vigorous exercises (Gaadham Vyayamo) as beneficial in diabetes (Ashtanga-Hridaya Chikitsa-Sthana Prameha-Chikitsa: 13.33,36,37).31 It recommends activities such as well digging, walking about 100 Yojana(s) i.e. 800 miles, walking with forest-feeding cattle; although it does not explicitly state the time frame for such rigorous activities. However if the 800 miles are divided by 365 days of a year, it is 2.2miles or 3.53 kilometers per day, not very far from modern recommendations. Modern medicine also advises exercise as the first line of treatment for mild diabetes. Exercising muscles take up glucose from

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blood rapidly and consume that glucose quickly. Thus exercise reduces blood sugar levels.

2. **MedoRoga or Metabolic Syndrome:** Although the modern medicine has only recently recognized Metabolic Syndrome characterized by central obesity, hypertriglyceridemia, low HDL cholesterol, hyperglycemia, and hypertension; Ayurveda has, hundreds of years ago, described MedoRoga as characterized by pouting belly, breathing difficulties, thirstiness, snoring, exercise intolerance, foul smelling sweatiness, reduced sexual capacities & general weakness. It also states clearly that when extreme, it can cause umpteen diseases including diabetes, and death. Ashtang-Hrudaya describes this condition and emphatically asserts that this condition arises as a result of 'Avyayam' that is lack of exercise and the excess Meda (fat) resides in the belly. It recommends fasting & laborious work along with proper diet as effective in destroying MedoRoga (Ashtanga-Hrudaya, Sthoulyadhikar: 39.1,2,3,4,8).32
3. **Uru-Stambha or Sciatica:** Exercises such as jumping repeatedly over a sand base, swimming in the direction opposite to that of a clean & cold stream of water have been recommended (Charaka-Samhita, VaataVyaadhiChikitsaa: 28.58,60).33 Modern medicine often suggests weight reduction for amelioration of sciatica. Although not explicitly stated by treatises of Ayurveda, the types and intensity of exercises recommended for sciatica in Ayurveda, are of such nature as to reduce the weight.
4. **Alcohol Dependence:** Ashtang-Hrudaya recommends, along with recollection of pleasurable events, stories, memories and listening to pleasurable music, the regular exercise as very helpful in regaining the composure of mind so as to enable the sufferer to achieve sustained abstinence from alcohol (Ashtanga-Hridaya; Chikitsa-Sthan, MadaAtyaadi-Chikitsa: 18.113,114,115).34
5. **Vata-Vyadhi:** It includes eighty conditions as per Charaka. Of these many are considered to be the result of improperly performed exercise. Some are thought to result from excessive & inappropriate kind of physical activity. Therefore Ayurveda recommends proper and controlled exercise as helpful in many types of Vata-Vyadhi(s), for both preventive and ameliorative purposes (Charaka-Samhitaa, Vata-Vyadhi: 28.16 , 58).35 Modern medicine opines that repetitive minor trauma does cause joint diseases.
6. **Vata-Rakta Vyadhi (Gout):** Charaka reported it as occurring due, amongst other reasons, to lack of physical activity, (Charaka-Samhita Chikitsa-Sthana; 29.8)36 (AchakramanaSheelanam Kupyatey VaataShonitam) & hence proper physical activity in form of regulated exercises is regarded as helpful in its amelioration as well as prevention.
7. **Amla-Pitta Vyadhi (Acidity):** Kashyapa-Samhita considers proper exercise as helpful, along with other remedies, (Kashyap-Samhita, AmlaPitta-Chikitsa: 16.42)37 in the amelioration of AmlaPitta.
8. **Arsha (Piles):** Lack of exercise has been considered by Charaka, along with other reasons such as sedentary work & constipation, as important in the causation of Arsha (Piles). (Charaka-Samhita, Chikitsa-Sthana: 14.9)38 (Kashyap-Samhita: 16.42)39 (Charaka-Samhita, Chikitsa-Sthana: 14.10).40 Although not explicitly stated, the implication here is that the regular physical exercise may be helpful in amelioration & prevention of Arsha/piles.

B) Improper Exercise Implicated in Causation of Disease

Ayurveda considers that some diseases can be caused by Exercise in Excess.

1. **Heart Disease:** "VyaayaamaTeekhshnaati", that is severe exercise, is told to be the cause of heart disease by Charaka; the other causes told being Anxiety, Fear, Stress, excessive Virechana and Basti, and improper treatment of other disease(s) (Charaka-Samhita TriVarmeeyaAdhyaaya, Chikitsa-Sthana: 36.77)41 .
2. **Gulma (Tumor):** The Vata-Prakruti person who ingests Vata-Pradhana food, indulges in excessive swimming, running, dancing, singing; drinks cold water, roams in cold environs likely develops Gulma-Vyadhi (tumor), (Kashyap-Samhita, GulmaChiktsa Adhyaya: 5)42 ; thus informs Kashyap-Samhita.
3. **Cough & Asthma:** Ayurveda mentions that severe exercise may cause cough &/or asthma. Modern medicine recognizes the category of exercise induced asthma.

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4. **Vata-Vyadhi:** is considered to be the result of improperly performed exercise. Some are thought to result from excessive & inappropriate kind of physical activity (Charaka-Samhita, VaataVyaadhiChikitsaa: 28.58,60).33 Therefore Ayurveda recommends proper and controlled exercise as helpful in many types of Vata-Vyadhi(s), for both preventive and ameliorative purposes.
5. **Raj-Yakshma:** Ckaraka said that excessive exercise weakens tissues reducing strength & resistance thus favouring development of tuberculosis (Charaka-Samhita, Chikitsa-Sthana: 8.14).43 Improper exercise or excessive physical activity is thus considered by Ayurved as harmful & causative of diseases.

C) Complete Avoidance of Exercise

This has been recommended by Ayurveda in the management of all types of fevers. Ashtang-Hrudaya advises unequivocally that unnecessary physical activity be avoided during fever & convalescence from fever (Ashtanga-Hridaya, Chikitsa-Sthana: 1.174)44 until most of the strength has been regained. BhavPrakash clearly tells to avoid physical exercise during fever and warns that fever might increase & cause unconsciousness, even death, if this advice is ignored (Bhav-Prakash, Uttar-Khanda: 8.17,18,19).45 It permits limited activities, such as change of bodily posture (Parshva-Parivartan) during acute states of fever. Charaka also considers heart disease, cough, asthma, vomiting, Rakta-Pitta-Vyadhi, ShoshaVyaadhi, as caused or aggravated by exercise and hence avoidance of exercise has been recommended for acute sufferers of these conditions (Charaka-Samhita, Sutra-Sthana: 7.33).46

Conclusion

Ayurveda, the ancient Indian medical & healthcare science, thus gave serious consideration to role of exercise in human health & disease. Ayurved declared as its motto “The protection & Promotion of Health of the Healthy & Amelioration of the Diseases of the Sick.” (Charaka-Samhita, Sutra-Sthana: 30.26).47 It recognizes that proper exercise induces a pleasurable state of mind (Sushruta-Samhita, 24.42 to 50), (Sushruta-Samhita, Sutra-Sthana: 15.41), (Charaka-Samhita, Sutra-Sthana: 9.4)7,48,49 in addition to bodily benefits. Both Sushruta and Charaka emphasized “the balance of the Dhatu(s) (the tissues), Agni(s) (the digestive and assimilative capacities), Dosha(s), MalaKriya(s) (the excretory functions) and the presence of the pleasurably calm, tranquil, contented frame of mind” as the cardinal characteristics of a healthy person,(Sushruta-Samhita, Sutra-Sthana: 15.41; Charaka-Samhita, Sutra-Sthana: 9.4),48,49 thus anticipating the WHO definition of health by more than 2500 years. The ‘Prasannata of Mana’, the pleasurable tranquility of Mind is thus considered by Ayurveda, as obtainable by exercise.

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4. Charaka Samhita, Sutra-Sthana, 1.41
5. Ashtanga-Hrudaya, Sutra-sthana: 2.3,4
6. Charaka-Samhita, Sutra-Sthana: 7.31,30
7. Sushruta-Samhita, 24.42 to 50
8. Ashtanga-Hrudaya, Sutra-Sthana: 2.10
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15. Ashtanga-Hrudaya, Sutra-Sthana: 2.7
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42. Kashyap-Samhita, GulmaChiktsa Adhyaya: 5
43. Charaka-Samhita, Chikitsa-Sthana: 8.14
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45. Bhav-Prakash, Uttar-Khanda: 8.17,18,19
46. Charaka-Samhita, Sutra-Sthana: 7.33
47. Charaka-Samhita, Sutra-Sthana: 30.26
48. Sushruta-Samhita, Sutra-Sthana: 15.41
49. Charaka-Samhita, Sutra-Sthana: 9.4

Footnote

Ancient Classical Texts of Ayurveda, written during varying periods, are not uniformly organized, posing problems in citing in a uniformly abbreviated manner. Author complies with APA guidelines by incorporating the references within the text, but retains references in a listed manner to enable readers to view them together.

