GENRE ANALYSIS OF SCIENTIFIC ABSTRACTS: A COMPARATIVE STUDY OF *SCIENCE* AND *NATURE* JOURNALS

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Thesis

Entitled

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Jiraporn Oneplee

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GENRE ANALYSIS OF SCIENTIFIC ABSTRACTS: A COMPARATIVE STUDY OF *SCIENCE* AND *NATURE* JOURNALS

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ABSTRACT

To identify patterns of rhetorical moves in texts, move analysis is one of the salient approaches to discourse analysis. The purposes of this corpus study were to 1) investigate, 2) compare, and 3) analyze the organization of journal article abstracts in the scientific field. One hundred abstracts found in two prestigious scientific journals, *Science* and *Nature* published, between 2006-2008, were objectively selected for analysis.

In order to analyze the organization of scientific abstracts, Santos' abstract move patterns theory (1996) was used as the paradigm for this study. The results of this study were compared with Santos' study in order to find the differences in the nature of abstract writing between linguistics and science. Five experts in science and linguistics were asked and trained to code a subset of the corpus, and the rhetorical moves were reliably identified.

This research indicated the norms of abstracts were written with five moves: Background Information, Purpose, Method, Result, and Conclusion. Interestingly, abstracts from scientists were mainly focused on the study's results (25.8%), background information (21.8%), and drawing conclusions (15.8%), which differs from the linguistic field studied by Santos. The study provided a basic template of the structure of scientific abstracts when considering the move ordering pattern. From this analysis the results showed that the trend of abstract writing in both *Science* and *Nature* were similar. That is, initially, the readers were provided with background information (21.8%), and the study results were given (25.8%). Then, conclusions were drawn (15.8%) and recommendations were given, but only occasionally (11%) was the research methodology described. The results revealed that in the scientific field, when it comes to abstract writing, there was only a slight focus on describing the research methodologies (11%). The model specified the status of the moves as either mandatory or optional depending on their frequency of occurrence.

The findings of this research in terms of the structure of abstracts in scientific journals may facilitate the process of disseminating scientific discoveries and advancements for both native and non-native science writers. English academic writing teachers along with postgraduate EFL/ESL students and other interested parties would find this study valuable for their academic careers.

Further study should be carried out to investigate the organization and linguistic features of abstracts in other disciplines, as well as investigating the organization of all conventions of article journal abstracts, in order to get a complete overall picture.

KEY WORDS: MOVE ANALYSIS / SCIENTIFIC / ABSTRACT / CORPUS

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การวิเคราะห์คลังข้อมูลเปรียบเทียบอัตถภาคของบทคัดย่อผลงานวิจัย ทางวิทยาศาสตร์ที่ตีพิมพ์ในวารสาร *SCIENCE* และ *NATURE* (GENRE ANALYSIS OF SCIENTIFIC ABSTRACTS: A COMPARATIVE STUDY OF *SCIENCE* AND *NATURE* JOURNALS)

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บทคัดย่อ

อัตถภาควิเคราะห์ (move analysis) นับเป็นการวิเคราะห์สัมพันธสารที่สำคัญแนวหนึ่งโดยมีจุดมุ่งหมายเพื่อกำหนดว่าตัวบทที่วิเคราะห์นั้นประกอบด้วยโครงสร้างของอัตถภาคและอนุวัจน์อะไรบ้าง งานวิจัยครั้งนี้มีวัตถุประสงค์หลักสองประการคือ 1) เพื่อค้นหาว่าบทคัดย่อผลงานวิจัยทางวิทยาศาสตร์ที่ตีพิมพ์ในวารสาร *Science* และ *Nature* ประกอบไปด้วยอัตถภาค (move) ใดบ้าง 2) เพื่อเปรียบเทียบอัตถภาควิเคราะห์ในการศึกษานี้ว่าต่างจากทฤษฎีต้นแบบหรือไม่ 2) เพื่อเปรียบเทียบอัตถภาคบทคัดย่อผลงานวิจัยจากทั้งสองวารสาร ทฤษฎีอัตถภาควิเคราะห์บทคัดย่อของ Santos (1996) ถูกนำมาเป็นต้นแบบในการวิเคราะห์อัตถภาค โดยใช้บทคัดย่อที่ตีพิมพ์ในปี พ.ศ. 2549-2551 ทั้งหมดจำนวน 100 บทคัดย่อ จากวารสาร Science จำนวน 50 บทคัดย่อ และวารสาร Nature จำนวน 50 บทคัดย่อ โดยใช้วิธีการสุ่มอย่างง่ายเพื่อเลือกบทคัดย่อในงานวิจัยครั้งนี้

เพื่อให้ผลการวิจัยครั้งนี้เกิดความน่าเชื่อถือผู้วิจัยและผู้ชำนาญการในสาขาภาษาศาสตร์และวิทยาศาสตร์ได้เป็นผู้ลงรหัสในการแบ่งอัตถภาค ผลการลงรหัสมีความเห็นที่สอดคล้องกันว่าบทคัดย่อผลงานวิจัยทางวิทยาศาสตร์ที่ตีพิมพ์ในวารสาร *Science* และ *Nature* มีความคล้ายคลึงกับทฤษฎีต้นแบบ Santos (1996) ซึ่งศึกษาในสาขาภาษาศาสตร์ ซึ่งประกอบไปด้วย 5 ส่วน คือ ข้อมูลที่เป็นภูมิหลัง การนำเสนองานวิจัย วิธีการวิจัย สรุปผลการวิจัย และการอภิปรายการวิจัย เป็นที่น่าสังเกตว่าแม้ในการเขียนบทคัดย่อในสาขาภาษาศาสตร์และวิทยาศาสตร์จะประกอบไปด้วย 5 องค์ประกอบหมือนกัน แต่การให้ความสำคัญในแต่ละองค์ประกอบต่างกันอย่างสิ้นเชิง จากการศึกษาครั้งนี้พบว่า บทคัดย่อในสาขาวิทยาศาสตร์ให้ความสำคัญกับการแสดงผลการวิจัยมากถึง (25.8%) รองลงมาเป็นการกล่าวถึงข้อมูลที่เป็นภูมิหลัง (21.8%) การอภิปรายการวิจัย (15.8%) การนำเสนองานวิจัย (11.1%) และอธิบายระเบียบวิธีวิจัย (11%) โดยสามารถที่จะสรุปได้ว่าในการเขียนบทคัดย่อในสาขาวิทยาศาสตร์มีรูปแบบการเขียนดังนี้ คือจะเริ่มต้นด้วยการกล่าวถึงข้อมูลที่เป็นภูมิหลัง จากนั้นจึงเป็นการเสนอผลการศึกษา และกล่าวอภิปรายการวิจัยพร้อม ๆ ไปกับการให้ข้อแนะนำ ทั้งนี้เป็นการพิจารณาจากความถี่ของการปรากฏซึ่งเป็นตัวกำหนดสถานภาพของอัตถภาคหลักและอัตถภาคเสริม นอกจากนี้จากการศึกษาพบว่าผลการเปรียบเทียบอัตถภาคของบทคัดย่อของทั้งสองวารสาร *Science* และ *Nature* นั้นไม่ต่างกัน

งานวิจัยชิ้นนี้จะเป็นประโยชน์ในการอ่านและการเขียนบทคัดย่อของนักวิทยาศาสตร์และนักวิชาการและผู้ที่สนใจที่จะตีพิมพ์ผลงานวิจัยของตนในวารสารทั้งสองนี้ สำหรับการศึกษาวิจัยในขั้นต่อไปควรศึกษารูปแบบการเขียนของบทความทั้งบทความ และเห็นควรที่จะศึกษาลักษณะทางภาษาศาสตร์ (Linguistic features) เช่น ลักษณะทางไวยากรณ์ แสดงอดีตกาล ปัจจุบันกาล (tenses) กรรตุวาจก (active voice) หรือ กรรมวาจก (passive voice)

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CHAPTER I
INTRODUCTION

1.1 Background of the study

Presently, in the world of international business and education, English is very important and widely used for both speaking and writing language. To be able to access world knowledge and information, both writers and readers need the mastery of English syntax and discourse patterns. There is ample evidence that technical communication will be effective if knowledge of both linguistic competence and knowledge of the appropriate structure of genres and forms are sufficient (Busch-Lauer, 1995).

Research articles (RAs) are undoubtedly one means of communicating in the wider international scientific community (Kanoksilapatham, 2005). In today's competitive academic world, the pressure to publish is continually increasing and in order to internationally publish in any prestigious journal, research articles must be well written and organized (Martin-Martin & Burgess, 2004). This has resulted in nearly all research articles for educational purposes being written in academic English, so as to be accepted and gain recognition on the international stage (Soler, 2007).

Almost all published articles, are written in English so as to be internationally accepted. In order to reach a wider audience and the international scientific community, scientific researchers prefer to use the written medium. This is to increase their chances of getting international recognition (Huckin & Olsen, 1991). In science, communication is crucial for sharing and exchanging ideas (Tobias & Tomizaka, 1992) as well as addressing new scientific knowledge. In order to achieve this sharing of information and ideas, linguistic competence is of paramount important. To function professionally in this arena implies an ability to participate in a whole range of genres. More importantly, writers will need the skills to adapt to and acquire a wide

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range of new genres (Flowerdew, 1993a) to share common purposes of communication.

Writing appears to be more suitable than speaking to describe science for the following reasons (Putipat, 1998). Firstly, writing being more structurally complex, abstract, analytical (Akinaso, 1982) and intergrated (Chafe, 1982) coincides with many aspects of science such as that of probing into the depths of physical nature and the universe. Secondly, writing emulates the logical thinking processes that are inherent in science (Aickin, 1991) as well as the importance of hierarchy and cause and effect reasoning (Duschl, 1990), by being linear and subordinative (Ohg, 1982). Thirdly, science's requirement for efficiency and economy in communication (Sager, Dungworth & Mcdonald, 1980) are met by writing through the lexical choices and the information-packed nature of writing (Halliday, 1989), and the fact that writing is more deliberately planned, explicit and easily retrievable (Cope & Kalantzis, 1993). Lastly, the more detached nature of writing (Biber, 1986) and reliance on the public arena as its predominant situation (Cope & Kalantzis, 1993) sit well with the impartial view of the scientific method.

To write research effectively, thus, the writers and researchers must have ability and skill in writing while readers need to have reading competence, in order to communicate to each other effectively (McMillan & Schumacher, 1997). Linguistic features play essential roles here**.** Additionally, they should have the ability to choose appropriate lexical and grammatical choices to communicate and convey the intended meaning (Kanoksilapatham, 2003). When writing research in the science and technology fields especially, researchers need to have the depth of knowledge to select appropriate lexical from various items to express meaning to readers. This is because readers may be novices, from cross disciplines, or even students who are not knowledgeable in the same field. That is to say, to have knowledge of a genre would facilitate readers and writers to cope with writing and reading tasks effectively.

Written articles are published within the scientific discourse communities. The research article written by and for the high-brow is as a rule considered to be the most important (Swales, 1990), and it is the 'best of the best" of academic writing (Bloor, 1996). This is because of its ability to absorb and disseminate the massive increase in scientific information (Atkinson, 1992). One can observe that research articles are

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becoming shorter and more formal (Bazerman, 1988), and there is a tendency for research articles to put more focus on the discussion than on the materials and methods (Atkinson, 1996). By placing the abstract at the beginning and using a fixed format of four sections, the research journal meets the demands for speed of today's science reader (Berkenkotter & Huckin, 1995). In addition, the web of work brings about a culmination of accumulated knowledge, a gate-keeping process, and intertextuality (Lemke, 1995).

It is indisputable that the language for discourse and dissemination of science throughout the world is English (Kaplan, 1986; Pueyo & Vol, 1996). Furthermore, Scientific English is able to reflect the general characteristics of an academic text, explicitness, objectivity, and in a formal register (Crystal, 1987). Scientific writing is marked by its simplicity and its to-the-point style; this is a result of its purpose of disseminating information and instructing, rather than entertaining.

Research articles are one of the genres that have been studied in great depth (Kanoksilapatham, 2005). They are a key method of introducing novel scientific knowledge into the wider scientific world (Soler, 2007). Researchers in today's world, wherever they come from, have to in the main write their articles in English in order to gain acceptance and international recognition for their work (Soler, 2007). In fact, most of them are not native English speakers. Thus, producing their work in English causes them great difficulty and is a huge challenge, as well as presenting the writer with linguistic and cultural obstacles. Consequently, they need to master a whole gamut of spoken and written genres of scientific research articles, poster and conference presentations, lectures and seminars, and grant proposals (Carter-Thomas & Rowley-Jolivet, 2001). English scientific research presents great challenges even to native speakers of English. Sengupta, Forey and Hamp-Lyons (1999) stated that "English native speaker-like competency does not guarantee that the individual has the skills to manipulate the production of academic genres….which are essential components for success in academia" (1999, p. 8). The studies conducted by Swales (1990) may help these academic persons.