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Exercise Science in the Ancient India

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Abstract

The origin of Indian civilization was at least ten thousand years old. Mahargarh and Indus Valley excavation proved its antiquity. Vedas was developed at the time of Vedic period and the Rig-Veda (1500BC), now considered as the world's oldest literature. Ayurveda, the "Science of long and healthy life", was the supplement of Vedas and was identified as the world oldest record of medicine practice. Caraka and Susruta Samhita were the authority of Ayurveda, the Indian medicinal system. The present researcher thoroughly reviewed all the aphorisms (slokes) of these two ancient Ayurvedic literature and identified many aphorisms on exercise (vyayama). Both texts defined exercise, its good and bad effect, contraindication and seasonal variation etc. Exercise was prescribed for prevention, cure and rehabilitation programmes. The world's oldest definition of exercise was found in these texts and it was considered as the world's oldest living evidence of exercise therapy. These ancient texts described hypokinetic and hyperkinetic diseases and their exercise prescription. For many kinds of diseases they suggested exercise therapy which may open new areas of research. Ancient prestige and assets should be honoured and incorporated in all the relevant and appropriate places.

Introduction

Ancient India was very rich in every sphere of life and culture. Health and its maintenance was the prime focus of that time. Different forms of yoga and exercises were practiced and it was reflected in daily life activities. Ancient Indian Topovana and Gurukula system of education, yoga, vyayama (exercise) and krida (sport) was the essential part of life. Probably from that time the word 'Yogavyayama' was commonly used for the 'mind-body exercises' which was a unique idea developed by the ancient Indians. It was identified that Taksila University, the world oldest university and other ancient Indian university students participated in exercise and yoga classes regularly. Exercise and sport teachers were very much respected in the ancient Indian society. In this paper, the author reported on exercise science literature which was searched and collected mainly from two ancient Indian text and other authentic references. The research in this area was first started earlier in nineteen seventies[1,2] and then the ball was subsequently rolled by the other scientists. [3,4,5,6,7,8,9,10]

Indian civilization was one of the oldest in the world and started at least ten thousand years ago. After Mahargarh (7000BC), the Indus Valley civilization was operational earlier than the carbon dated value of 3300 BC. [11,12] The excavation revealed an advanced culture with major concerns for sanitation and public health as demonstrated by a public water and sewage drainage system, massive public bathing buildings, a fresh water tanks, soakage pits for sewage as well as private baths and Lavatories. [13,14] Other than their views on public health, little is known concerning their views on health and exercise. From the arm positions of recovered statues, it appears the residents were familiar with select movements of yoga exercises. [15,7]

Recently, 'Aryan Invasion Theory in India' has been challenged by the archaeological and major genetical evidences.[16] The most important time of Indian civilization was Vedic period (3000BC to 1000BC). Rig, Sam, Yajur and Atharva Veda were originated in this time. Rig-Veda was now considered as the oldest literature in the

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world.[17] Rig-Veda whose date has been most frequently cited as circa 1500BC17 but listed by Gordon as early as 4000BC[18]. Originally written in the Sanskrit language, the Rig-Veda contained 1028 hymns organized into 10 books or mandalas. However, there were no hymns that suggested exercise was advantageous for one's health or that physical activity or exertion could facilitate the recovery process with diseases.7 The health practices and medical concepts were not found in Sam and Yajur Vedas. The Atharva Veda (Circa, 1000BC) consisted of 20 books by numerous authors with 731 hymns containing extensive information pertaining to disease, health and medicine.[19,20] Other than the mentioning of dancing, there was no insightful information within Atharva Veda concerning the advocacy of exercise to improve one's health and recovery status.[7]

During the late Vedic period (1500 – 1000BC) a number of Upaveda (supplement to the Vedas) like Dhanurveda, Gandharvaveda and Ayurveda etc. were developed.[21,22] In Ayurveda, 'Ayur' means 'long and healthy life' and 'Veda' means 'science' or knowledge'. Ayurveda or Science of long and healthy life is also called as Indian Medicinal System. Most authentic available Ayurvedic literatures are Caraka Samhita, Susruta Samhita, and Astanga Hrdyayam. These great trios are recognized as Brhattrayi. However, Caraka and Susruta Samhita, both considered as the authority of Ayurveda and profusely they mentioned exercise for health and diseases in their text.

Exercise Science in Ancient Indian Ayurvedic Literature: Caraka Samhita

Ayurvedic text Atreya Samhita was considered as the world's oldest record of medical practice.[12,18] Agnivesa, on the advice of Atraya, his preceptor, compiled Ayurveda which was subsequently redacted by Caraka. The original text of Agnivesa Samhita was composed perhaps 1000 years before Christ. It was redacted by Caraka during 7th century BC.[23] So from Atreya to Agnivesa and then Agnivesa to Caraka the knowledge of Ayurveda spread for the mankind. As Atreya Samhita was the oldest record of medical practice in the world, so, the definition of exercise and the application of exercise for positive health and therapy found in the Caraka Samhita was the oldest in the world.[8,9]

In Caraka Samhita there are many slokes (aphorism) on 'Vyayama' resemble with the term 'exercise'. The present author reviewed thoroughly complete Caraka Samhita and identified one hundred twenty aphorisms (slokes) on exercise (Vyayama). Vyayama (physical exercise) is derived from vy (specific) + aa (particular) + yam (control) + ghang (by which it is done). So, vyayama (exercise) means by which specific and particular control has been done in the body. Caraka Samhita describes detail about exercise in the first section and in the chapter on 'Non suppression of natural urges'. Exercise was defined in Caraka Samhita as, 'such a physical action which is desirable and is capable of bringing about bodily stability and strength is known as physical exercise. This has to be practiced in moderation,[23] (Vol-I, p-151). This definition is very much modern and it might be the world's first definition of exercise.[8,9]

Caraka Samhita described human is the combination of body, mind and soul. This Samhita clearly suggested vyayama (exercise) and Krida (sport) for the body and yoga for mind and soul.[23] It gave the idea of the maintenance of positive health where it include proper diet, sleep, rest, active habit, regular exercise etc[23] (Vol-I, P-587). In Caraka Samhita, the features of correct exercise are stated as "Perspiration, enhanced respiration, lightness of the body, inhibition of the heart and such other organs of the body are indicative of the exercise being performed correctly." It mentioned the good effect of exercise "Physical exercise brings about lightness, ability to work, stability, resistance to discomfort and alleviation of impurities (dosas). It stimulates the power of digestion". In the next aphorism, Caraka Samhita indicated bad effect of excessive exercise, "Physical exercise in excess causes exertion, exhaustion, consumption, thrust, bleeding from different parts of the body, dyspnoea, cough, fever and vomiting." It was aware about the contra-indication of exercise, "Exercise is contra-indicated for persons who are

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emaciated due to excessive sexual activity, weight lifting and by traveling on foot and for those who are in grip of anger, grief, fear, exhaustion and for the children, for the old person and for persons having vatika (air) constitution and profession of speaking too much. One should not do exercise while he is hungry and thirsty also[23] (Vol-I, P. 152-153). It was suggested that in hot summer season physical exercise is to be given up and in heavy rainy season one should abstain from excessive exercise, other time one can do regular physical exercise[23] (Vol-I, P. 138-140).

Caraka reported many types of exercises such as: Walking, running, jumping, flying, fighting, club exercise, archery, swimming, playing with ball, water games, long and fast walking[23] (Vol. 2, P-104, 195, 277, 493);[23] (Vol-3 Pp-459, 469);[23] (Vol-5, Pp-15, 16, 23, 89)' [23] (Vol-6, P-247). Also Caraka Samhita reported following exercises lifting weight, straining in excess with a bow, lifting heavy weight, falling from high altitude, fighting with stranger persons, restraining running and strong animal requiring control, throwing heavy stones, wooden blocks or equipment made of stone, killing powerful animals, reciting scriptures at the top of voice, walking a long distance, walking too fast, crossing a big river by swimming, running along with a running horse, sudden high and long jump, practicing violent dance for a long time, walking over the ground covered with gavels and sands in the morning, swim against the current of river, swimming frequently in a pond having clean, cold and stable water, riding over horses, camels or on vehicles drawn by them.[23] (Vol- 2, Pp 104, 195, 277, 493);23 (Vol-3, Pp-459, 469);23 (Vol-5, Pp-15, 16, 23, 89);23 (Vol-6, Pp-247).