Swales (1981) was the first person to explore the organization of research areticles (RAs). He classified each section of the RAs (Introduction, Method, Result, Discussion) into "moves". The notion of move as defined by Swales, (1990) is a

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functional unit in a text used for some identifiable purpose. It is most often used to analyze text for regularities in certain genres of writing. Move is also used to explain the function that any particular part of text realizes in the context of the overall task (Connor, Davis & De Rycker, 1995). A move's contribution to the communicative purpose of the genre can vary in length and size from a few words to several paragraphs. Genre study is not complete without investigating moves within the text, as moves are semantic and functional units of texts, which can be identified because of their communicative purposes and linguistic boundaries.

Since genre based study was introduced by Swales, it has been used increasingly in the field of language learning and teaching English academic writing, particularly in the field of English for specific purposes (ESP). Swales' move analysis has been applied to a variety of studies. Wood (1982) studied the Methods section of RAs. Thompson (1993) studied the Results section. Posteguillo (1999) studied the Discussion section. Additionally, Swales' move analysis model has been used successfully to capture the rhetorical organization of other types of academic writing. Thompson (1994) studied university lectures. Nwogu (1991) studied textbooks. Bhatia (1993) studied business letters and legal cases. It has been clearly demonstrated by these studies that the role of genre is very important in academic writing and shows the necessity for writers to acquire this knowledge.

Up to the present time, there have been few studies on the topic of abstracts and genre analysis. Both Swales (1990) and Bhatia (1993) briefly mention abstracts, but only within the larger context of research writing in general. In comparison with other parts of RAs, abstracts seem to have been neglected. In view of the crucial nature of research article journals, it seems odd that more research has not taken place on this very important part of RAs. Abstracts are a crucial feature of a research article as they represent all of the elements in the article. In addition, they may influence the decision whether the whole paper will be read because most readers make their decision as to whether to read on after reading the abstract (Wang & Bai, 2007). Potential readers rely on the abstract to give them a true reflection of what is contained in the RAs (Rowley, 1988; Salager-Meyer, 1990).

As an ideal vehicle for projecting news, the journal abstract appears to be growing in importance, as noted by a number of writers (Berkenkotter & Huckin,

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1995; Melander, Swales, & Friedrickson, 1997; Salager-Meyer, 1990, 1992; Ulijin & Pugh, 1985), and appears to be becoming longer and more informative, with an increasing amount of space being dedicated to the results of the articles they accompany (Berkenkotter & Huckin, 1995). Abstracts foreground important information for easy access, serve as an early screening device, frame the reading of the article they accompany and provide a summary of the main points of the article for later reference (Berkenkotter & Huckin, 1995).

Abstracts are a growing field of study in linguistics (Montesi & Urdicain, 2005b). The interest that linguists show in the genre of the RA abstract stems from the need to understand the mechanisms which underlie these multifunctional texts. As Ventola (1994, p. 333) states, abstracts "have become a tool of mastering and managing the ever increasing information flow in the scientific community". They constitute the gateway that leads readers to take up an article, journals to elect contributions, or organizers of conferences to accept or reject paper (Lores, 2004). Moreover, English is the major vehicle by which this particular journey is made. In fact, it is not unusual for journals published in languages other than English to expect the author to write an English abstract of their article. This requirement responds to the function of the English-language abstract, which is "to guarantee that the reported results of scientific work will circulate worldwide" (Ventola, 1994, p. 333).

A research article journal abstract is one type of academic genre. This study views abstracts as a particular text-type, one that lends itself particularly well to genre analysis. In comparison with other languages, the most used language in scientific research publications worldwide is English (Baldauf & Jurnudd, 1983; Garfield, 1983). Most research article journals require the mentioned types of abstract. There is some evidence supporting this. First, research articles these days are prefaced by English abstracts. Second, many journals often call for the English abstract together with a research article. Consequently, this study attempts to contribute to this area of research by analyzing the move structure in RA abstracts, an academic genre that has thus far been neglected from this point of view, in order to have a better understanding of how RA abstracts are linguistically constructed. Research articles in these modern times take many forms, from traditional time-honored publications, through to the use of Internet databases as a means of publication and information retrieval.

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The Internet is the largest academic resource in the present world. It affords access to an almost unlimited amount of information. With the advent of online search facilities offered by prestigious learning institutions and academics, to name just a few, the Internet has become indispensable as a research tool. However, to get the best from the Internet as a source of information, searchers need to develop the skill of being very precise about what it is they are looking for. This will cut down on the amount of irrelevant information to be read, thus saving a lot of time in sorting out what is important to the searcher. Searchers type keywords into a search engine and a vast array of relevant results will likely be found. As a consequence, using the Internet is very convenient because it is extremely quick and saves valuable time.

Researchers, practitioners, and scholars also use the Internet as a gateway for communicating, exchanging and sharing ideas and information as well as working in collaboration with other interested parties (Cross & Oppenheim, 2006). There is a wide variety of academic resources to be found, for instance, articles, reports, and news items. Most researchers, practitioners, and scientists take advantage of the Internet to search for information in e-databases from published journals, namely, *Nature*, *Science*, *Modern Language Journal*, and *International Journal of Applied Linguistics*, to carry out literature reviews of their studies or research. It is therefore apparent that e-databases have become an indispensable research tool for academics, scientists, and researchers; and abstracts will help them to make a decision on whether or not to read the full article.

1.2 Rationale of the study

There are at least four good reasons to study the topic of genre analysis. First, According to Bhatia (1997) genres are mainly described in terms of language concepts and use in a communicative setting. Consequently, they have a tendency to use relatively stable language in terms of structure and form; however, in some respects, they tend to restrict the use of lexico-grammatical resources in expressing these forms. Swales (1990, 2004b) quite rightly brings to our attention that a deep knowledge of the use of genres is more likely to be prevalent in those who are exposed to the use of genres on a regular basis, as opposed to those who are involved in them on an

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occasional basis. As a result, in order to write systematically and effectively, researchers need to have knowledge and understanding of the workings of genre.

Secondly, readers need to have the ability to understand and to achieve reading objectives comprehensively. Genre could assist readers in clarifying the nature and use of text as it is utilized in academic writing. Further to this, it will help readers to gain more insight into the workings and criteria for identification of genre as well as its construction, interpretation, and use in the world of academia (Bhatia, 1997).

The third reason pertains to learner needs. According to Skulstad (1999), one should aim at further developing the students' understanding of genre by sensitizing the student to the correlation between language and culture and the patterns of language use and norms in a discourse community in which these genres and rhetorical patterns are used. Analyzing genre reveals useful data that include models of rhetorical movements which academic writers and speakers use as a matter of course. Dixon (1987) and Sawyer and Watson (1987) considered that learners should be free to choose the generic conventions which are best appropriate to their needs. This idea seems to agree with Bakhtin (1986, p. 80), who says that "genres must be fully mastered in order to be manipulated freely".

The fourth reason is the development of appropriate teaching materials. As stated by Hopkins and Dudley-Evans (1988), English for Specific Purposes (ESP) literature is largely concerned with the practicalities of establishing procedures for verifying student needs, materials production, and the methodology for using these materials in the classroom. That said, however, ESP practitioners are becoming more aware of the need for further research into how to use teaching materials and classroom methods to fully prepare learners for the tasks that they will be expected to perform in English. A system for analyzing texts is needed that will describe the texts that the students are expected to produce and therefore be able to: (1) differentiate between different types of text; and (2) provide useful information about the nature of different type of texts that is of pedagogic value. Thus, the central principle of using authentic texts in the ESP classroom takes on a new dimension (Skulstad, 1999). Besides, genre analysis may also provide useful insights for the teaching of vocabulary (Ventola, 1984). The genre of service encounters, for example, may be analyzed in terms of field. If the field is postal matters, we may predict that lexical items such as

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stamps, *surface-mail*, *air-mail* and *parcels* will frequently occur. She also says that teaching lexis in connection with genre and register notions is apt to make learning more purposeful.

In short, a genre analysis of scientific abstracts is a worthwhile study with benefits for all concerned both practitioners and researchers. Researching corpora from whatever discipline will not be as time-consuming as writers, scientists, and teachers become more skilled at producing coherent and concise RA abstracts.

1.3 Statement of the problem

According to Cross and Oppenheim (2006), over the past three decades the publication of science research articles has seen a dramatic increase. This is clearly shown by the Information and Library Management (ILM) literature, and is documented in other academic fields. This dramatic increase, of course, has resulted in the phenomena known as “information overload or document inundation” (Lancaster, 2003, p. 104; Pinto, 1994, p. 111). The result of this overload is that efficient information retrieval systems have become of the utmost importance (Tibbo, 1993). For the potential reader a short and concise abstract to aid in the search for articles is also vitally important.

There have been, in fact, numerous studies on the readability of abstracts (Armstrong & Wheatley, 1998; Blakeborough & Oppenheim, 1980; Fox & Hartley, 2003; Hartley & Sydes, 1995; King, 1976; Snizek, Oehler & Mullins, 1991; Wheatley & Armstrong, 1997). There have been few studies on the structural discourse and genre analysis of abstracts, especially in the field of science. Abstracts, in fact, lend themselves very well to genre analysis. Abstract analysis is seen as being a strong means of clarifying and explaining the contents and it “provides a communication system for the use of writers and writing, and readers and critics in reading and interpreting” (Swales, 1990, pp. 42-45). Moreover, accurate communication in the scientific and technical fields requires both linguistic competence and knowledge of appropriate structures of genres and the forms of their linguistic representation (Busch-Lauer, 1995).

The lack of formal training in abstract writing increases the risk of subjectivity and verbosity (Cross & Oppenheim, 2006). For international publications to accept a

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researcher's article, the hallmarks of a good abstract are that it is short, accurate, and completely reflects the overall contents of the article in question. The problem is that most writers have never had any formal training in writing an abstract; as a result, novice scientists are therefore placed in a problematic situation with little indication on abstract writing styles in the different disciplines and genres.

Abstracting is a complex and difficult task that requires sound knowledge of the principles of summarizing and defining macrostructures (Cross & Oppenheim, 2006). Writing an effective abstract is a daunting task, especially for non-native speakers of English, Bloor (1984 cited in Swales, 1990) agrees with this. Her research at the University of Cordoba, Spain, on needs analysis revealed some surprising answers. Learners were expected to produce journal abstracts with English abstracts. Students were not happy about this and resorted to using translation services to meet this requirement. Additionally, non-native English (NNS) writers have to know more than what is suggested in abstract manuals for example, the particular conventions: layout, form, and style of their own discipline or overall length.

Busch-Lauer, (1995) listed the constraints that make writing and summarizing in particular so difficult for NNS. Basically there are three categories of constraints:

(1) Inadequate language competence

Text production is impaired due to a lack of knowledge of the L2 lexico-grammatical system by the NNS. The problems encountered, teaching experience shows, occur with sentence types, grammatical patterns and the inappropriate use of cohesive devices, and lexis (Swales, 1987).

(2) *Insufficient awareness of summarizing principles and of the discursive/rhetorical macrostructure of abstracts in L1 and consequently in L2*

Because of the time it takes, writing and summarizing skills are seldom practiced in the L2 teaching process, probably because there is no immediate feedback as there is for speech. Furthermore, producing an abstract is a complex process requiring the ability to organize thoughts effectively to express them using appropriate and concise language. In particular this holds true for topic sentences, arrangements of moves, paragraphing and paragraph-linking devices.

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(3) *Insufficient awareness of cultural, cross-linguistic peculiarities*

Clyne (1991 cited in Busch-Lauer, 1995) pointed out the very obvious differences between the "Teutonic" and "Anglo-Saxon" styles. Therefore, because of the absolute dominance of English, if NNS of English writers do not follow the Anglo-Saxon formal norms, this is according to Clyne, "indicative of faulty research".

Due to the above mentioned inadequacies, it could be said that NNS of English often feel less competent and even inferior when writing abstracts in L2; and they basically rely on translation services. These, however, often produce inadequate abstracts in terms of accuracy of the scientific content, the information conveyed, and the linguistic means applied. It is crucial that students are taught some of the processes of constructing a well-formed and effective abstract, so that they can successfully present, communicate, and persuade others of the importance of their research (Cross & Oppenheim, 2006).

It is therefore not surprising that research into abstracts has increasingly become a topic of discussion (Ayers, 2008; Bonn & Swales, 2007; Busch-Lauer, 1995; Cross & Oppenheim, 2006; Hartley, 1999,2000a,2000b,2002; Harley, Pennebaker & Fox, 2003; Hopewell, Eisinga & Clarke, 2007; Kaplan, et al, 1994; Kemper, Dreyer & Casey, 1997; Lores, 2004; Martin-Martin & Burgess, 2004; Montesi & Urdiciain, 2005a,2005b; Pinto & Galvez, 1999; Rothkegel, 1995; Samraj, 2005; Salager-Meyer, 1990,1992; Santos, 1996; Taddio et al, 1994; Tibbo, 1992).

Consequently, this study is an attempt to contribute to the corpus of available knowledge on the writing organization of abstracts as seen in two prestigious journals: *Nature* and *Science*. The ultimate aim is to reveal the move structure used in those journal abstracts in order to help those native and non-native English speakers who wish to publish their work in the wider international arena.

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1.4 Purpose of the study

The primary aim of the present research focuses on abstracts and abstracting in the field of science published by two leading science journals, namely *Science* and *Nature*. This research work is intended to explore how communicative purposes are achieved in one science field. Therefore, a hundred abstracts that have appeared in *Science* and *Nature* during the period of 2006 to 2008 were analyzed. The articles published in these journals belong to various scientific fields. These journals publish multidisciplinary science issues all around the world. Thus, the content and authors of these articles are not a factor for selecting them. This study explores the move ordering pattern (move structure) of those journals on the grounds of Santos's (1996) moves pattern, with the aim of knowing whether there were move variations found in the pattern. The following are the specific research questions that this study aims to explore.

1. What moves were found in the science article abstracts?
2. How do the scientific abstracts in Science and Nature differ from Santos' pattern?
3. Do the science article abstracts in *Science* differ from those found in *Nature*?

To facilitate analysis of scientific abstracts, an appropriate abstract move patterns theory needs to be used as a paradigm. For this study, Santos' abstract move patterns theory was used to identify the various moves within scientific abstracts. Santos' previous work in this area was confined to linguistics. He modeled his work on the work of the highly respected linguists; Swales, (1990), Dudley-Evans, (1986), and Crookes, (1986). Santos' abstract move patterns theory provided an ideal platform for this study of scientific abstracts.

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1.5 Significance of the study

The move analysis in this study significantly contributes to a clearer understanding of how article abstracts in science are constructed. It is anticipated that the findings of this research will serve as an information source which will be helpful in the following ways:

1. Language teachers and researchers may obtain an accurate picture of how information is typically organized in research paper abstracts in the field of science.
2. Practitioners, non-native speakers, including scientific researchers, and students who wish to publish their RAs in *Science* and *Nature* may find that the outcome of this study will be helpful for writing their own research abstracts.
3. Readers who are novices and want to access scientific knowledge may find that the results of this study will be helpful for comprehending the contents of the articles that are of interest to them.
4. ESL/EFL graduate students, who have to conduct research, might find this study to be a useful guide when writing abstracts.

1.6 Scope and limitations of the study

This research was limited in the following ways:

1. The article abstracts used in this study were in the science field. All were drawn from *Science* and *Nature* e-journals.
2. Only one hundred science article abstracts found were analyzed
3. The analysis of the organization of science article abstracts was on the grounds of Santos's (1996) abstract move patterns.

1.7 Definition of terms

1. A corpus is "a collection of naturally occurring examples of language, consisting of anything from a few sentences to a set of written texts or tape recording, which have been collected for linguistic study" (Hunston, 2002, p. 2).

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2. Genre analysis is an explanation of why language is used differently within specific cultures and a demarcating of this specific language into smaller elements called moves (Crossley, 2007)
3. A research article journal abstract, simply defined, is a conclusion that presents succinctly the objectives, scope, and findings of a document. This information is usually conveyed together with an indexing system, which further helps to identify document content. An abstract, as a rule, is aimed at a specific group of users who either may not read or may not have easy access to the original document. Abstracts usually summarize the main contents, purposes, methodologies, results and conclusions (Maizell & Smith, 1970).
4. "Move" is defined as a segment of an article abstract. Each move demonstrates a particular intention or purpose while contributing to the overall communicative purpose of the text (Swales, 1990).
5. Mandatory move, refers to the cut-off frequency of 20% of occurrences, which was arbitrarily established as a potential measure of move stability for any move posited in this study, specifically, to be recognized as a conventional move.
6. Optional move, refers to when the frequency of a move was lower than 20%.

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CHAPTER II
REVIEW OF LITERATURE AND RELATED RESEARCH

The purpose of this present research is to analyze a corpus of scientific article abstracts by means of using a move analysis approach. Previous research has shown that move patterns are found in research articles, especially abstracts. This is the ultimate aim of this study. This chapter will first introduce the notion of corpus, which is the main concern of this research, and then goes on to address the notion of genre and move analysis as hypothesizes by Swales (1981, 1990), which is a crucial facet of teaching ESP. This paper then moves on to discuss article journals and abstracts, exploring prior research and provides an in-depth look at the genre that has been the subject of previous study. A subsequent section looks at a genre based approach to teaching, writing and aspects of reading. Additionally, all sections provide a prior study of each issue in order to gain an insight into how scientific abstracts are linguistically constructed.

2.1 Corpus analysis

A corpus should be defined by describing both its form and its purposes (Hunston, 2002). Naturally occurring language is described collectively by linguists as *corpus*, which may consist of just a few sentences, to a large body of text or recordings that have been collected for linguistic study. Corpus has been described by linguists such as Trask (1993) as “a body of linguistic data from a particular language, in the form of recorded utterances or written texts that is available for analysis”. Similarly, Leech (1997) states, “a corpus is, of itself, a rich resource of authentic data containing structures, patterns, and predictable features that are waiting to be “unlocked” by human intelligence”.

Due to the ease of computers to store and process large amounts of text, much more text is easily available for the purposes of study than the paper based collections that have been traditionally available for interested researchers and teachers (Hunston,

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2002). A text is planned for some linguistic purpose and very little of the text occurs by chance (Hunston, 2002). How the text is selected is dictated by the purpose that it is intended, and the aim is not directed at preserving the text, but to make use of it for some purpose (Carter & McCarthy, 1995). Herein lies the difference between a library or an electronic storage and retrieval system and a corpus.

Corpus is stored so that it can be studied both qualitatively and quantitatively, the purpose being not simply to read them which again distinguishes corpus from the library and archives (Stubbs, 1999).

Linguists in the past mainly used paper based methods of analyzing language features of a text. There were numerous problems to this. As Cheung (1993) states, "people might have always wished to do text analysis but have avoided doing so because of the labor and time involved". Because of the time constraints of analyzing paper based text, results may not be accurate, but fortunately in this new age of computer technology, computer programs have been developed that facilitate speedy and accurate results. As a result, problems of compiling and analyzing corpora have been in the main eliminated and resulting in great changes in the way patterns are compiled and analyzed (Kaewphanngam & Soranataporn, 2002).

2.2 Genre analysis

Bhatia (1997) proclaimed that the linguistic approach of genre analysis is defined as the study of linguistic behavior in both academic and professional settings. The concept of genre has over the last few years become a cornerstone of language education (Hyland, 2004). Genre is often defined as "a distinctive category of discourse of any type, spoken or written" (Swales, 1990, p. 33) that serves as "responses by speakers or writers to the requirements of a social context" (Johns, 2002, p. 3). ESP practitioners as a rule describe or define genre as "structured communicative events engaged in by particular discourse communities whose members share common communicative purposes" (Swales, 1990, pp. 45-47; 2004a). Roseberry (1997) was even more succinct, defining genre as "property of text which allows them to be defined as a sequence of segments or moves, with each move accomplishing some part of the overall communicative purpose of the text". Some linguists have categorized genre into three theoretical positions in applied linguistics

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(Hyon 1996). First, the approach as reported by Systemic Functional Linguistics is adopted by many researchers who investigate the broad genres of teaching (Henry & Roseberry, 2001) and learning, such as description, narration, exemplification, and argumentation, in the Australian school contexts (Paltridge, 1996). Second, the New Rhetoric approach is established by composition researchers in North America who are engaged more in the social and ideological significance than in the rhetorical organization and the language features of genres (Devitt, 2004). Third, English for Specific Purposes (ESP) is concerned with the major theoretical and pedagogical aspects which framed genres as oral and written text types defined by their formal properties as well as by their communicative purposes within social contexts (Bhatia, 1993).

Genres are an area of interest and a very important phenomenon (O'Neill, 1997) because they reflect the cultural values and norms of a particular society that produce them.

> A genre is a socially recognized, repeated strategy for achieving similar goals in situations socially perceived as being similar. A genre provides a writer with a way of formulating responses in certain circumstances and a reader a way of recognizing the kind of message being transmitted.…Thus the formal features that are shared by the corpus of texts in a genre and by which we usually recognize a text's inclusion in a genre, are the linguistic/symbolic solution to a problem in social interaction. (Bazerman 1988, p. 62)

As a result, a number of important movements in the teaching and learning of language has emerged that promotes the notion of genre in educational linguistics. One important stand of influence in this area is as a result of the work of linguists and language educators who have aimed to apply insights gained from systemic-functional linguistics to language education (Hyon, 1996). In order to master academic, professional or educational discourse, knowledge of genre is very necessary, this has been widely acknowledged for the past decade, regardless of the perspectives adopted (Ruiying & Allison, 2004).

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2.3 Move analysis

Basically Swales' notion is analysis of rhetorical moves (1990). Swales' early paradigm is characterized by the analysis of "moves", or the "defined and bounded communicative act with the main purpose to achieve one main communicative objective". A segment of text that performs a communicative act is referred to as a "rhetorical move", and each of the four sections of a research article is made up of an identifiable sequence of rhetorical moves. These four sections comprise Introduction, Method, Result, and Discussion (IMRD). Broadly speaking, a genre is based on moves with each move pointing to a basic coherent understanding of the text (Swales, 1981,2004b). Genres are associated with particular discourse communities, such as academic disciplines or particular professions, and frequently use the nomenclature of these communities, such as "research article" and "lab report" to identify valued genres (Johns, 2003).

If a writer is to be accepted by the genre community, specific language associated with each move must be carefully considered to be wholly accepted by the target genre community. Connor, Precht, and Upton (2002) asserted that when writers move between different cultures with the same genre, some re-learning must take place so as to be able to correctly take into account the cultural differences within the same genre. Therefore, if one wants to move between cultures one should re-learn the genre within those particular groups.

Move analysis then, is basically isolating text and examining it to discover the structure of certain genres paying attention to the allowable move order, move construction, and linguistic features. Being able to identify these key linguistic features leads to a good understanding of genres and allows for this understanding to be passed on to others and facilitate their assimilation into the genre. Having this understanding of genre within different cultural communities allows native and non-native English writers, readers, and researchers to be more aware of what is expected among academic disciplines. As a consequence, fewer mistakes will be made in fulfilling the expectations of a genre. We can assert therefore, that these variations should be taken into account when writing or reading research articles.

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2.4 Move analysis and English for Specific Purpose (ESP)

Hyon (1996) states, ESP researchers have been interested in genre as a tool for teaching spoken and written language to nonnative speakers in academic and professional settings (Bhatia, 1993; Flowerdew, 1993b; Gosden, 1992; Hopkins & Dudley-Evans, 1988; Love, 1991; Nwogu, 1991; Swales, 1990; Thompson, 1994; Weissberg, 1993). These scholars have framed genres as oral and written text types as shown by their formal properties and the communicative purposes within the within social or cultural contexts. Swales (1981, 1990), whose work has been pivotal in forming genre theory in ESP, describes genres as "communicative events" that are characterized both by their "communicative purposes" and by various patterns of "structure, style, content, and intended audience" (1990, p. 58). There are other descriptions of ESP and genre which are concerned with both social function and form (Bhatia, 1993; Flowerdew, 1993b; Hopkins & Dudley-Evens, 1988; Thompson, 1994; Weissberg, 1993).

The accepted leader in genre and move analysis in the field of ESP is Swales. His paradigm of discourse analysis is used extensively by researchers and teachers (Kanoksilapatham, 2005). In order to describe various texts and rhetorical organizational patterns in a variety of academic disciplines and genres, Hopkins and Dudley-Evans (1988) studied Masters of Science dissertations. Samraj (2002) studied university lectures. Thompson (1994) studied movie reviews. Swales developed his framework in order to help university students who were non-native speakers of English. Swales' notion of move analysis has been implemented in many professional situations from around the world (Kanoksilapatham, 2005). In the Asian region, for example, ESP research was led by Bhatia (1993, 1997) in English and in Business and Technology (EBT) in Singapore, and By Flowerdew (1993b) in English for Professional Communication (EPC) in Hong Kong.

Swales was interested in genre analysis as it was obviously useful in applied linguistics and to teaching in Languages for Academic Purposes (LAP) courses in particular (Ventola, 1989). Eggins and Martin (1997) Describe genre theory as a means of differentiating how text is like and unlike each other and why. Similarly, Hopkins and Dudley-Evans (1988) say that genre analyses provides useful information about the nature of different types of text that is pedagogically useful. The article

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abstract may include models of the rhetorical organization of texts which belong to a particular genre.

Swales (1990) noticed that his students were running into difficulties writing articles, especially the first few paragraphs. Central to an LAP course, is the research article so, as a consequence of his observations, Swales thus decided to carry out a study of "research article introductions" in order to gain useful insights for such ESP courses. As a result of this analysis, he formulated his model of the rhetorical movement conventionally found in these introductions ….the Create a Research Space (CARS) model. This name reflects the main communicative purpose of a research article introduction very aptly. That is to say that its purpose is to establish the writers work within the relevant research tradition. It follows that this would have an outcome of allowing native and non native speakers to write effectively. Swales' (1990) study identified three moves which serve to provide a solution to this rhetorical problem. The moves are; Move 1 Establishing a territory; Move 2: Establishing a niche; Move 3: Occupying the niche.

Skulstad (1996, 1997) employed move-step analysis to the field of business. He identified a model of move-step analysis in the introductions of corporate annual reports, the chairman's statement, as the Relationship and Confidence (RECON) Model. These specifics three moves are establishing relationships, maintaining confidence, and reinforcing the relationships that writers of British chairmen's statements conventionally make. Therefore, these studies could be facilitating scholars, writers, and practitioners to produce effective writing tasks.