Caraka Samhita reported that the cause of diseases relating to both (mind and body) are three fold: wrong utilization, non-utilization (hypokinetic) and excessive utilization (hyperkinetic) of time, mental faculties and objects of sense organs[23] (Vol-I, P-39).

Caraka Samhita described importance of good built, "Persons having proportionate musculature and compactness of the body no doubt possess very strong sensory and motor organs and as such they are not overcome by the onslaught of diseases. They can stand hunger, thirst, the heat of the sun, cold and physical exercises. They can digest and assimilate properly".[23] (Vol-I, P. 377-378). Caraka Samhita, world's oldest living evidence of exercise therapy literature prescribed vyayama (exercise) for diseases. It pointed out, "If strong individuals suffer from diseases of moderate nature, such diseases can be cured by physical exercise and exposure to sun and wind. It goes without saying that diseases of mild nature of these individuals can also be cured by the same devices"[23] (Vol-I, P. 390). It prescribed exercise for the twenty types of Kaphaja (Phlegm) diseases and many other diseases to cure or minimize the consequences and used exercise therapy for the following twenty varieties of diseases due to the variation of Kapha (Phlegm): anorexia nervosa; drowsiness; excessive sleep; timidness; heaviness of the body; Laziness; sweet taste in mouth; salivation; mucus expectoration; excessive excretion of excreta; loss of strength; indigestion; phlegm adhered in the vicinity of heart; phlegm adhered to throat; hardening of vessels; goiter; obesity; suppression of digestive power; urticaria; pallor; whiteness of urine, eye and faces[23] (Vol-I, P-370).

Caraka Samhita mentioned two very common life style diseases: diabetes mellitus and obesity. It pointed out that, "those who take in excess, heavy food, those who sleep too much and have sedentary habits; those who given up physical and mental exercises may suffer from diabetes mellitus[23] (Vol-I, P. 327). Excessive corpulence (obesity) is cause by over intake, intake of heavy, sweet, cooling and unctuous food, want of physical exercise, day sleep, uninterrupted cheerfulness, lack of mental exercise[23] (Vol-I, P. 375). For reducing over corpulence the following are the prescription; diet and drinks which can reduce fat; should indulge more and more in vigil, regular physical and mental exercise[23] (Vol-I, P. 379-380). Caraka Samhita cautioned that excessive exercise may create heart problem, external and internal abscesses, whereas lack of exercise may develop swelling, insomnia, etc. It suggested exercise therapy may be useful for the disease of vomiting reflex, obstinate, urinary disorder, problem of bone marrow and semen. It also suggested along with exercise therapy, reducing (fasting) and nourishing (dieting) therapy, oleation, fomentation and massage therapy are important to cure the diseases[23].

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Exercise Science in Ancient Indian Ayurvedic Literature: Susruta Samhita

Susruta's existence is shrouded in mythology and controversy. One version has Dhanwantari, the physician to the gods and reputed Vedic father of medicine, coming to earth to minister to the misery and disease of mankind while extolling them in the science of life.6,[24] He subsequently migrates to Benares (Varanasi) and meets Susruta as the son of Saint Vishvamitra, a disciple of Dhanwantari and instructs him on the science of life and the surgery of medicine. Later, Susruta writing was compiled into a Samhita. Another version has Susruta being trained by Divodasa, a physician king of Varanasi.[25,26] This version creates more confusion because select authorities consider Divodasa and Dhanwantari to be the same entity. Regardless Susruta was a physician who taught surgery and medicine at the university in Benares and was a historical figure during 600BC.[26,27] Susruta Samhita is containing six sections (sthana) and 186 chapters and a total of 8500 slokes (aphorism).[28] The present researcher reviewed all the aphorisms in Susruta Samhita.

Susruta first mentioned vyayama or exercise in the 'Prevention of future diseases' in section IV and twenty fourth chapters in Susruta Samhita. He advised for regular cleaning, the various parts of the body, bathing, proper food and drinks; proper rest and sleep. He emphasized massage and sun bath for good health. About exercise he mentioned, "Activities which produce exertion to the body are known as vyayama (exercise). After doing it, the entire body should be massaged mildly (comfortably)." Then he elaborated, "health growth, brilliant complexion, well manifest divisions of the body, keen digestive fire (power of digestion), absence of lassitude, stability, feeling of lightness, cleanliness, ability to withstand exertion, fatigue, thirst, heat, and cold and best of health; all these accrued from physical exercises; nothing else that it (physical activity) exists which is best to reduce corpulence (obesity); enemies will not be able to vanquish/defeat the person who does exercises habitually; old age does not invade him quickly, the muscle of the body become stable (strong) in the person who does exercises daily habitually. Diseases will not occur in persons who practice physical exercises and get their body trampled by foot (by others) just as small animals do not go near to the lion; it makes the body beautiful to look at even of those persons who are deficient in age, physique and qualities. Even incompatible (unhealthy) foods consumed by persons who indulge in physical exercises, foods which are either properly cooked or improperly cooked get digested without any trouble. Physical exercises are always beneficial for strong persons and who consume fatty foods; it is most beneficial for these especially during cold and spring seasons. Exercise should be done daily, in all the seasons by men/women who desire their own wellbeing[28] (Vol-II, P. 227).

He further mentioned, "Physical exercises should be done to the level of half of the strength of the person; otherwise, it will kill him; when vayu (air) residing in the region of the heart comes up through the mouth (in other words – more upward breathing) that is the sign of half the strength of the person. Exercise should be done in accordance with age, strength, physique, habitat, season and nature of food; otherwise the person gets affected by diseases. Consumption, thirst, loss of taste/appetite, vomiting, bleeding diseases, dizziness, exhaustion, cough, phthisis, fever and dyspnoea are diseases produced by excess of physical exercises. Exercises should be avoided by patients of bleeding diseases, emaciation, consumption, dyspnoea, cough, injury in the chest (lungs) and by the person who has taken meal just then; who feeling exhausted after meals or copulation, who is suffering from thirst and dizziness"[28] (Vol-II, P. 228).

Susruta advocated for walking, "Walking causes loss (decrease) of colour/complexion, Kapha (Phlegm), obesity and tender physique. Excess walking is opposite to these qualities; bring up old age and debility quickly. Moderate walking does not cause much trouble to the body, enhances life span, intelligence, digestive power and stimulates the sense organs[28] (Vol-II, P. 234). He prescribed to avoid physical exercise in the time of fever, ear, nose, eye and lung diseases.[28]

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Susruta define exercised as a, "sense of weariness from bodily labour and it should be taken every day"[26] (Vol-II, P. 485). He described exercise referring to movements associated with walking, running, jumping, swimming, diving or riding and participating in sports such as archery, wrestling and javelin throws. He prescribed exercise should be moderate in nature or to an intensity that will cause labour breathing. However, before exercise was to be prescribed, the age, strength, physique and diet of the individual was to be considered as well as the season of the year and the terrain of the area.[26] Susruta advocated moderate exercise because it improve the growth of limbs; enhanced muscle stoutness (mass), strength, endurance, tantness (tone) and development; reduced corpulence; increased digestion, increased the resistance against fatigue; elevated temperatures and thirst while improving appearances and complexions. Moderate exercise was also advocated because it "gives the desirable mental qualities of alertness, retentive memory and keen intelligence[6],[26] (Vol-II, P. 40).

Susruta included physical exercise within his recommended hygiene practices and preventive and curative purposes. He felt regular moderate exercise provide resistance to diseases and against physical decay and stated, "diseases fly from the presence of a person, habituated to regular physical exercise."[26] (Vol-II, P. 486). He strongly opposed excessive exercises, which was interpreted to mean continued heavy or maximal exercise, because it would cause diseases and disorders such as consumption, thirst, phthisis, asthma, cachexia, hemorrhaging, vomiting, coughing and fever.[26] He included exercise in his recommendation to prevent and cure the occurrence of Kapha (phlegm) diseases.[26,29,30] Susruta considered obesity to be a diseases and prescribed physical exercise for prevention and cure[26] (Vol-II, P. 135-137). Diabetes was regarded by Susruta as a disease of the urinary tract. Treatment that included dietary changes and participation in an exercise program that included long walks, engaging in sports such as wrestling and riding on a horse or an elephant[6,26] (Vol-II, P. 377).

Conclusion

Rig-Veda was considered as the world oldest literature and there was no information about exercise science. Other three Vedas: Sam, Yajur and Atharva also did not have any literature on exercise science. However, Atharva Veda reported enormously on health, diseases and medicine. Ayurveda was a supplement of Vedas and the world oldest record of medical practice. Ayurveda means science of long and healthy life. It believe human is the combination of body, mind and soul. It prescribed vyayama (exercise) and krida (sport) for the body and Yoga for the mind and soul. Ayurveda or the Indian medicinal system gave tremendous importance to exercise for the maintenance of general health and for prevention, cure and rehabilitation of diseases. Exercise science in the ancient Indian literature was identified and the justified claim now established in the scientific communities. It should be introduced in the general text book of exercise and sport sciences all over the world.

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Philosophy and Science of Yogic Exercise in Ancient India

Dr. Manmath Manohar Gharote

Ancient seers view a human being as a living organism and one single unit. It comprises various levels such as physical, mental, emotional, social and spiritual, parts and components having number of functions and activities each minute one of which is inseparably related to the entire being. It has Consciousness intermingled with non-conscious elements. It breaths, this is the most prominent sign of life. It also closely relates to the surroundings it lives in. In addition, it enjoys a special relationship with a Force which is understood by many as Supreme.

All these are so very closely intertwined that it is almost impossible to segregate even any one factor from a human being and then the same human cannot be expected to be the same. All these factors together make a man. All these hold key to his health.

A man, according to ancient world, has divinity as the only potentiality due to which it comes to life, lives and (by its dictum) passes away (perhaps to come back again). Ancient literature holds the opinion that missing contact with this potentiality causes utter disintegration. This disintegration is the illness of all illnesses. When disintegration percolates to intuitive, psychic, emotional and physical planes, various symptoms or signs erupt. These are recognized as diseases. Therefore, restoration of integrity is restoration of true health.

Ancient sources have observed and realized this interrelation of the so called parts of the self. And they establish this relation internal with due deliberation. Therefore the holistic approach is in place.

The theory of integrated approach accepts that a body like a machine is-'a whole'– This 'whole' has many parts– All parts together make one 'whole'. Each part is closely interrelated to each other parts as well.

Therefore it is easy to derive that one affects the other. One influences the other. A part affects another part in the system. The whole can also affect each part.
Aupanishadika understanding says that a human being comprises of at least five layers or sheaths namely *annamaya, pranamaya, manomaya, vidnyanamaya, & anadamaya* etc which are inter-related.

On more practical count, a man willing to enjoy good health, needs to be in sync with his totality— his mental attitude, emotionality, behavioural pattern, values, ethics, morals, spiritual quest. Though for man it is necessary to live with the worldly objects around, a normal and social life cannot be imagined by a man without the world and its innumerable objects. But ancient seers say that these very objects exert immense pressure on man thus snatching his awareness away from his centre. The more a man moves away from his 'centre' or core, the more he faces difficulty to come back. This lack of connectivity with the core or the self is bad health.

In this sense, the highest objective of human is to terminate all movements (be it on physical, pranic or mental planes) for ever and to maintain the same state for eternity. A human being experiences movement on all three planes of his existence, such as body, breath and mind. Thus one can transcend the differences (duality) effected by time and space. All this is a work of the mind alone. Thus, all distinctions, differences and dualities are only mental projections. Once mind (along with especially breath and also body) is completely silenced of all projections (thoughts), differences appear to be only 'false'. This is the final aim of a human being.

Such a state of being can be attained systematically, consciously bringing down the rate of movements first of all at the gross physical plane and then gradually approaching the higher planes. This must be the very core concept

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of exercise. Right from early civilization man is facing the conflict between the instincts and reasoning or intellect. Often our intellect may not be able to overcome the inner ways of our thinking and feeling but persistence is sure to pay. Human wellbeing depends upon healthy mind and healthy body. State of consciousness, health and well-being are difficult to describe but can be recognized and transmitted. If the health is defined as a condition of optimum integrated functioning and relational exchange at all levels of consciousness, exercise must consider all aspects of wellbeing into account. In this sense the idea of exercise of the whole person is very ancient. Genuine exercise cannot be and should not be limited only to musculature development or just the treatment of physical disorders. Attention to emotional and mental aspects of well-being must be included. Wholeness depends upon the balanced integration of physical, emotional, mental, existential and spiritual levels of consciousness. Health is not a static condition that is achieved once and for all, but a dynamic on-going process of optimum functional, satisfaction and relational exchange on all levels.

Everybody accepts the value of health. However, each person has his own ideas about exercise for his health. In keeping fit, tone of the muscles plays a prominent role. Muscles of different organs are kept in proper tone through exercises. The less we exercise our muscles the softer and flabby they become. The law of use and disuse governs the state of fitness. The human body requires proper use of the organs to function efficiently. No single sport or any physical activity truly provides adequate attention to all the parts of the body. Especially for the persons over the age of forty and / or of sedentary habits and work consideration of suitable exercise is necessary. The exercise should be appropriate to the age and physical condition of the individual. Moreover, the parts of the body that requires special attention during the later age the muscles of the trunk and abdomen, different joints, lungs and vital organs situated in the abdominal cavity. Relaxation both physical and mental is found to be more and more essential in the modern way of life. As one advances in age mild form of exercise is beneficial to the functions of vital organs. Thus fast, vigorous or strenuous physical exercise should be avoided in advanced age.

Keeping this in view all the great seers in ancient world invented the most practical physical exercise system which is termed as “Yoga”. The ancient exercise system of yoga i.e Hatha yogic exercises, namely, *Asanas*, *Bandhas* and *Mudras, Kriyas*, *Pranayama*, and meditation techniques are introduced very cleverly for all round development of a person. In following this routine one has to bear in mind that the *Yogic* exercises are not meant to be a form of self-torture.

This was the vision of ancient seers, sadhus, saints and masters when they invented the age old exercise system which they named as Yoga. In yoga whatever practices are being introduced, they are designed in such a way that practitioner should achieve integration of personality at all the levels of an individual. Yoga is basically a philosophy, a way of life and thinking. It embraces aspect of existence, spiritual, emotional, mental and physical. It is a system of conscious evolution or self-improvement which has been cherished over thousands of years of its documented existence. The main reason why people take to Yoga, are to reduce nervous tensions, to slim or to become more agile physically and mentally. However a study of Yoga leads naturally to modifications of thought and behaviour and a new realization of the purposes and processes of life. This holistic approach leads to total wellbeing.

In fact all self-organizing activities are mental activities. Mental activity has several levels of working but we are not aware of them. The interdependence of mind and body is greatly emphasized in Yoga. Two thousand years back when *Maharshi Patanjali* systematized the system of Yoga, accepted the necessity of two-pronged approach, one from the psychological side and the other from the physiological side, to deal with the problem of personality.

The concept of health in *Yoga* is very wide and is stated in terms of the absence of factors that disturb the mind. It is the theory of *Yoga* that mind responsible for the bondage and liberation, for the health and disease and for

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happiness and unhappiness. The concept of exercise in *Yoga* is explained in terms of Integration and Harmony, Balance which leads to *Samadhi* or *Samatva*. As against this they use the term "*Vyadhi*" which etymologically means disintegration or disease. In this sense *Maharshi Patanjali* has described yogic exercises in eight steps. They are: *yama, niyama, asana, pranayama, pratyahara, dharana, dhyana* and *samadhi*. The first four steps are classed under *bahiranga yoga* and the last four steps are under *antaranga yoga*. The first four steps are considered preparatory for the *antaranga yoga*.
Yamas and *Niyamas* are rules of self-discipline in the cultivation of attitudes. Under yamas come certain firm and solemn decisions to regulate one's behavioural attitudes towards society while niyamas emphasize on the cultivation of certain personal habits and attitudes. Yamas are five: *ahimasa* (non-injury), *satya* (truthfulness), *asteya* (non-stealing), *brahmacarya* (control of carnal desires), *aparigraha* (abstention from hoarding). *Niyamas* are: *sauca* (purity), *santosa* (contentment), *tapas* (austerities), *svadhyaya* (study of such literature as would be helpful for self-realization), *isvarapranidhana* (surrender to God's will). *Yamas* and *niyama* are meant for cultivation of correct psychological attitudes. *Asanas* and *pranayamas* have been further developed and systematized by the *hathayoga*.