ESP analyses focuses on the general rhetorical organization within various academic and professional texts. In addition, a number of ESP studies also look at sentence-level linguistic features that are prominent in particular types of texts, such as passive voice in Tarone, Dwyer, Gillette, and Icke (1981), hedging in Hyland (1994, 1996a, 1996b, 1996c, 1998, 1999, 2000), and tense in Gunawardena (1989). The dual nature of considering both the communicative functions of the texts and linguistic exponents for each function allows ESP analyses to be relatively thorough in capturing linguistic characterization of texts.

It has also been claimed that move-based applications can help non-native speakers of English to master or control the macro level organizational structures and

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the micro level of linguistic features conventionally used in texts required in their disciplines and professions (Bhatia, 1993; Flowerdew, 1993b; Hyon, 2002; Swales, 1990). Rhetorical consciousness can be developed in learners by working with them to examine particular texts and explicate the ways in which those texts make use of accepted practices and structures and to look critically at the genres they encounter in their academic life.

Table 2.1 *Summary of Genres*

Section/Study	Discipline	Major Findings
Writing		
1. Bazerman (1988)	- Analysis of high school and middle school students' appropriation of the Research Article genre in science classes.	- The coding scheme is enable the comparison of genre appropriation patterns across a large number of texts from a variety of school and curricular settings. The coding scheme produces a series of numerical scores to indicate students' fulfillment of the standard rhetorical move of scientific research articles, the written personas that students project, the ways in which they use sources and authorities to support argument.
2. Golebiowski (1998)	- Rhetorical approaches to scientific written an English-Polish contrastive study	- The results of the analysis indicate that discoursal organization employed by Polish authors differs from that utilized by Anglo-American scholars. It is argued that styles of academic prose are interconnected with underlying cultural values.
3. Conner (2000)	- Variation in rhetorical moves in grant proposals of US humanists and scientists	- The system of moves was clear and meaningful to the researcher-writers, but that US grant proposals required an additional 'institutional commitment' claim, a hypothesis statement in addition to goals, and move metatextual transitional statements than the proposals in the earlier EU study.

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Table 2.1 *Summary of Genres* (cont.)

Section/Study	Discipline	Major Findings
Reading		
Hyon (2001)	- Long-term effects of genre-based instruction: a follow-up study of an EAP reading course	- The class genres were related to some of the students' academic and non-academic reading materials. In addition, students' commentary on text passages and impressions of the class indicated that a number of students remembered class genre features and thought they applied the material to their L2 reading and writing.
Teaching		
1. Flowerdew (1993b)	- An educational , or process, approach to the teaching of professional genres.	- The writer examines distinctive features of professional genres in order to illustrate some of the types of variation which genres are subject to, and which learners need to be made aware of. A number of genre analysis activities are presented to demonstrate how learners can be taught to approach, adapt to, and ultimately acquire new genre.
2. Kay & Dedley-Evans (1998)	- What teachers think?	- The writers' experiences and concerns of the participants indicate that while genre-based teaching approaches are largely viewed positively, there are many concerns to be addressed-through research, practice, and dialogue. Genre, in short, continues to be a controversial topic, though never a dull one.
3. Henry & Roseberry (1998)	- An evaluation of a genre-based approach to the teaching of EAP/ESP writing	- The results of the study indicate that a teaching approach focusing on rhetorical organization can be successful in an EAP/ESP teaching situation with reasonably advanced learners. One possible explanation for the results is that an awareness of the generic structure of the text makes it easier for writers to organize their material, which allows them to concentrate on combining the elements effectively in terms of both achieving their communicative goals and producing more highly textured writing.

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Table 2.1 *Summary of Genres* (cont.)

Section/Study	Discipline	Major Findings
Textbook		
Shi & Kubota (2007)	- Pattern of rhetorical organization in Canadian and American language arts textbooks: An exploratory study	- The authors found that these texts all have a three-part structure consisting of introduction, body, and conclusion. However, the introductions in some texts are lengthy with multiple paragraphs. In addition, the opinion or main idea is not necessarily presented in the introduction but rather in the middle or at the end of the essay. The findings of a gap between the pattern recommended for school writing and the actual structures that appear in some of the reading materials in school textbooks highlights the problem of explicating discursively constructed rhetorical conventions in teaching.
Letters		
1. Yunxia (1997)	- An analysis of structural moves in Chinese sales letters	- The findings show that all sales letters in the corpus follow a linear development and that most sales letters follow a direct approach and speak to a point, although some are indirect, providing introductory or transitional sections. This indirectness is basically linear in structural development and is not related to 'circularity' or 'digression'.
2. Henry & Roseberry (2001a)	- A narrow-angled corpus analysis of moves and strategies of the genre: 'Letter of Application"	- The results show striking differences between the different levels of analyses and form 'general' English. The analysis has revealed that within one move of the genre, a very wide range of discourse and syntactic features can be found which provide more detailed genre specific information than can be obtained from existing textbooks or form a dictionary. In order to teach the Letter of Application, ESP practitioners need to be aware of not just this range of features, but where they are used and for what purpose.

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Table 2.1 *Summary of Genres* (cont.)

Section/Study	Discipline	Major Findings
3. Santos (2002)	- Genre analysis of business letters of negotiation	- In this study Santo asserts that whereas genre analysis can provide students with valuable data from language in use, he goes on to say that in fact a more holistic approach as suggested by St. John (1996), Gunnarson (1997), Firth, (1991), and Louhiala_Salminen (2002) seem to provide teachers and consequently students with more comprehensive data about context effects on language communicative processes within genres.

2.5 Research articles

Over the last 20 years, a large number of studies on academic writing have been devoted to the research article, in particular, its structure, social construction, and historical evolution (Samraj, 2002). A number of these studies have concerned themselves with the overall organization of various parts of the research article, such as introductions (Swales, 1981, 1990; Swales & Najjar, 1987), the result sections (Brett, 1994; Thompson, 1993), discussion (Hopkins & Dudley-Evans, 1988). Ruiying and Allison (2004) stated that the prior studies can be further summarized into two groups according to differences in focus. One group of studies is on the structure of research articles, dissertations or other professional writings (examples among many are Bhatia, 1993; Holmes, 1997; Nwogu, 1997; Swales, 1990), the other is on the particular features of research articles, such as the use of hedging, modality and reporting verbs (examples include Hyland, 2000; Salager-Mayer, 1994).

2.6 Article journal abstracts

In recent times, research articles are more widely read than in previous decades. The advent of computers and e-databases (including the Internet) has made journals of all genres accessible to everybody. The readership has changed so much over recent times that journals are now being written with this new readership in mind (Ayers, 2008).

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Evidence indicates that scientific journal articles are becoming more news-oriented (Ayers, 2008). With the emergence of e-journals and the profusion of and easier access to scientific articles, it will undoubtedly bring about change, possibly to the promotional content of research articles. The value of the research article abstract appears to be growing in importance and is an ideal vehicle for projecting news value. This has been noted by a number of writers (Berkenkotter & Huckin, 1995; Melander, Swales, & Friedrickson, 1997; Salager-Meyer, 1990, 1992; Ulijin & Pugh, 1985; Wheatley & Armstrong, 1997), and seems to be getting longer and more informative, more and more of the content being dedicated to the results of the research articles they accompany as well as providing a summary of the salient points of the article (Berkenkotter & Huckin, 1995).

2.6.1 Definition of abstract

An abstract, simply stated, is a condensed document and represents the main contents of a research article (Cross & Oppenheim, 2006). The abstract is basically a concise summary of a much longer report (Lores, 2004). Although the term suggests differing meanings in diverse contexts, one can surmise that an abstract will reflect accurately the central points presented in the paper and probably mirrors the writing style within the main corpus (Rowley, 1988, p. 10) abstract is both a representation and condensed document of a parent document. The American National Standards Institute (ANSI) (1979 cited in Bhatia, 1993) defines it as follows: "[it] is an abbreviated, accurate representation of the contents of a document, preferably prepared by its author(s) for publication with it." The *Oxford English Dictionary* defines "representation" as a set of means by which one thing stands for another. The idea of condensing a document, or extracting the most pertinent details, is one example of a cognitive process that is used in circumstances that need memory and reasoning (Anderson, 2000; Sternberg, 2003; Endres-Niggemeyer, 1998).

This definition seems to suggest that abstracts faithfully portray the form and content of their originals. But, as Nwogu (1990, p. 113) points out, this is not always necessarily so. In fact, although abstracts may represent the content of their originals, they do not (always) represent the surface form of these originals.

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2.6.2 Types of English abstracts

There are two basic types of English abstract. They are: indicative or descriptive and informative abstracts (Eisenberg, 1982; Huckin & Olen, 1991). Further to this, Swales and Feak (1994) suggested two other approaches to writing abstracts. First approach is known as "results driven" abstract writing which concentrates on research findings and results. The second is "research paper summary" writing. That is to say, in this approach, that the writer has summarized each section of the paper such as purposes, methods, findings, conclusions and discussion. In either case, both types of abstract can be informative or indicative.

Indicative or Descriptive Abstracts let the reader know what the report, article or paper contains and include the, methods, and scope of the report, article, or paper. In the abstract, it will refer to the author's results, conclusions, or recommendations, as well as introducing the subject. Abstracts are usually found in review papers or reference reports of government documents or in literature. The main function of these abstracts is to help readers understand the general nature and scope of the research article; it indicates the subject and the main findings of the paper, but it does not go into a detailed step-by-step account of the process involved.

Informative Abstracts inform as to exactly what the report, article, or paper contains. It will also include problems, purposes methods, and scope of the report, article, or paper. They provide the report, article, or paper's results, conclusions, and recommendations. Medical Science abstracts are 'structured abstracts' (Ad Hoc Working Group, 1987; Huth, 1987; Mulrow, 1987; Taddio et al, 1994). It is called this because of the way it is laid out under particular headings such as *Purpose*, *Subjects*, *Methodologies*, *Intervention*, *Results*, and *Conclusions*. Informative abstracts first show readers what the article as a whole is about and to help them to decide whether to carry on reading. Second function, is to serve as a text itself but in a precise version to give readers a picture for determining whether the subject matter is related to their interests. The last function, is to prepare the reader for the main details should they decide to read the complete article. On the other hand, informative abstracts encapsulate the whole paper; as Jordan (1991, p. 50) states, "they act as a report in miniature". Additionally, according to Swales and Feak (1994), these three abstracts below are also informative.

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1. A conference abstract is written in order to determine whether or not an author will be accepted for the conference program. Furthermore,

2. An abstract journal abstract is often used in special conventions and is written by professional abstractors.

3. A research paper abstract, is placed in research and based on a text that has already been written. This type of abstract is 'non-structured or traditional one' in medical science view, since it is written without headings and simply summarizes the contents of the whole article (Ad Hoc Working Group, 1987; Mulrow, 1987; Taddio et al, 1994).

Scientists rely on the abstract as a concise and accurate reflection of the main body of a document (Salager-Meyer, 1990; Rowley, 1988). There are five of reasons for the importance of abstracts:

First, abstracts save reading time, as the reader is able to ascertain as to whether the full-text document is likely to be of sufficient interest to warrant reading in its entirety.

Second, they help overcome the language barrier, they allow the reader access to the central themes of an article written in a foreign language.

Third, they can provide some language preparation for the text by using key words and ideas that are used in the full-text document;

Fourth, if they are well written abstracts they can serve as a key to understanding fully the argument of the original article (Swales, 1990).

Fifth, they serve the function of a current awareness tool.

2.7 Moves in English abstracts

Both indicative and informative abstracts consist of typical patterns such as Introduction, Method, Result, and Discussion (IMRD). These patterns are called "moves" by linguists. Prominent linguists employed move-based patterns to every abstract. They are Swales (1990), Bhatia (1993), Taddio et al (1994), Santos (1996). Details are explained.

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2.7.1 Bhatia's abstract pattern (4 moves)

According to Bhatia (1993), English abstracts basically consist of four moves: Introducing the Purpose, describing the Methodology, summarizing the Results, and presenting a Conclusion. This pattern is also accepted by many researchers (Day, 1988; Maher, 1990; Phantama, 2000; Swales, 1990).

Move One: Introducing the *Purpose:* Here the author's intentions, thesis or hypothesis which forms the basis of the research are spelt out precisely. It could also include the goals or objectives of research or the problem that the author wishes to engage.

Move two: Describing the *Methodology*. In this move the author strongly indicates the experimental design, and information on the data, procedures or method(s) used and, if necessary, the scope of the research being reported.

Move Three: Summarizing the *Results*. Here is where the author comments on his findings and recommends solutions.

Move Four: Presenting the *Conclusion*. This move is used to give the authors interpretation of the results and draw inferences from these interpretations. It is not unusual to include some indication of the implications and applications of the present findings. According to the move mentioned above, it can be concluded that different moves serve different purposes.

2.7.2 Taddio's et al (1994) abstract pattern (7 moves)

1. The first move is purpose given, which asks: 1) was any information on the purpose given? 2) Was the purpose explicitly stated? 3) Was the main purpose distinguished from the secondary ones?