Hathapradipika, one of the important *hathayoga* texts, refers to fourfold curriculum of yogic exercises as follows: *asanas* (postures), *pranayamas* (control of respiration (prana), *mudras* (locks and holds of the semi-voluntary and involuntary musculature) and *nadanusandhana* (meditation on the internally aroused sound).Though not explicitly mentioned as a separate step, *hathapradipika* describes six purificatory exercises along with the discussion on *pranayama*.
Gheranda samhita describes seven steps of yoga curriculum while other texts like *Goraksa Sataka* etc. describe six steps. Taking a synthetic view of the above exercises we shall find that the various exercises of *yoga* curriculum could be grouped as follows:
i) Attitude forming practices — *yamas, niyamas*, and other ethical virtues. These help individuals to evolve a set of values in life.
ii) Psycho-physical Practices — *asanas, pranayamas, bandhas* and *mudras, kriyas*.
iii) Meditation Practices — *pratyahara, dharana, dhyana* and *samadhi*. These may include various other exercises helpful in meditation.

In the light of the broad based discussion above and considering this vast treasure trove of knowledge we can merely say yoga is a "system of exercise"? If still we call *yoga* a "system of exercise" then our understandings about the concept of exercise should be very clear. *Yoga* has become popular throughout the world and people are taking interest in practicing various kinds of yogic exercises.

Asana has become favourite yogic exercise with almost all *yoga* practitioners. However, there is no other technique so grossly misunderstood as that of *asana*. *Asanas* are looked upon as *yogic* exercises without precisely understanding the meaning and the scope of the term exercise. The word exercise is very loosely used by the common man. This is the cause of confusion and has given rise to the controversy about the static and dynamic nature of the asanas. Some call *asanas* static and others practice them in a dynamic way without the precise understanding of the words static and dynamic.

The term 'exercise' scientifically defined means repeated movements of particular parts of the body. There is no exercise without movement. The basic principle in any exercise is movement.

The term asana etymologically means position which is devoid of movement or having very little movement.The word static signifies absence of movement while the term dynamic invariably suggests movement.

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Do asanas involve movement? Should we consider asanas as exercise? On the basis of the definitions of *Asana* and Exercise we have to consider them different.
The difference between asanas and physical exercises may be stated as follows:

1. *Asanas* involve very little or no movement and are maintained for some time. Exercises involve repetitive movements.
2. *Asanas* consume minimum energy. Exercises consume more energy.
3. *Asanas* bring optimum tone in the muscles and affect the mind to become tranquil. Exercises affect the body mainly for strength.
4. *Asanas* can be advantageously practiced by old people and by heart patients. Physical exercises are prohibited for the heart patients and have limitations for the elderly persons.
5. Practice of asanas leads to freshness by removing physical lethargy. Exercises lead to fatigue and may not be suitable for all persons.
6. *Asanas* do not increase the muscle mass but improve the muscle tone and functioning of the vital organs by increasing the blood circulation in the abdominal organs. Physical exercises being of the nature of the contraction of the muscle increase the muscle mass.
7. *Asanas* keep the spine flexible and joints supple. Exercises can bring the rigidity of the joints and in the spine.
8. In *Asanas* the emphasis in on slow stretching, this is static in nature. Exercises being of the nature of repetitive movements the stretch are seldom held.
9. In adopting and maintaining the asana there is a co-ordination between the nervous system and the muscular system. Exercises being jerky there is a tendency to force the body to certain extent.

Thus the philosophy and physiology of *asana* is different from that of physical exercises. The purpose of physical exercise is to cater to the needs of the body bringing physical fitness. The channel through which this is attained is working with the muscles. Physical exercises induce physiological changes such as increased respiration, increase in the heart rate and producing waste products by increasing of CO2 content. Intense exercise leads to fatigue.

> The ultimate purpose of asanas is to reduce the disturbances of the mind and bring sedative effect in the individual. According to patanjali they reduce the impurities of the body and mind. He uses the word *asuddhi-ksaya*. This is attained by eliminating the neuromuscular imbalances called dvandas (*tato dandvanabhighatah*). *Asana* is distinctly a sign of transcending the human consciousness. The motionless position of the body imitates some other condition than human. Man by definition is mobile, agitated, unrhythmic. *Asanaputs* an end to the mobility of the body by reducing the infinitely possible positions to a single posture. Refusal to move in the *asana* leads to series of refusals (controls) of every kind. *Maharshipatanjaligives* two characteristics of *asana* – stability and comfort (*sthira-sukham-asanam*). This definition of asana gives us the idea of psychological nature of asana. The word stability conveys the condition of the body while comfort suggests the condition of the mind. For the performance of asanas no effort should be involved according to *patanjali* (*prayatna-saithilya*). This is just the opposite of the theory of exercise. In exercise you force while in *asanas* you try to relax as much as possible.

Asanas are those static exercises wherein a constant pattern of posture is maintained stably by the interaction of groups of muscles working more of less statically to stabilize the joints to preserve a state of equilibrium against gravity and other forces. Meditative *asanas* can be easily maintained in a semi-relaxed state because of the broad base afforded by the adjustment of the lower extremities.

In order to succeed in the state of wellbeing suitable background needs to be formed through the other hathayogic exercises like Kriyas (purificatry processes), *Asanas* (stretching practices), *Pranayama* (breath regulating practices) and Mudras and Bandhas (internal pressure manipulation practices) as well.

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In conclusion, we can say that asanas are meant to restore the homoeostasis in the body so that we can experience a sense of well-being, stability and lightness in the body and tranquillity of mind. The objective of yoga is complete cessation of modification of thoughts (‘*cittavrttinirodha*’), and the same is attempted through all the steps of *yoga*. *Asanas* are no exception. The relationship of the stability of asana with the control of mental functions has been beautifully explained by *brahmananda* in *yogarasayana* as follows:

> “One who can be stable in the asana is fit to undergo yogic practices. With unstable body one cannot have a stable mind. When asana becomes stable, surely the mind too gains stability. The movement of *prana* indeed slows down. The fickleness of the senses also are certainly set at rest. Then only one gets established in yoga and therefore one should practise asana.”

Historically seen the number of asanas was very small in ancient days. More emphasis was laid on meditative asanas which was the main purpose of asanas. But when it was observed that prolonged practice of asana for meditation was not easy, probably the efforts were made to condition the body suitably by bending and stretching various muscles and organs in different directions. The idea of removing all the possible hindrances in the prolong sitting was always the main consideration behind practicing various forms of asanas.

As *tejobindu-upanisad* says—‘*Asana* is that in which one is able to contemplate on the Absolute Being (brahma) continuously over a longer time. Otherwise it is no asana which leads to discomfort.’ Thus it will be clear that the nature of asana is static exercisein consideration of its technique and purpose. In this sense all the yogic exercises such as *pranayama, kriya, bandha-mudras,* meditation are complimentary to each other and each practice contributes to similar effects on a greater of lesser scale.

Yogic exercises contribute to all the three aspects of health, namely, promotive, preventive and curative. However, Yoga has always been recognized as a preventive exercise system although it is being increasingly used in a remedial way to produce cures or alleviation of diseases. What detracts one from the ideal conditions of health is the lack of adjustment with the environmental conditions, both external as well as internal. Yogic exercises help to improve and increase the power of adjustment which normally expressed in terms of resistance, both physical and mental. While suggesting the practices of Yogic exercises, Patanjali, the author of the ancient yogic text “Patanjala Yoga Sutra”, gives us three important principles governing the effects of the exercises. These are long period of practices (exercises), continuity of practice (exercises) without break and full conviction about the utility of practice (exercises).

For consideration of these principles the selected routine should be specific and small so as to consume less time, it should be within the physical limits of an individual and it should be efficacious for the individual. Then only better results could be expected. Modern civilization has provided many amenities of life. Yet the peace of mind is lacking. Man is exposed to the stresses and strains of life almost every minute with which he is not able to adjust. He needs some way through which he can reduce the burden of stress. This can happen only when he is able to adapt himself to the situation. Immediate need for modern man is to develop psycho-physiological resistance to enable him to successfully meet with the circumstances and to find the reactions on the part of the body and mind not out of proportion. To the problems of modern man in modern era yoga has an answer who sincerely wants to seek. In ancient period although yogic knowledge has been used as a mean to attain self-realisation, but modern era proved its utility for cure of diseases and for therapeutical purposes which was proved through scientific experiments conducted by modern stalwarts. One of such name of Great stalwart was Swami Kuvalayananda alias Jagannath Ganesh Gune.

The fundamental scientific aspects of Yogic methods were first brought to the notice of the public by Swami Kuvalayananda. It was universally acclaimed to open a new vista, both in the realm of Science and Yoga with

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its unique discoveries of the scientific principles involved in many of the apparently obscure Yogic exercises. It drew the attention of the Indians as well as foreign Universities to the possibilities of the great art and science of Yoga. Swami Kuvalayananda established most of the basic scientific principles behind the common exercises of Yoga as a result of which it has now become possible to use these exercises rationally in the treatment of several functional and psychosomatic disorders. He tried to reach its goal through the propagation of Yoga by coordinating yogic culture with modern sciences. This field of coordination was naturally very vast and covered every aspect of human existence. A small beginning was made by him tackling physiological and therapeutical aspects. Yogic exercises such as Asanas, Bandhas, Mudras, Shat Kriyas and Pranayamas were subjected to laboratory experiments, chemical, microscopic, X-ray and other tests. The results were extremely interesting. These scientific investigations threw new light not only upon yogic processes but also upon some of the problems of modern sciences. Many persons of light and leading appreciated the scientific value of the yogic research that was carried out by Swami-ji. Late Pandit Motilal Nehru wrote in his letter dated 07.03.1930 that: "I have been very much impressed with the work of Swami Kuvalayananda. He has opened out an entirely new field of scientific research and has already shown that the different aspects of yogic culture and therapy can not only stand the fierce light of modern sciences but are well in advance of all that has so far been discovered in the West."

Swami Kuvalayananda conducted several scientific experiments to show the utility of Yogic exercises in modern era. Although it is not possible to mention all of them still, some of them are unique experiments related to Nauli (kriyas), Uddiyana (Bandha), Pranayam and Asanas.

Uddiyana and Nauli were the two important Yogic exercises first scientifically investigated by Swami Kuvalayananda using X-Ray method. Uddiyana is a Yogic exercise of raising the diaphragm by raising the ribs and expanding the thorax after full exhalation and without inhaling the air. Nauli is the isolation and rolling manipulation of the rectus abdominals. The performance of Nauli is a step further than Uddiyana. Nauli enables a student of Yoga to raise water into the colon without any external mechanical help. Although this was known to many the phenomenon was explained on the basis of antiperistalsis hypothesis. It was stated that by the practice of Nauli, antiperistalsis could be started in the rectum and anal canal which when in contact with water, sent back a current of it through the colon. No one cared to collect any experimental evidence and it was merely a matter of speculation. The antiperistalsis action is unnatural in the rectum and it would lead to serious constipation and state of auto-intoxication. Nauli is advised in Yoga as a daily exercise. Traditionally Nauli is looked upon as a curative exercise for constipation and auto-intoxication.

Swami Kuvalayananda studied the problem in the laboratory with the manometer. He used a syphon barometer. The free end of this was connected with the colon by means of an India-rubber tube passed through the rectum. As soon as the muscles were moved for Nauli, the mercury fell through 40 mm. indicating a clear partial vacuum. The experiment was repeated on several occasions and every time a partial vacuum of 30 to 47 mm. was recorded according to the cleanness of the colon. This partial vacuum in the colon during Nauli was named Madhavadasa Vacuum after his spiritual Master His Holiness Paramahamsa Shriman Madhavadasa Maharaja of Malsara by the discoverer Swami Kuvalayananda.

This was the first planned and controlled scientific experiment conducted in the field of Yoga and the renaissance of scientific Yoga started from 1920. The genesis of the Madhavadasa Vacuum has been clearly explained by Swami Kuvalayananda on the basis of the further X-Ray experiments as follows:

> "The isolation of the recti and elevated position of the diaphragm increase the capacity of the abdomen. This increased capacity reduces the intra-abdominal pressure and allows the colon to dilate under internal gas pressure. Thus the volume of the intestinal gases is increased leading to a proportionate decrease

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in their pressure. This decreased pressure causes the manometer to fall when connected with the colon during Nauli and indicates the Madhavadasa Vacuum."

Swami Kuvalayananda demonstrated development of Negative Pressure in colon during the practice of Nauli. Upto that time the possibility of creating pressure changes in the internal cavities by voluntary manipulations was not known nor investigated in the field of physiology. The X-Ray experiments on Uddiyana and Nauli showed the distribution of colon contents during these practices and the position of colon changed moving every part of the bowel upwards and downwards and from side to side.

Another scientific experiment based on practice of Pranayama, the O^2 consumption and CO^2 output in Pranayamic breathing with different time units for inhalation, retention and exhalation were studied and compared with that of normal breathing. This investigation shattered the popular notion and even among eminent medical authorities, that through Pranayama O^2 consumption and CO^2 elimination are increased. It was revealed that in certain types of Pranayama the minute ventilation, O^2 consumption and CO^2 output are comparatively less than that of normal breathing. These findings would be very useful in understanding the physiology of Pranayama. Effects of Asanas like Sarvangasana, Matsyasana, and Shirshasana on blood pressure and heart rate were investigated also by Swami-ji. This study helped to remove the prevalent notion that Asanas are strenuous physical exercises and would put lot of strain on the heart and the circulatory system.

As scientific experiments also proved the utility of Yoga in modern era we have to expand our vision and to accept Yoga as an only mean to achieve Integration of personality. Total development in man means the state of harmony and balance between his attitudes, action, behaviour, character, skills, thinking, patterns and maintenance of human relations. This perfection in such is nothing but the versatile development of his personality, which is called simply as 'Integration of personality'.

Yogic exercises has a graded way to tackle these aspects with adequate emphasis on some but is homogenously linked together and when one aspect is tackled other aspects too are indirectly and conveniently tackled. Thus yoga believes in the exercise of the whole man and his personality which have several facets.

Yoga has the means which are efficacious in all the individuals considering their differences in abilities and capacities. Thus yoga can cater to the needs of physical, mental, emotional, social, and spiritual according to the limitations and interests of the persons. To get full benefits of *yogic* exercises, they should be performed daily for whatever little time that may be available. Though *Yoga* can be taken up with advantage at any stage of life, it has; perhaps, most to offer the middle aged persons. It is never too early or too late to start *Yoga*. Young men and women can set about looking and feeling years younger. Physical poise promotes mental poise and mental poise influences bodily poise. *Yogic* exercises work on both.

Yogic exercises are not limited to any caste, creed, religion, sex or age. It is available both in health and disease. However, depending on the circumstances and the individual difference due discrimination will have to be made. Be fit, feel fit and stay fit through Yogic routine. Learn Yogic exercises properly with following all the ancient and fundamental principles and practice them for your good health and longevity.

To sum up, we can say that the science of exercise in ancient world was truly based on authentic principles and very useful for every individual to attain the state of complete wellbeing and integrated personality.

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Current Issues

Recent Research into Children's Physical Activity

Richard Bailey

This short paper summarises researched published during 2015 and 2016, focusing on certain central topics:

- Patterns of Physical Activity
- Children's Physical Activity and Obesity
- Influences on Physical Activity
- Physical Activity and Educational Performance

A full reference list is given at the end of the paper. I can send copies of any of the papers cited, as necessary.

Patterns of Physical Activity

It is widely believed that moderate-to-vigorous-intensity physical activity (MVPA) declines markedly in adolescence, particularly in girls. This assumption has led to substantial research and policy effort aimed at reducing the perceived decline in MVPA during adolescence. A potentially very important study from the University of Glasgow (Reilly, 2016) examined this assumption by analysing existing systematic review evidence, recent longitudinal studies, and accelerometry data, and concluded that the assumption was mistaken. MVPA begins to decline, and sedentary behavior begins to increase, from around the time children enter school. This timing is significantly earlier than most policy plan for.

Designed to Move is premised on the importance of establishing physical activity behaviours and attitudes during the first ten years, and this view is offered supported by the Glasgow research.

The accelerometry data from Reilly (2016) was taken from the very useful International Children' s Accelerometry Database (http://www.mrc-epid.cam.ac.uk/research/studies/icad), which contains accelerometer data from twenty studies conducted in ten countries. The initial analysis of these data was by Cooper, et al (2015) who used the dataset to describe objectively-measured physical activity and sedentary time patterns in youth. Predictably, boys were less sedentary and more active than girls at all ages. After 5 years of age there was an average decrease of 4.2 % in total physical activity with each additional year of age, due mainly to lower levels of light-intensity physical activity and greater time spent sedentary. In addition, physical activity differed between samples from different countries, with a 15– 20 % difference between the highest and lowest countries at age 9– 10 and a 26– 28 % difference at age 12– 13.