2. The second move is limited to methodology, which can be divided into two sub-moves –design and setting. To measure the design, questions such as 1) was any information on the research design given? 2) Were technical descriptors used? 3) If a follow-up study, was the duration given? While to measure the setting, questions about 1) was any information on the setting given and 2) was the level of clinical care (e.g. primary care) indicated?

3. The third move is subjects move, the following questions are asked: 1) Was any information on the subjects given? 2) Were common demographic characteristics

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given? 3) Were technical descriptors of subject selection used (such as, random sample)? 4) Was the number of subjects indicated? 5) Were the response and refusal rates indicated? 6) Was the number of dropouts and losses indicated? 7) If the samples were matched were matching characteristics given, In order to examine the interventions?

4. The fourth move focuses on: 1) Was any information on intervention given? 2) Were the commonest names and common synonyms given? 3) Was a description given? 4) Was the duration indicative?

5. The fifth move is a measurement move, four questions are asked: 1) Was any information on the measure given? 2) Were the variables explicitly defined? 3) Was the source of the data given? 4) If the measurements were subjective were the observers blinded to the patient groupings?

6. The sixth move is a results move, which needs to check: 1) Were any results given? 2) Were they directly related to the purpose? 3) Were appropriate numeric data given? 4) Were appropriate statistical values given?

7. The seventh move is the conclusion move, in this move, six questions are asked: 1) Were any conclusions drown? 2) Were they directly related to the purpose? 3) Were they consistent with the results? 4) Were the study's limitations mentioned? 5) Were the study's implications mentioned? 6) Were there recommendations for further study?

2.7.3 Santos's abstract pattern (5 moves)

Santos (1996) studied the organization of 94 abstracts published in three prestigious journals named Language Learning, Applied Linguistics, and TESOL Quarterly in the year 1990 to 1992. Santos continued the work of Swales (1990), Dudley-Evans (1986), and Crookes (1986). As a result of this further research he found one new move which he called *'Situating the Research or Background Information of the Study*. Thus, he comes up with these five moves. Details and examples are given in table 2.2 below.

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Table 2.2 Santos's abstract pattern

The Five Moves
Move 1: Situating the Research
Submove 1A – Situating current knowledge
And/or
Submove 1B – Citing previous research
And/or
Submove 1C – Extended previous research
And/or
Submove 2- Stating the problem
Move 2: Presenting the Research
Submove 1A – Indicating main features
And/or
Submove 1B – Indicating main purpose
And/or
Submove 2 – Hypothesis raising
Move 3: Describing the methodology
Move 4: Summarizing the results
Move 5: Discussing the research
Submove 1- Drawing conclusions
And/or
Submove 2 – Giving recommendations

Santos (1996) developed his own notion of move patterns which comprised of the five move pattern: Move 1: Situating the research, Move 2: Presenting the research, Move 3: Describing the methodology, Move 4: summarizing the results, Move 5: Discussing the research. Move 1 can have a maximum two submoves, submove 1 has 3 subcategories (submove 1A- Stating current knowledge, submove 1B- Citing previous research, and submove 1C- Stating a problem). In Move 1 submove 1A, the writer gives the reader a feeling of where his research is coming from and raising interest so as to encourage the potential reader to read the complete

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article. Move 1 has one obligatory element and that is submove 1. This can take one of three predominating forms. To illustrate these moves/submoves, Santos (1996) presents the following examples:

- *Cloze tests have been the focus of considerable interest in recent year*s as easily constructed and scored measures of integrative proficiency.
- *Current research has supported the existence of* a critical period for the acquisition of the grammar of a second language.

Move 1: Situating the research submove 1B- citing previous research, previous research, in submove 1A is accompanied by the naming of specific researchers. When researchers are specifically cited text elements lose their *stating current knowledge* status and are assigned the status of *citing previous research*. There is an example provided below:

- Empty pronouns are not only acceptable in finite clauses of Spanish and Chinese but are pragmatically more natural *(Rizzi, 1982; Huang, 1984, 1985).*

In Move 1: Situating the research submove 1C- extending previous research, the author would like to make clear that the current research is part of an ongoing debate as the example below shows:

- *Extending the research done on* the effects of different types of task and different participant arrangements used to foster negotiated interaction among L2 learners, we attempt to ….

Move 1: Situating the research submove 2 is stating a problem which could be mean that problem statements point out that previous research has not been thoroughly successful or complete. Examples are indicated below:

- ……. *few* studies have been done on ….
- Empirical studies designed to …. have *provoked wildly conflicting* results.

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- *This empirical investigation sought to* determine the attitudes of both L1 and L2 listeners toward specific regional accents of US English and to compare and/or contrast those attitudes.

Move 2: Presenting the research is to make a kind of announcement that justifies the article, either by describing the key features of the research in question, or by presenting its purpose. Move 2: Presenting the research can take one of two forms: a *descriptive* form or a *purposive* form. Some examples are presented below:

Move 2: Presenting the research sub-move 1A: Indicating main features

- *This study investigates* …….
- *In this study, we investigate* ……

Move 2: Presenting the research sub-move 1B: Indicating main purpose

- This empirical investigation *sought to* ……
- The *purpose* of this study was to ……

Move 3: Describing the methodology indicates the design of the study in terms of subjects, procedures, materials, instruments, variables, according to the type of experimentation. Some examples are demonstrated as follows:

- This study examines the responses of 60 *Spanish, Chinese, and German L2 learners* to English sentences with empty pronominal categories (ECs).
- This paper is concerned with how *advanced L2 learners of English* interpret reflexive anaphors and pronominals.
- This study investigates the listening comprehension of *388 high-intermediate listening proficiency (HILP) and low-inter-mediate listening proficiency (LILP) Chinese students of English as a foreign language*.
- *Using three information transfer tasks and intervening discussion sessions*, we attempted to investigate the actual communicative outcomes of interaction prompted by the tasks.

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Move 4: Summarizing the results, contains answers to the questions such as "What was the problem?", "How did you study the problem?" Move 4 provides an answer to the question "What did you find?". Move 4 thus summarizes briefly the main findings of the research, and indicates how the data were manipulated. A typical example of a results statement is given below:

- *Results showed that* moderately fast speech rates resulted in …….
- *A MANOVA and a series of univariate analysis of* of ….. *showed*….
- ..... revealed *greater* and *more* consistent growth in …. *than* for ….

Move 5: discussing the research, is about making claims relative to the value or implications of the results obtained. This expression in some respect covers both the evaluation of findings, and also another type of sub-move which characterizes the linking of the reported research back to the broad research field. In other words, Move 5 makes claims based on reported findings which are typically realized by two sub-moves: drawing conclusions; giving recommendations. Examples are presented below:

Move 5: Discussing the research submove 1- Drawing conclusions

- The results *suggest* that misunderstanding of ……
- It is *concluded* that large-scale testing of oral communication is ….
- *These findings* lend strong support to our hypothesis that……..
- The *research* provides evidence of the importance of case studies in verifying critical assumptions about ……
- The main *conclusions* of this study are: ……..

Move 5: Discussing the research submove 2- Giving recommendations

- *Implications and conclusions of the results of foreign language learning are drawn*.

Santos' framework has been exploited to investigate 94 abstracts in journal articles in the field of applied linguistics. However, other researchers have adopted Santos' framework abstract move patterns to capture the rhetorical organization of abstracts in different fields. Cross and Oppenheim (2006) studied the organization of

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twelve scientific abstracts (protozoology) by using Santos' model of abstract move patterns. Vongvanit, (2001) applied Santos' model to study the moves of one hundred and fifty abstracts in the field of English Language Learning and Teaching. It can be said that Santos' framework has stimulated substantial research on English use in a variety of academic disciplines. Examples given above are just a few.

Thus, when comparing the detail inserted in each move, 'Indicating main features' (submove 1A of Move 2) and 'Giving recommendations' (submove 2 of Move 5) of Santos (1996) with Bhatia (1993), there is other information to be found. The first submove (Indicating main features) has the function of describing the type of research being studied (e.g. study, investigation, examination, analysis or survey). The second submove (Giving recommendations) outlines suggestions for future practice or investigation.

To write an effective abstract, authors have to consider the length of words and they must be precise. Authors, therefore, have to keep their articles short and to the point so as not make the abstract too long. Thus, writers may eliminate or combine information as shown below. This is what Weissburg and Buker (1990) recommend.

Order of Information Elements in Reduced Abstracts

P+M = purpose and method of the study

R = results

C = conclusions and recommendations*

* optional

2.8 Previous studies on article journal abstracts

The abstract (produced by machine or human) as a concise statement of the message of a document, has become an increasingly important tool for distinguishing truly relevant information from the bulk of information available (Pinto & Galvez,

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(1999). Recent research into the quality of abstracts conducted in the area of information science (IS) can be classified into two major groupings. Firstly, there are theoretical approaches to quality, which describe all the desirable properties of an abstract, as well as the elements that come into play when its suitability in a given context has to be established (Pinto, 2003). Secondly, a considerable amount of effort has been made to assess readability formulae (Tenopir & Jocso, 1993; Armstrong & Wheatley, 1998).

Abstracts are a growing field of study in linguistics. The interest that linguists show in the genre of the RA abstract, stems from the need to understand the mechanisms which underlie these multifunctional texts. As Ventola (1994, p. 333.) states, abstracts "have become a tool of mastering and managing the ever increasing information flow in the scientific community". They constitute the gateway that leads readers to take up an article, journals to select contributions, or organizers of conferences to accept or reject paper (Lores, 2004).

Several books and review papers have been published over the last two decades about improving the clarity of the abstracts of articles in scientific journals, including several recent studies (Hartley, 1994; Swales, 1990; Ad Hoc Working Group, 1987). Three main areas of importance have been discussed:

1. The language, or the readability, of an abstract;
2. The sequence of information, or the structure, of an abstract; and
3. The typography, or the presentation, of an abstract.

This study considers the rhetorical organization of abstracts in the field of science. The main aim of this study is to reveal how these abstracts are linguistically organized. Thus, two prestigious journals: *Science* and *Nature* were selected for this corpus study. These journals are the world's top journals publishing basic scientific research in all fields of science. They are of such high standing that they are potentially capable of effecting change in the scientific community as a whole. There are a number of prior studies on a variety of article journal abstracts that investigate different aspects of rhetorical organization within these scientific journal abstracts. In order to obtain an adequate knowledge, hence some literature review of the article journal abstracts were shown as follows.

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2.8.1 A comparison study of research article abstracts

Studies on contrastive genre analysis have become a current issue in research on language for specific purposes (LSP) and are intended to economize specialist communication. There are linguists who studied on this topic (Bonn & Swales, 2007; Busch-Laur, 1995; Martin-Martin, 2003).

Busch-Lauer (1995) studied a corpus of 20 abstracts taken from German medical journals representing different degree of specialism/professionalism (expert-expert, expert-staff, expert-layperson). Various German medical journals of the period from 1989 to 1993 were scanned with regard to their journal character, language(s) of publication and instructions for authors. The purpose of the study was to compare formal schemata and linguistic devices of German abstracts and their English equivalents, written by German medical scholars to English native speaker (NS) abstracts. The method of linguistics analysis includes (1) the overall length of articles/abstracts, (2) the representation/arrangement of "moves", (3) the linguistic means (complexity of sentences, finite verb forms, active and passive voice, tenses, linking words, and lexical hedging).

This study yielded several findings. First, the results show no correlation between the length of articles and the length of abstracts journal. In contrast to NS authors abstracts, the move "Background information" predominated in the structure of the studied German non-native speaker (GNNS) abstracts, whereas "Purpose of study" and Conclusions" were not clearly stated. German medical abstracts and their English equivalents do not necessarily follow the guidelines for manuscript in the International Standard Organization (ISO) standard nor do they follow the structure and argumentation of the original article.

The presentation and arrangement of moves is regulated by author's intentions and summarizing skills. The compulsory "moves" established by Salager-Meyer (1990, 1992) for NS medical abstracts could not be identified in all abstracts of the corpus. In contrast to NS medical abstracts, the studied material puts emphasis on "background information", but largely omits "purpose and scope" as well as "conclusions". Second, the analysis indicates the equivalent NNS English abstracts are translations or were partly translated by the authors themselves and not revised. In linguistic terms, the German abstracts frequently contained lexical hedges, complex

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and enumerating sentence structures, passive voice and past tense as well as linkers of adversative, concessive and consecutive character. The GNNS English equivalent abstracts were authors translations and contained structural and linguistic inadequacies which may hamper the general readability for the scientific community. Therefore, abstracting should be systematically incorporated into language courses for the medical profession and for technical translators.

Bonn and Swales (2007) studied English and French journal abstracts in the language science (60 abstracts in each language). These article journals published each year as encapsulations of and sometimes advertisements for their accompanying articles. This practice subset has been specifically designed to explore similarities and differences between French and English practice in this area, especially since discourse-analytic work on French written academic genres has been surprisingly sparse. The study was an attempt to understand how and why language choice might affect this part-genre, both in actual use and according to authors' linguistic and rhetorical perceptions. They compared abstracts from a leading UK linguistics journal written in English and a leading linguistics journal written in French from Paris. It looked like a good basis for comparison at first sight because of the surface similarities between the texts, both sets of texts being written by experts in their fields and expert in their academic languages. Two corpora are used: Corpus A consists of abstracts from a French linguistics journal and a corresponding English one; Corpus B contains paired French and English abstracts from the bilingual EAP journal *ASp*; along with a report on e-mail interview findings from two articles in *ASp*. The finding revealed for this point was not potentially significant.