Another multi-national review was carried out by a Dutch team (Van Hecke, 2016). They carried out a systematic review of all existing studies that measure physical activity in youth, in cross-European studies, to describe the variation in population levels of physical activity, and to describe and define challenges regarding assessment methods that are used. 30 studies were found that met the criteria for inclusion (from an initial sample of 9,756 studies – that's systematic reviewing for you!). An immediate difficulty with analyses like this is that researchers use different measurement tools and different intensity thresholds (how much is enough to count as active), so comparisons always need to be made cautiously. Nevertheless, the finding that boys were more active than girls is plausible, as is the considerable variation in measured levels of activity across Europe.

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Until a Europe-wide, standardized tool is developed and agreed, comparisons between countries (and within countries) and changes over time will always be frustratingly difficult to make.

A study from Brazil and Portugal identified an important issue regarding research into children's physical activity patterns that might be relevant to any interpretation of data like that given above (Barbosa Filho, et al, 2016). Simply put, the authors wanted to learn how much previous reviews on promoting physical activity for children and adolescents take into account studies from low- and middle-income countries (LMIC). This is important because evidence suggests quite different patterns of activity between richer and poorer countries. They found that from 50 systematic reviews and 25 empirical studies, only 3.1% of mentioned were from LMIC. Unlike the Glasgow study, these researchers found support for the idea of focusing physical activity promotion during adolescence, although this conclusion is undermined by the low number of studies, low methodological quality, and/or small sample size of the empirical studies analysed.

The most interesting finding from this paper is the shocking lack of evidence from LMIC. The conclusions about adolescent-based activity promotion are, I suggest, unwarranted due to poor data.

French Swiss researchers examined the 'developmental trajectories' (I think they are using the wrong term, and really just mean physical activity patterns) and determinants of
MVPA during PE lessons in young children (8–12 years of age) in primary schools (Cheval, et al, 2016). With quite a large sample, they found that:

- boys had a higher percentage of MVPA than girls;
- both boys and girls were less active as they got older;
- higher perceived competence predicted a higher percentage of MVPA (for boys, not girls);
- none of the children reached the recommended physical activity levels.

The obsession with achieving recommended physical activity levels through PE alone seems doomed to failure, and a much more holistic approach is needed – break and lunch times, before and after school, sports, etc. I'm not aware of any quality studies that have found PE lessons meeting the total requirement alone.

The other side of the activity coin is sedentary behaviour. Janssen, et al, (2016) used participants in Gateshead Millennium Study cohort in the UK to assess longitudinal changes in sedentary behavior, and examine the degree of tracking of sedentary behavior from age 7 to 15 years. Using accelerometry with 507 children, the researchers found that the daily sedentary time increased from 51.3 % of waking hours at 7 to 74.2 % at 15 years old. The largest changes in sedentary time occurred between 9 to 12 years, a period which spans the transition to secondary school.

Similar to other studies, it has been found that the transition between Primary and Secondary Schools can have a powerful effect of children's physical activity behaviours. Strangely, very little has been done to address this challenge.

Children's Physical Activity and Obesity

The relationship between physical activity and obesity is contentious one, with some arguing that obesity is primarily caused by low levels of physical activity or sedentary behaviour, and others argue that it has almost no influence at all! One useful study examined the relationships between MVPA, vigorous physical activity (VPA), sedentary time, and obesity in children from 12 countries, spread across five regions of the world (Europe, Africa, the Americas, South-

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East Asia and the Western Pacific) (Katzmarzyk, et al, 2015). In light of the observation made about the paucity of research in LMIC, such multi-site research has an additional value. Working with a sample of 6539 9–11 year olds, the researchers used accelerometers worn 24 hours a day. Findings were remarkably robust across countries: MVPA and VPA were consistently negatively associated with obesity, independently of sedentary time, across the whole multinational sample and at each site individually.

The quantity of MVPA that best discriminated obese and normal weight children was 55 minutes adding support to the existing guidelines that recommend children accumulate 60 minutes of MVPA per day.

Influences on Physical Activity

A few papers focused on social support for children's physical activity. This is important as there is some evidence to suggest that social support can impact the physical activity levels of adolescent girls, although the relationship is complex and not well understood.

One (Laird, et al, 2016) systematically review and meta-analyse the relationship between social support and physical activity in adolescent girls, exploring how different types and providers of social support might influence the relationship. Small but significant associations between all available providers of total social support (except teachers) and physical activity were found, as were identified for emotional, instrumental and modelling support for some providers of support. Overall, though, the findings suggest that social support is not a strong predictor of physical activity in adolescent girls though parents and friends may have a role in enhancing activity levels.

Another (Yao and Rhodes, 2015) looked at the effects of parental behaviors (i.e., modelling and support) on children's physical activity by analysis existing datasets. Results showed parental support and modelling relate to child physical activity, yet results revealed a significant degree of heterogeneity among the studies that could not be explained well by our proposed moderators.

So we don't know!

A more optimistic picture comes from an American study of the home environment and after-school physical activity and sedentary time among 6th grade children (about 11 years old) (Lau, et al, 2015). Children's after-school total physical activity (TPA), MVPA, and sedentary time were measured by accelerometers. Parents completed surveys assessing elements of the home social and physical environment. It was found that the availability of home physical activity resources was associated positively with after-school TPA and negatively with after-school sedentary time in boys. Parental support was associated positively with after-school TPA and MVPA and negatively with after-school sedentary time in girls. In other words, the home physical environment was associated with boys' after-school physical activity and sedentary time, whereas the home social environment was associated with girls' after-school physical activity and sedentary time.

The school is another social influencer for physical activity, although evidence suggests that most interventions have proven to be ineffective. Hunter, et al (2016) examined how naturally-occurring changes to school physical activity policy, recreational programming, public health resources, and the physical environment, impact adolescent MVPA over a 1-year period. Longitudinal data was gathered by self-report physical activity questionnaire from 18,777 Grade 9– 12 students (mean age = 15.1 ± 0.02 years), and changes to physical activity policies, recreational programming, public health resources, and the physical environment from 86 schools. Changes such as adding or increasing access to facilities, and adding multiple recreational programs, seemed to be effective for increasing student MVPA. However, given the specificity of results, a one-size fits all approach may not be effective for increasing MVPA.

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Another study of school environments (Morton, et al, 2016) focused on the effects of school-based policy, physical and social-environmental influences on adolescent physical activity and sedentary behaviour, by systematically reviewing 98 papers. A range of school-based policy (e.g. break time length), physical (e.g. facilities) and social-environmental (e.g. teacher behaviours) factors were associated with adolescent physical activity. There was much less evidence related to sedentary behaviours. This study revealed the importance of specific activity settings (type and location) and intramural sport opportunities for all students. Important physical education-related factors were a mastery-oriented motivational climate and autonomy supportive teaching behaviours.

Physical Activity and Educational Performance

A comprehensive analysis of the evidence related to possible relationships between physical activity and educational achievement (Bailey, 2016) found varying degrees of positive associations between activity and: cognitive functioning psychosocial development; school engagement; and general educational attainment. This is the first attempt to provide an explanatory model of the different factors that seem to mediate the relationship. It concludes:

> "Active young people tend to perform better than their sedentary peers. They tend to perform better at school; on tests; and during their career. It is impossible to calculate the total full advantage offered by these improvements, but is worthwhile acknowledging that they result from participation in activities that are mostly free, and, when presented appropriately, with which young people will participate in happily and voluntarily. This means that the common assumption that physical activity and classroom learning are necessarily in conflict is mistaken, and educators ought to rethink the planning and delivery of schooling radically."

There have been a number of studies looking at the relationship between exercise and cognitive function (and a new ICSSPE book in 2017). For example, van der Niet, et al (2016) examined the effects of a physical activity programme including both aerobic exercise and cognitively engaging physical activities on children's physical fitness and executive functions (high-level cognitive skills used to control and coordinate other cognitive abilities and behaviors). Working with children from 3 primary schools (aged 8-12 years), one group participated in a 22-week physical activity programme for 30 minutes during lunchtime break (recess), twice a week, while those in the control group followed their normal lunch routine. Children in the intervention group showed significantly greater improvement than children in the control group in measures of inhibition and verbal working memory skills), suggesting a physical activity programme that includes aerobic exercise and cognitively engaging physical activities (such as team games) can enhance aspects of executive functioning in primary school children.

An interesting Dutch study took the issue of physical activity and cognition a stage further by examining the use of physical activity in the teaching of academic lessons (Mullender-Wijnsma, et al, 2016). 500 8-year-olds participated in active lessons for 2 years, 22 weeks per year, 3 times a week. A control group participated in regular classroom lessons. Children's academic achievement was measured by 2 mathematics tests (speed and general mathematics skills) and 2 language tests (reading and spelling). Analysis revealed that children in the intervention group had significantly greater gains in mathematics speed test, general mathematics, and spelling scores. This equates to 4 months more learning gains in comparison with the control group. No differences were found on the reading test. Physically active academic lessons significantly improve mathematics and spelling performance of primary-aged children!

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ICSSPE News

Katrin Koenen

Uri Schaefer Elected President

ICSSPE General Assembly

On the eve of the 3rd ICSEMIS and the Paralympic Games the 26th ICSSPE General Assembly elected Uri Schaefer President of the organisation. Uri Schaefer is a former head of the sport administration of the Israeli Ministry of Culture and Sport, as well as former director of the Wingate Institute. He held the office provisionally, since the death of President Margaret Talbot. In addition, Darlene Kluka, Barry University, USA and Maria Dinold, University of Vienna, were elected as Vice Presidents. Wolfgang Baumann was also confirmed for a second term as Vice President.

In the course of the Assembly, delegates approved a series of motions which include the budget for the upcoming two years as well as changes of the organisation's statutes. Parts of these changes reflect the strategy revision process which was initiated by the President's Committee and supported by the members present unanimously.

Furthermore, the delegates appointed former ICSSPE President Gudrun Doll-Tepper Honorary President of the organisation, thereby acknowledging the exceptional contribution she made during her presidency from 1997 to 2008, and subsequently, for the development of ICSSPE.

Girls' and Women's Engagement with Physical Activity

ICSEMIS Symposium in Memory of Margaret Talbot

It is not religion per se that keeps girls and women away from being physically active. It is the politics behind that sometimes prohibits one half of society to live a healthier life. This was one of the outcomes of the Margaret Talbot Symposium which took place during the 2016 ICSEMIS, held from 31 August until 4 September 2016 in Santos, Brazil.

Under the guiding title *Girls, Women and Physical Activity: Religion, Culture, Tradition and National Policies around the world*, experts and over 100 participants reflected what hinders women and girls from participating in physical activity and sport. This was one of the dominant themes throughout Margaret Talbot's career, and it continues to be topic of considerable importance within ICSSPE and further afield. Margaret Talbot, former ICSSPE President who died in 2014, led the way in advocating for equity in sport, physical activity and physical education, and it was fitting that this great visionary's work was remembered through this unique symposium. The symposium, sponsored by Nike Inc., was moderated by ICSSPE Honorary President Gudrun Doll-Tepper.

Tansin Benn from the United Kingdom gave a fascinating talk about the need to Accept and Respect, which made the case for diversity and difference through sport. Drawing a range of disciplinary insights, from education, pedagogy, development studies and sociology, she gave numerous examples from her own work with Muslim girls to show what can and must be done.

Jorid Hovden from Norway focused on sociological and social policy perspectives. Her talk, Powerful women as change agents in Scandinavian sport, showed some of the ways in which women can drive change, and create a

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culture of equality in sport.
Pablo Scharagrodsky came from Argentina, and offered a Latin American perspective. Drawing on historical and sociological scholarship, Scharagrodsky presented some exciting ideas for promoting just and equitable spaces for women.

The final speaker was Richard Bailey from ICSSPE. After reminiscing about conversations with Margaret Talbot, Bailey offered a philosophical critique of the common policy of increasing choice and opportunity, without addressing the wider cultural problems generated by patriarchal societies.

Former ICSSPE President Margaret Talbot Awarded

Receipt of David Talbot

Former ICSSPE President, the late Professor Margaret Talbot, has been awarded the Jürgen Palm Award by TAFISA, during the close of the 24th TAFISA World Congress, held in Budapest in 2015. The award was now handed over to Margaret Talbot's widower, David Talbot during the ICSSPE General Assembly in Santos, Brazil, on 31st August, 2016.

The Jürgen Palm Award is given in recognition of Margaret Talbot's outstanding contribution to the international sport for all and physical activity movement.

How can Physical Activity Help to Include Refugees?

"Communities and Crisis" Seminar will try to Find Answers

ICSSPE will host the 9th edition of "Communities and Crisis – Inclusive Development through Sport" in Rheinsberg, Germany, from 30th October until 5th November 2016.The seminar provides participants with unique insights into the use of sport and physical activity for inclusive community building, particularly in areas recently affected by crises. These crises include natural disasters such as earthquakes, floods or tornadoes, as well as human-made crises like civil wars and vulnerable communities. But this year a special focus will be on refugees, their situation within the European countries and potential psycho-social support through physical activity programmes. Sport, play and physical activity are integral parts to a community building process. Careful design and implementation of such programmes under consideration of cultural diversity, gender and inclusion of all age groups are critical to ensuring positive development and avoid potentially harmful psychological effects. Through this symposium, participants learn to use sport as positive means of physiological and psychological rehabilitation, both through practical, hands-on workshops as well as through theoretical learning sessions. It emphasises the importance of cultural sensitivity and the implementation of appropriate monitoring and evaluation techniques.

Remarkable Success for ICSSPE

Latest Cycle of EU Funding

ICSSPE has achieved a series of important successes in the recent funding opportunity from the European Union. They all relate to research and development projects, with partner organisations from across Europe. In one of

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these projects, ICSSPE is taking the lead. The EU's programme to support education, training, research and youth in sport is called Erasmus+. Its budget of €14.7 billion provides opportunities for millions of Europeans. ICSSPE's projects all relate to either research or development in sport:

PRIME – Participation, Recreation and Inclusion through Martial Arts Education – aims to develop a high quality coaching framework to facilitate the promotion of healthy martial arts participation among persons with a disability in Europe. The PRIME partnership is a unique consortium of international agencies and organisations representing a range of martial arts styles, and from different EU Member States. In addition to groups at the forefront of inclusive practices in the martial arts, such as the Disability Karate Federation and the International Taekwondo Federation, the partnership includes the International Council for Coaching Excellence, and the UNESCO Chair Transforming the Lives of People with Disabilities, their Families and Communities, Through Physical Education, Sport, Recreation and Fitness at Tralee Institute of Technology, Ireland. ICSSPE will be leading this project.

ADVICE – Anti-Doping Values in Coach Education - aims to reduce doping in grassroots sport by developing an evidence-based mobile application for coaches, who work in grassroots sport with athletes aged between 14 to 21 years of age. The project is led by ICSSPE member, the University of Hull from the UK. Other project partners include Kea Fair Play Code Hellas, Agence Francaise De Lutte Contre Le Dopage, The Association for International Sport for All (TAFISA), the French National Anti-Doping Agency, and others.
ASPIRE, led by the European Non-Governmental Sports Organisation (ENGSO) aims to develop knowledge, skills and understanding among sports coaches to work with and support refugees in Europe. ICSSPE will be contributing to the research and material development part of this project.

WHISTLE - Whistleblowing of Harmful Irregularities In Sport Through Learning & Education – is led by the Greece-based K E A sports transparency integrity protection hellas. WHISTLE aims to inform and activate partner countries to recognize harmful irregularities in sport and introduce comprehensive whistleblower legislation to protect those who speak out and ensure that their claims are properly investigated. ICSSPE will be joined by Aristotle University of Thessaloniki, Greece, Sheffield Hallam University, UK, National University of Physical Education and Sports, Bucharest, the Cyprus Sport Organization, and the International Council for Coaching Excellence.

SGO2017 is led by Play the Game and the Danish Institute for Sports Studies. The main aim of the Sports Governance Observer 2017: Benchmarking sports governance across national boundaries is to assist and inspire national sports organisations to raise the quality of their governance practices. This initiative is meant to enable sports leaders and outside stakeholders to measure, discuss and amend the governance standards and practices of sports organisations by adapting and applying the Sports Governance Observer benchmarking tool. In addition, the project seeks to establish sustainable networks, educate and train sports leaders, researchers, as well as government representatives, and disseminate national as well as comparative international and national data.

The project periods last between two and three years starting January 1st, 2017.

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Issue No. 71 of ICSSPE's Bulletin provides the Special Feature *Exercise and Science in Ancient Times*, which contains a collection of scientific articles. It will help to focus our attention towards other civilizations and to uncover the hidden history of science in sport and exercise. Ancient societies were often well-versed in arts, science, literature, architecture, philosophy, sports, leisure, education, festivals, religious rituals, and agriculture. The Bulletin reveals interesting ancient records, which might also inspire the present and future of sport science and physical activity.

The Special Feature was reviewed by Dr Suresh Harsher Deshpande, of the National Association of Physical Education and Sports, India.

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