As Swales (2004a) points out, it is increasingly doubtful whether viable comparisons can be made between "big" English-language journals and "small" ones publishing in other languages. In retrospect, therefore, it would have been better to have selected a much less prestigious English language linguistics journal in their attempts to find a true "maximum similarity." There are three level of difference that emerged from this study (linguistic, cultural, and sociological) which could have some fairly immediate pedagogical uptake, not only for Francophones writing abstracts in English, but also for Anglophones attempting French abstracts to accompany their papers for an estimable journal such as *ASp*. In the end, however, it was found that

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certain features such as choice of voice are ascribable to general differences between the two languages. Second, it would appear that personal pronoun use, sentence length and transition word selection can be aligned with expectations as to what constitutes appropriate academic style. Thirdly, differences in the way the research reported is "situated" are most likely due to differences in discourse community size.

Martin-Martin (2003) studied a genre analysis of English and Spanish research paper abstracts in experimental social sciences to investigate to what extent there is rhetorical variation between the research article abstracts written in English for international journals and those written in Spanish and published in Spanish journals in the area of experimental social sciences. A total of 160 RA abstracts written in English and Spanish were used in his study. The corpus in English is made up of 40 abstracts selected at random from two leading international journal in the field of experimental phonetics: *Phonetica* and *Journal of Phonetics*. A number of 40 research article abstracts were selected at random from two leading international journal in the field of experimental psychology: *British Journal of Psychology* and *Applied Psycholinguisitcs.* Therefore, the final corpus in English is constituted by 80 abstracts belonging to four different journals in the area of experimental social sciences. The structural units that constitute the macrostructure of these texts have been analyzed comparatively. The author follows the textual organization of each abstract proposed by Dudley-Evans (1986), Salager-Meyer (1992), Santos (1996) and Swales (1981, 1990). The results show that the rhetorical structure of abstracts written in Spanish in the area of experimental social sciences generally reflects the international conventions based on the norms of the English academic discourse community. This is seen in the fact that, for the most part, the Spanish abstracts, in a summarized form, the four basic structural units which constitute the different sections of the underlying research article. Similarity, these rhetorical elements follow in all cases a similar linear sequence which reflects the logical order of the process of experimental research (Introductions-Methods-Results-Discussions). The analyses carried out in this study indicate that the abstracts written in English for international journals in the experimental social sciences more closely reflect Swales's (1990) model as regards the use of the three moves, whereas the Spanish abstracts in the same field are less rhetorically complex.

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2.8.3 Organization

As stated earlier, some researchers investigated in academic disciplines and professional genres of article abstracts such as (Cross & Oppenheim, 2006; Kaplan et al, 1994; Lores, 2004; Vongvanit, 2001). Vongvanit (2001) investigated the organization and linguistic features (writing strategies and tenses) of the research article abstracts in the field of ELLT (English Language Learning and Teaching. He exploited Bhatia (1993) and Santos (1996) abstract move as criteria for his study. One hundred and fifty abstracts from two journals named RELC and foreign language annuals published between 1997-1998 were selected for analysis. The results of his research indicated that most analyzed abstracts were written with five moves: background information, purpose, method, result, and conclusion. For the investigation of writing strategies, he found that the writing strategy name 'Description' was used in every move. Regarding the analysis of tenses, the study found that simple present and simple past were used in all the moves. He also stated that further study should be carried out to investigate the organization and linguistic features of abstracts in other disciplines.

Cross and Oppenheim (2006) attempt to establish the structure of proto-zoological research article abstracts though the definition of moves by adopted Santos' move abstract paradigm to exploited. The study was an effort to initiate the structure of the abstracts reflected in the subject discourse; and last, to determine how closely abstracts follow stipulated guidelines. A number of twelve scientific abstracts were analyzed in order to answer these questions. Kaplan et al. (1994) suggest that the choices that the abstract authors make regarding thematisation affect the persuasive quality of the abstract. Theme, as defined by Rashidi, is the clause level constituent that the author uses as a starting point of the message, Rashidi (1992) observes that this constituent moves "the decoder (reader) towards the core of the communication". Thus, its importance as a persuasive tool is evident. Furthermore, Brown and Yule (1983) propose that an analysis of theme is clarificatory as it serves as a way to realize the structure of a text and what meaning the author wishes to impart with that piece of information. They note that the "thematic organization appears to be exploited by speakers/writers to provide a structural framework for their discourse". Moreover, it appears that the choice of grammatical subject as a marker of theme reveals how the

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writer seeks to position him/herself in their discourse community and against other discourse communities.

The findings yielded that authors of scientific abstracts thematised their subject by referring their subject in the "real world", that is, that the research in question constitutes an answer to a relevant "real" world research problem. The abstracts presenting the theme in the discourse domain, that is, focusing either on the processes of reporting one's research, referring to units of discourse, to discourse internal entities or to units of discourse other than the writer's own discourse entity. The usual way in which the writers thematise their subject is to present the theme in the participant domain. In answer to the question regarding how closely abstracts follow stipulated guidelines, the finding revealed that the abstract in general succeed in this task which these findings correspond to the conclusions of a similar study on applied linguistics abstracts undertaken by Santos (1996).

For an abstract to be effective, Endres-Niggemeyer (1998) suggests that it must mirror the macrostructure of the parent document. However, there were a few discrepancies. There were some formulaic expressions, introducing moves that were evidence of lexical redundancy. Further, a small number of abstracts showed authorial presence in the text via personal pronouns, which demonstrated subjectivity. In addition, some of the abstracts revealed conceptual scatter that impeded clarity of meaning. It is imperative that the abstract fulfils its function as a type of condensed document representation and successfully represents the main arguments of the parent document logically, coherently, and briefly, so that the reader can assess relevance and gain access quickly. This approach (Santos' abstract move pattern) allows the writer to organize information in a way that marries the need to impart information succinctly and cohesively in a necessarily condensed document. The authors also noted it was not all the abstracts however, that followed the adopted abstract paradigm. Moreover, they further stated that further research in this subject needed; one way would be by analyzing a larger corpus. Another way would be an examination of the specific differences and similarities between abstracts and the original documents that they represent; a linguistic analysis of how meaning is realized in the abstract and how this reflects the discourse community of which it is a part; and an exploration into the processes involved in summarizing information, specifically in regard to abstracts.

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Such a study would be able to assess, in close detail, how a well-formed abstract is constructed and what constitutes such a document. It may also provide the basis for future research on developing computer-generated abstracts as the link between applied linguistics and artificial intelligence grows.

The study of Lores (2004) has been carried out on a corpus of 36 abstracts taken from four prestigious publication in the field of linguistics; Journal of Linguistics, Applied Linguistics, Linguistics and Journal of Pragmatics. The study set out to analyse the global organization of the textual mechanisms which lay under the construction and understanding of this complex genre. The analysis of rhetorical structure carried out following Swales's (1981, 1990) model of move structure was backed up by a thematic analysis of the two main types of rhetorical structures found: the IMRD and the CARS type of abstract. With this purpose, thematic analysis was applied, as a potentially useful tool in exploring genre, since thematic choice is significant as part of a writer's available linguistic resources and is one means through which writers can achieve local and global discourse goals. In this sense, both thematic progression patterns and the methods of thematic development were analyzed in this corpus study.

On the level of rhetorical structure, this study has shown that, even if the majority of the abstracts of papers on linguistics analyzed display the rhetorical structures commonly accepted to be the canonical global organization of abstracts, one which mirrors the organization of the RA, a significant percentage, about one-third of the samples, display a different structure, one which matches the organization of the Introductory section of RAs: the CARS structure (Swales, 1990). The exploration of Theme, which focused on the analysis of thematic progression (TP) patterns and the method of thematic development (studied at the level of the syntactic realizations of Themes and of Grammatical Subject (GS) domain), yielded interesting results. Lores, (2004) points out the concept of "thematic progression" (TP) was first introduced by Danes (1974) as an organizing principle that accounts for the ordering of information in discourse beyond the level of the sentence. The notion of TP is one of the constituent elements of the wider functional sentence perspective (FSP proposed by scholars of the Prague School. To start with, the variation found in TP patterns sustains our perception of distinct rhetorical structures. The findings confirm the

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combination of two main types of patterns (simple linear and constant), and a claim can be made that this combination is not random. On the contrary, the different sections or moves which constitute each type of abstract seem to display a distinct combination of thematic patterns, both within the moves or across boundaries between moves.

Kaplan et al (1994) studied a corpus of 294 abstracts submitted in response to a professional association "call for paper" on the basis of five features: thematic structure; clause structure; pragmatic moves (Swales, 1981); propositional organization; and lexical cohesion. Abstracts of this type were found to: differ in a number of ways from other abstract types; constitute condensed, reduced forms, containing fully elaborated syntactic structures, but employing syntactic and semantic devices which contribute to compaction; be extremely propositionally dense; be lexically rich, but be constrained by topic genre, and the need for compaction; employ redundancy both syntactical and lexically; follow the "Introduction-Methods-Results-Discussion" structure previously described for fully elaborated scientific articles, in compacted form; be topic-based and detached rather than interactional and involved, reflecting strategies that position the writer in relation to the paper, the research paradigm, and the world; be full of jargon, acronyms, repetitions, adjectival modifications, subordinate clauses, and nominalizations, and include occasional parenthetical citations, in some instances even modest bibliographies; eschew the use of past tense verbs, third person pronouns, and passive constructions; be influenced by pronominal conventions employed more generally in scientific writing; be influenced by the presence of at least four rhetorical features, in descending order of importance: introducing the study; establishing the field; presenting the results; describing research.

Overall, this chapter describes the corpus analysis, genre, and moves which are the main core of this study. In this chapter provides the previous studies in order to acquire prevalent knowledge as well as prior move study on ESP. This chapter also illustrated previous studies in the area of writing, reading, teaching, textbook, and letter. Consequently, moving on to discuss the crucial core of this study which is article abstracts along with showing abstract move paradigms which were established by different linguists in difference times. As stated earlier, this study applied the

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abstract move pattern of Santos (1996) to analyze a hundred scientific abstracts. Therefore, all issues above were carefully organized and studied in order to gain a better understanding acquire adequate knowledge on a current topic study.

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CHAPTER III
RESEARCH METHODOLOGY

This chapter describes the corpus and procedures for analysis used in this study. The chapter begins by describing the framework of the study. Subsequently, the chapter presents the corpus of the study, the selection of the journal, the selection of the journal article abstracts, coder selection, coder training, the given text and their structures, framework of the corpus analysis, the analysis tools, and statistics.

3.1 Framework of the study

To achieve the research goals, the overall framework of the study is described to show how the research was to be carried out.

1. Study of the previous related research on corpus-based analysis, both organizational and linguistics features, in order to have adequate information, input, and in-depth knowledge of this particular subject to conduct quality research.

2. Construction of specific criteria to select an article abstract text corpus based on research objectives which can be divided into three stages. Firstly, text selection to form this corpus study pertaining to multi-disciplinary science from world prestigious scientific journals. Secondly, selection and evaluation of abstract analyses done by previous researchers. For this study of abstracts, the move pattern of Santos (1996) was adopted as the theoretical framework to analyze all abstracts. Finally, five coders received an explanation and practiced rating moves of abstracts in order to ensure that they fully understood the concept of an abstract move pattern. Then, they completed this task competently.

3. Decision on the main analysis comprising a hundred scientific journal article abstracts which were published during the period 2006 to 2008 only. The journals namely "*Science*" and "*Nature*" were selected on the basis of their high impact factor rank.

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4. Downloading of all samples of scientific article abstracts from the e-database of Mahidol University's Central Library and storage in a computer to analyze the move ordering patterns of those abstracts.

5. Printing out of all scientific article abstracts from the computer to analyze their organization based on the abstract move patterns of Santos (1996). These patterns were used as analysis models.

6. Coding of each abstract which was printed out for analysis.

7. Making of six copies of the abstracts for the researchers: five for the coders. (see detailed explanation in last section) and one for put as appendix. Coders were asked to participate at a meeting to discuss any possible concerns about working on this project. They were also asked to practice rating the abstracts together in order to be able to handle this project individually without any problems. Then, they performed their coding individually.

8. Collection of all analyzed results and consultation with the advisor and the co-advisor to ensure that a consensus was reached by all involved parties.

9. Investigation and analysis of the data to answer the research questions. Move ordering patterns of scientific article abstracts were explored.

10. Finally, presentation and explanation of the linguistic rhetoric of these.

3.2 Description of the corpus

Move-based studies discussed in a previous chapter have demonstrated that disciplinary variations have a discernible influence on the structure of rhetorical moves (Kanoksilapatham, 2005). This study attempts to show the linguistic nature of rhetorical moves of scientific article abstracts. The chosen articles are in the scientific field because it is a discipline of interest to scientists, scholars, practitioners, and researchers. These journals provide multi-disciplinary scientific knowledge. Consequently, the findings generated by this study should be beneficial to scientists, scholars, and professionals from related fields of science.

A number of research articles have been sampled and analyzed (Nwogu, 1997; Swales, 1990). While some studied a small sample of abstracts (Busch-Lauer, 1995; Cross & Oppenheim, 2006); only one, Ayers (2008), explored the evolution of abstracts in the journal *Nature*. This study analyzed a hundred abstracts from two

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prestigious science journals: *Nature* (50) and *Science* (50). Thus, the database in this study reflects the present corpus in science and the outcomes of this study are generally applicable to the scientific article abstracts genre.

3.3 Selection of the journal

The scientific journal article is becoming more news-oriented, evidence indicates that (Bazerman, 1988; Berkenkotter & Huckin, 1995; Swales & Najjar, 1987). This would be in line with Bhatia' work (1993, 1997) which shows there is an increasing use of promotional strategies in genres which are traditionally considered non-promotional texts (in this case the scientific journal article). The recent emergence of e-journals and the consequent greater diffusion of and easier access to scientific journal might also bring change (Swales, 2004b), possibly the increase of the promotional content of scientific articles.

As an ideal vehicle for projecting news value, the journal abstract appears to be growing in importance, as noted by a number of writers (Berkenkotter & Huckin, 1995; Melander, Swales & Friedrickson, 1997; Salager-Meyer, 1994; Ulijin & Pugh, 1985), and appears to be becoming longer and more informative, with an increasing amount of space being dedicated to the results of the articles they accompany (Berkenkotter & Huckin, 1995). Abstracts foreground important information for easy access, serve as an early screening device, frame the reading of the article they accompany and provide a summary of the main points of the article for later reference (Berkenkotter & Huckin, 1995).

Consequently, the corpus for this study consists of a hundred scientific article abstracts collected from two specialized journals, that is to say, journals of focused readership written for professionals and a variety of audiences, for example, researchers, instructors, scientists, scholars, and practitioners from elsewhere who want to update their scientific knowledge in order to carry out their own research. The selection of the journals was based on the ranking of journals in Journals Citation Reports: Science Edition (2006) which ensured that the selected journals were from the world's leading scholarly scientific journals; therefore, they are representative of the discipline. *Journal Citation Reports*, published by the Instituted for Scientific Information (ISI), is a multi-disciplinary database presenting statistical data that

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systematically provides an objective and quantitative way to determine the relative importance of journals within a broad range of subject categories. The science edition of Journal Citation Reports covers about 6,166 leading international science journals. A number of quantitative measures, such as total cites, impact factor, cited half-life, immediacy index, and total articles are used for ranking, evaluating, categorizing, and comparing journals.

To objectively select the two most prestigious scientific journals to form the corpus, their impact factor seems to be the most appropriate measure. According to Journal Citation reports (2006), the impact factor is calculated by dividing the number of current citations to articles published in the two previous years by the total number of articles published in the two previous years. This figure is useful in evaluating a journal's relative importance, especially when a comparison is made to other journals in the same field.

In Journal Citation Reports (2006) published by ISI, the most updated bibliographic database available at the time of the compilation of the current corpora are found published research conducted in various countries around the world. The present study chose scientific journals which have a high impact factor. Two scientific journals, namely "*Science*" and "*Nature*" were selected (see details in Table 3.1). This present corpus study focuses on only science issues; therefore, the review journals were excluded. The selected journals are: *Science* and *Nature* details are as given in Table 3.2.

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Table 3.1 The list of top twenty journals from Journal Citation Report (2006)

Rank	Abbreviated Journal Title	Total Cites	Impact Factor	Imme-diacy Index	Articles	Cited Half-life
1	CA-CANCER J CLIN	5266	63.342	16.526	19	2.9
2	NEW ENGL J MED	177505	51.296	12.743	303	6.9
3	ANNU REV IMMUNOL	15482	47.237	9.500	24	6.3
4	ANNU REV BIOCHEM	16761	36.525	4.433	30	8.5
5	REV MOD PHYS	20672	33.508	6.656	32	>10.0
6	NAT REV CANCER	13189	31.583	4.675	80	3.4
7	PHYSIOL REV	16209	31.441	4.906	32	7.2
8	NAT REV MOL CELL BIO	14132	31.354	3.894	85	3.6
9	**SCIENCE**	**361389**	**30.028**	**5.555**	**885**	**7.7**
10	CELL	132528	29.194	6.403	352	8.7
11	NAT REV IMMUNOL	11098	28.697	4.628	78	3.3
12	NAT MED	43664	28.588	5.261	153	5.3
13	ANNU REV NEUROSCI	9139	28.533	3.050	20	6.8
14	NAT IMMUNOL	20761	27.596	5.856	132	3.6
15	**NATURE**	**390690**	**26.681**	**6.789**	**962**	**7.8**
16	ANNU REV CELL DEV BI	7499	26.576	1.000	27	6.3
17	CHEM REV	57509	26.054	2.778	189	7.5
18	LANCET	133932	25.800	7.419	301	7.4
19	BRIEF BIOINFORM	1428	24.370	0.207	29	2.6
20	NAT GENET	54053	24.176	7.144	202	6.1

Table 3.2 Number of abstracts collected from the two scientific journals

Name of Journal	No. of abstracts in each year			Total
	2006	2007	2008	
1. Science	22	20	8	50
2. Nature	4	35	11	50
Total	26	55	19	100

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Table 3.2 shows that these two journals selected are similar in terms of their publication of multi-disciplinary science articles. In addition, both journals also share a similarity in terms of frequency of their publication and number of publications. They are weekly publications. *Science* represents the most prestigious science journal in the United States of America. *Nature* is also prestigious and popular for readers of high quality science journal which is published in the United Kingdom. The circulation of these journals is extremely high.

3.4 Selection of the article journal abstracts

This present study focused on abstracts in the field of science. It originates from two prestigious worldwide scientific journals, namely "*Science*" and "*Nature*" during the period of 2006 to 2008. The first task in this study was to get samples from the above journals. Fifty article journal abstracts from each journal were drawn from past issues. Those journals publish multi-disciplinary science issues worldwide. Thus, the content and authors of these articles were not a factor in selecting them. They publish weekly articles. Simple random sampling is used to select articles in case there is more than one article published weekly. Articles were selected until the total research objective, which is fifty abstracts from each journal, was completed. Simple random sampling was employed. However, there is no certainty that there will be in fact, at least one article published each week. Actually, the research found that no RAs were published in those journals in some issues, for example in the year 2007 in May and April. Occasionally, there is no science RA in a publication.

The second task was to put all downloaded abstracts into Microsoft Word with a running number and to make six copies, one copy to put in the paper as an appendix and the rest given to five coders to mark the moves of the abstracts. Santos's move criteria for each abstract were attached and all abstracts were given to coders.

3.5 Coder selection

There are a numbers of factors that should be considered in coding including background of the coders, training of the coders, and the coding scheme itself (Shohamy, Gordon, & Kraemer, 1992). In this study, one professor was a scientist who teaches undergraduate students at Mahidol University International College

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(MUIC). In addition, he is a native speaker of English who has a postgraduate degree in science (Ph. D. Botany). Two professors are experts in the field of linguistics. One of them is a native speaker of English who teaches doctoral and post-graduate students at Mahidol University. He produces research published internationally. The other linguistics professor is a Thai, who teaches doctoral and post-graduate students. He is an expert in the field of Linguists (Ph.D. Linguistics). A mathematics professor who teaches under-graduate students at Mahidol University International College was also asked to be a coder. She was born in the United Stated and completed her Bachelors and Masters degrees in the United States in the field of Mathematics. Obviously, all coders were experienced in reading academic papers, and are involved in academia. The researcher also coded the articles. In brief, journal article abstracts were randomly selected and photocopies of sample abstract moves have been marked and a summary of criteria for the identification of the moves were presented to the five coders. They were asked for opinions on the appropriateness of the analysis of the moves from the abstracts. Finally, the analysis was refined based on the feedback obtained from discussions with the coders along with the advisor and co-advisor, in order to come up with one absolute conclusion.

3.5.1 Coder training

This present study used Santos (1996) as the theoretical framework to investigate a hundred scientific abstracts. The researcher gave a copy of abstract moves posited by Santos (1996) to all coders to read before the training day, so they could gain insight into current topic being studied. A co-advisor and Ph. D. Linguist trained the researcher and two scientists as to what moves are and how to code abstracts, in order to make sure that they could work individually and independently and also avoid anticipated problems or questions. Questions and answers as well as discussion were done after all coders finished their coding. At the beginning of the discussion of this project, there some moves seemed to overlap and sounded ambiguous for some coders. Consequently, all the questions and problems were discussed by the five coders until they understood and were able to work individually and independently. In order to increase accuracy of move identification and reliability of the analysis, all of these steps must be done carefully (Kanoksilapatham, 2005).

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After the coders finished coding the scientific abstracts individually, they found that one statement played a role in more than one functions. Then, all coders had a discussion amongst themselves in order to reach an absolute conclusion.

3.6 The procedures for obtaining the corpora and the criteria for corpora design

The journal abstracts are available from the Internet were used in this present study. However, choosing from among the available corpora is not an easy task and the researcher decided to adapt some ideas from the works of specialists in corpus (Sinclair, 1991; Flowerdew, 1993a; Sutarsyah, Nation & Kennedy, 1994; Thurstun & Candlin, 1998; Biber, Conrad & Rappen, 1998; Kuo, 1999). The primary design criteria are the following.

A. Homogenous disciplines

The text corpus should be from a unique discipline so that the organization and linguistic features are prominent.

B. Size of corpus

It is required that the size of a general academic text corpus should be as large as possible in order to provide strong results. Normally, a good corpus used for classroom purposes should comprise of at least 100,000 running words (Kaewphamgam & Soranasataporn, 2002).

C. *Variety of sources*

The aim of this research is to analyze scientific article abstracts. All abstracts collected come from the e-database of two specialized journals. Two of the most prestigious scientific journals were objectively selected for this corpus study.

D. Availability

The texts included in the corpus should be available for everyone to access so that the selected texts can be representative of the language found in general, not just in specific areas. All abstracts can be found on the Internet so that anyone can access them.

E. Variety of authors

The appropriate general academic text corpus should not allow texts that include only a few authors in the corpus construction. A variety of authors is needed so that the corpus is not influenced by only some authors.

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3.7 The given texts and their structures

Scientific article abstracts were used as the academic text to form the corpus of this present study. Before downloading all abstracts to calculate and analyze by computer, all titles and authors were deleted. The corpora of this study comprised 15,162 running words, which seems to be a reasonable number because the corpus selected was article journal abstracts. The principle hallmarks of a good abstract are that it is short, accurate, concise, and completely reflects the overall contents of the article in question.

3.8 Framework of the corpus analysis

After getting the corpus, the researcher downloaded all of the texts into a computer and checked for errors and edited them where necessary. Then, they were printed out and given to the coders for analysis of the abstract organization found in the corpora. The five coders consist of the researcher, two native speaking English professors, and two Thai professors. The corpus was analyzed to highlight the various moves within the abstracts based on Santos (1996) abstract move patterns. The texts corpora may consisted of five moves as promulgated by Santos (1996), the five moves analysis pattern is showed in Table 3.3.

Santos' abstract move pattern was objectively chosen for this corpus analysis for these reasons: first, Santo is a linguist who is highly regarded in the linguistic community. He has been working in the linguistic field for a long time. Second, Santos has been published in most prestigious journals such as: *English for Specific Purpose* and *Text*. Third, he studied the work of many highly respected linguists such as Swales, (1990), Dudley-Evans, (1986), and Crookes, (1986) to synthesize and come up with his own pattern of move. Finally, Santos' abstract move pattern has been widely used to capture abstracts in other disciplines by researchers from different countries around the world. The five moves abstracts of Santos is shown and explained as in Table 3.3.

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Table 3.3 Santos's abstract move pattern

The Five Moves
Move 1: Situating the Research
Submove 1A – Situating current knowledge
and/or
Submove 1B – Citing previous research
and/or
Submove 1C – Extended previous research
and/or
Submove 2- Stating the problem
Move 2: Presenting the Research
Submove 1A – Indicating main features
and/or
Submove 1B – Indicating main purpose
and/or
Submove 2 – Hypothesis raising
Move 3: Describing the methodology
Move 4: Summarizing the results
Move 5: Discussing the research
Submove 1- Drawing conclusions
and/or
Submove 2 – Giving recommendations

3.9 The analysis tools

Four analysis tools were used in this corpus study: The five coders, Santos' (1996) abstract move patterns, coding schemes, and a spread sheet.

1. Five coders from scientific and linguistic fields analyzed the abstracts for this study. One is a researcher and two are professors and also native speakers of English. The remaining two are Thai professors.

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2. Criteria for abstract organization focused on the communicative purposes develop by Santos (1996) were used to identify abstract move patterns.

3. A coding scheme was designed by the researcher and give to the five coders for coding.

4. A spreadsheet was used for collecting all coding results.

3.10 Statistics

Frequency and percentage were used to calculate numbers and percentages of the moves which are used in the scientific article abstracts.

In brief, this chapter described the corpus and methodology of this study, including how the journals and articles were selected to represent scientific research articles. The methodology of this research is an approach to textual analysis which is move analysis. The corpus was analyzed by move analysis to determine rhetorical moves employed in the scientific abstracts from two prestigious science journals namely *Science* and *Nature*. Santos' (1996) abstract move patterns were adopted for this study as a theoretical framework to analyze those abstracts.

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CHAPTER IV
RESULTS

This chapter presents the results of the move analysis carried out on research article abstracts from two of the most prestigious science publications. The rhetorical moves identified in the corpus are compared with the findings of previous studies of that particular abstract, with regard to the elements or sub-moves made up each move and their sequence and cyclical pattern. Besides a model of rhetorical moves for an abstract is presented, featuring all variations in the entire corpus, an overall model of move structures for scientific abstract journals is proposed.

Basically, the findings of this study are presented in two parts. Starting this chapter by answering the first question that was posed in Chapter one: what moves were found in scientific abstracts? Then, continuing with the second question: How do the scientific abstracts in *Science* and *Nature* differ from Santos' pattern? Lastly, do the science abstracts in *Science* differ from those found in *Nature*?

The corpus for this study consists of a hundred scientific article abstracts collected from two specialized journals, that is to say, journals of focused readership written for professors and a variety of audiences, for example: researchers, instructors, scientists, scholars, and practitioners from elsewhere who want to update their scientific knowledge in order to carry out their own research. The two most prestigious scientific journals to form the corpus were objectively selected. Their impact factor seems to be the most appropriate measure. This present study focuses on abstracts in the field of science. It originates from two prestigious world renowned scientific journals, namely "*Science*" and "*Nature*" during the period of 2006 to 2008. Fifty article journal abstracts from each journal were drawn from past issues. These journals are similar in terms of their publication of multi-disciplinary science articles. Moreover, both journals also share a similarity in terms of frequency of their publication and number of publications. *Science* represents the most prestigious science journal from the United States of America. *Nature* is also prestigious and popular for readers of high quality science journals and is published in the United Kingdom. The circulation of these journals is extremely high.

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Table 4.1 Number of abstracts collected from the two scientific journals

Name of Journal	No. of abstracts in each year			Total
	2006	2007	2008	
1. Science	22	20	8	50
2. Nature	4	35	11	50
Total	26	55	19	100

Table 4.2 Shows the overall of article journal abstracts to form this corpus.

Journals	Abstracts	Sentences	Words
1. Science	50	271	7,301
2. Nature	50	357	7,861
Total	**100**	**628**	**15,162**

The abstracts drawn from *Science* and *Nature* journals in the period of time between years 2006 to 2008 and which contain a total of 628 sentences. Each abstract has an average of between 5-7 sentences.

At the outset, the research begins with the first question: what moves were found in scientific abstracts? In order to answer this question, Table 4.3 illustrates the number of moves found in the corpus.

In order to count any particular move or submove that may be found in the scientific abstracts from this study, two methods of quantifying the results were chosen: 1) a simple percentage ratio of the total, 2) the calculation method is the same as in the first, but takes into account duplicated moves that may occur in an abstract.

First step of the calculation followed Kanoksilapatham's (2003) study of quantifying the frequency of move occurrences to find (1) conventional moves, which means the frequency of each move or submove occured at least 60% of the time and (2) optional moves, which means the frequency of each move or submove found is less than 60%. The results are as illustrated in Table 4.3

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Table 4.3 The frequency of moves found

The Five Moves	Frequency Abstracts/100	Frequency 100%
Move 1: Situating the Research	-	-
Submove 1A – Situating current knowledge	*85	85
and/or		
Submove 1B – Citing previous research	^5	5
and/or		
Submove 1C – Extended previous research	-	-
and/or		
Submove 2- Stating the problem	^37	37
Move 2: Presenting the Research	-	-
Submove 1A – Indicating main features	^58	58
and/or		
Submove 1B – Indicating main purpose	^16	16
and/or		
Submove 2 – Hypothesis raising	^7	7
Move 3: Describing the methodology	^49	49
Move 4: Summarizing the results	*67	67
Move 5: Discussing the research	^32	32
Submove 1- Drawing conclusions	*71	71
and/or		
Submove 2 – Giving recommendations	^15	15

* conventional moves

^optional moves

The results from counting the scientific abstracts showed there were 3 conventional moves: Move 1: Situating the research submove 1A- Situating current knowledge, Move 4: Summarizing the results, and Move 5: Discussing the research submove 1- Drawing conclusions. There were 9 optional moves: Move 1: Situating the research, submove 1B- Citing previous research, submove 1C- Extended previous research, submove 2: Stating the problem, Move 2: Presenting the research ,submove 1A-Indicating main features, submove 1B- Indicating main purpose, submove 2-Hypothesis raising, Move 3: Describing the methodology, Move 5: Discussing the research, submove 1- drawing conclusions, submove 2-Giving recommendations. The

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notion of a conventional move as defined by Kanoklisapatham, (2003) are moves or submoves which occured more than 60% of the time and it also means that these moves or submoves are obligatory for abstracting. Optional move means, the frequency of moves or submoves that occur less than 60% of the time and it therefore means that these moves or submoves are optional for abstracting.

This corpus study has 628 sentences in total in both *Science* and *Nature*. Interestingly, after analyzing the corpus, the total numbers of moves found in this study were 682. This is because some sentences have more than one instance of a move occurring within it. Instances of sentences with more than one move can be seen in Table 4.4. The second method was used for a deeper analysis of move occurrence frequency.

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Table 4.4 Some examples showed an overlapping of moves within one sentence

Moves/ Submoves	Number of sentences		Example sentences
	Nature	Science	
1.1A -1.2	6	4	[Nature/2] Type 2 diabetes mellitus results from the interaction of environmental factors with a combination of genetic variants(1.1A), **most of which were hitherto unknown.(1..2A)**
2.1A-3	2	8	[Science/53] In this study, using time-lapse imaging of green fluorescent protein–labeled undifferentiated spermatogonia (Aundiff) and three-dimensional reconstitution (2.1A), **we revealed a biased localization of Aundiff to the vascular network and accompanying Leydig and other interstitial cells, in intact testes.(3)**
5.1-5.2	6	4	[Nature/2] These associations explain a substantial portion of disease risk and constitute proof of principle for the genome-wide(5.1) **approach to the elucidation of complex genetic traits.(5.2)**
3-2.1B	3	7	[Science/67] We analyzed local experiments(3), **long-term regional time series, and global fisheries data to test how biodiversity loss affects marine ecosystem services across temporal and spatial scales.(2.1B)**
3-4	2	2	[Nature/22] After input-specific LTP induction by two-photon glutamate uncaging or by synaptic stimulation, subthreshold stimuli, which by themselves were too weak to trigger LTP,(3) **caused robust LTP and spine enlargement at neighbouring spines.(4)**
1.1A-4	-	10	[Science/89] Iron regulatory protein 1 (IRP1) binds iron-responsive elements (IREs) in messenger RNAs (mRNAs), to repress translation or degradation, or binds an iron-sulfur cluster(1.1A) **to become a cytosolic aconitase enzyme.(4)**

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Abbreviation

Move 1: Situating the Research

Submove 1A – Situating current knowledge

Submove 1B – Citing previous research

Submove 1C – Extended previous research

Submove 2- Stating the problem

Move 2: Presenting the Research

Submove 1A – Indicating main features

Submove 1B – Indicating main purpose

Submove 2 – Hypothesis raising

Move 3: Describing the methodology

Move 4: Summarizing the results

Move 5: Discussing the research

Submove 1- Drawing conclusions

Submove 2 – Giving recommendations

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The second step was performed after the researcher found that one statement played more than one function. Therefore, the occurrence of moves and submoves may appear to differ from the first step. The researcher explored deeper by counting the frequency of moves and submoves that occur with the anticipation that the investigation of the corpus may yield another angle of corpus analysis. The procedure and method is shown and explained in Table 4.5.

Table 4.5 The analysis of article journal abstracts from *Science* and *Nature*

	Science[1]		Nature[2]		Both[3]	
The Five Moves	**F**	**%**	**F**	**%**	**F**	**%**
Move 1: Situating the Research						
Submove 1A – Situating current knowledge	66	21.9	83	21.8	149	21.8
and/or						
Submove 1B – Citing previous research	2	0.7	8	2.1	10	1.5
and/or						
Submove 1C – Extended previous research	0	0	1	0.3	1	0.3
and/or						
Submove 2- Stating the problem	14	4.6	27	7.1	41	6.0
Move 2: Presenting the Research						
Submove 1A – Indicating main features	32	10.6	44	11.6	76	11.1
and/or						
Submove 1B – Indicating main purpose	4	1.3	6	1.6	10	1.5
and/or						
Submove 2 – Hypothesis raising	0	0.0	4	1.1	4	0.6
Move 3: Describing the methodology	47	15.6	28	7.4	75	11.0
Move 4: Summarizing the results	73	24.2	103	27.1	176	25.8
Move 5: Discussing the research	3	1.0	11	2.9	14	2.1
Submove 1- Drawing conclusions	58	19.2	50	13.2	108	15.8
and/or						
Submove 2 – Giving recommendations	3	1.0	15	3.9	18	2.6
Total	**302**	**100**	**380**	**100.0**	**682**	**100.0**

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Notes:

1. The moves identified in *Science* journal abstracts were classified, counted, and then calculated as a percentage by using the following formula:

$$\text{Percentage of each move} = \frac{\text{Number of occurrences of that move} \times 100}{\text{Total number of abstracts in } \textit{Science}}$$

2. The moves identified in *Nature* journal abstract were classified, counted, and then calculated as a percentage by using the following formula:

$$\text{Percentage of each move} = \frac{\text{Number of occurrences of that move} \times 100}{\text{Total number of abstracts in } \textit{Nature}}$$

3. The moves identified in both *Science* and *Nature* journals abstract were classified, counted, and then calculated as a percentage by using the following formula:

$$\text{Percentage of each move} = \frac{\text{Number of occurrences of that move} \times 100}{\text{Total number of abstracts in } \textit{Science} \text{ and } \textit{Nature}}$$

The analysis of the structure of the corpus of scientific abstract article journals is based on the Santos (1996) framework. In order to visualize how the texts were analyzed, the demarcation of a text taken from the corpus into move and sub-move is exemplified. Below is a reproduction of scientific abstracts from *Science* and *Nature*. The following is an example demonstrating how textual demarcation was conducted in this study:

4.1 What move were found in science article abstracts?

4.1.1 Move 1: Situating the research, submove 1A - Situating current knowledge

There were 146 occurrences of Move 1: Situating the research, submove 1A-Situating current knowledge, which were from *Science* = 66 times, 21%; *Nature* = 83 times, 21.8%; both = 149 times, 21.8%. There was a large number of occurrences of Move 1 sub-move 1A. Based on Santos' model, Move 1, authors may (i) identify the field by stating that a given topic is of considerable professional concern. The authors may also (ii) state current ideas or practice in teaching and research. Alternatively, they may (iii) offer the reader a generalization. The examples are given below.

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[Science/53]

> **Mammalian spermatogenesis produces numerous sperm for a long period based on a highly potent stem cell system, which relies on a special microenvironment, or niche, that has not yet been identified.** In this study, using time-lapse imaging of green fluorescent protein–labeled undifferentiated spermatogonia (Aundiff) and three-dimensional reconstitution, we revealed a biased localization of Aundiff to the vascular network and accompanying Leydig and other interstitial cells, in intact testes. Differentiating spermatogonia left these niche regions and dispersed throughout the basal compartment of the seminiferous epithelium. Moreover, rearrangement of Aundiff accompanied the vasculature alteration. We propose that the mammalian germline niche is established as a consequence of vasculature pattern formation. This is different from what is observed in Drosophila or Caenorhabditis elegans, which display developmentally specified niche structures within polarized gonads.

[Nature/14]

> **Chromatin allows the eukaryotic cell to package its DNA efficiently.** To understand how chromatin structure is controlled across the Saccharomyces cerevisiae genome, we have investigated the role of the ATP-dependent chromatin remodeling complex Isw2 in positioning nucleosomes. We find that Isw2 functions adjacent to promoter regions where it repositions nucleosomes at the interface between genic and intergenic sequences. Nucleosome repositioning by Isw2 is directional and results in increased nucleosome occupancy of the intergenic region. Loss of Isw2 activity leads to inappropriate transcription, resulting in the generation of both coding and noncoding transcripts. Here we show that Isw2 repositions nucleosomes to enforce directionality on transcription by preventing transcription initiation from cryptic sites. Our analyses reveal how chromatin is organized on a global scale and advance our understanding of how transcription is regulated.

4.1.2 Move 1: Situating the research, submove 1B-Citing previous research

There were 10 occurrences of Move 1: Situating the research, submove 1B-Citing previous research, which were from *Science* = 2 times, 0.7%; *Nature* = 8 times, 2.1%; both = 10 times, 1.5%. As stated by Santos, authors may attempt to give credibility to the claim outlined in submove 1A or submove 2 by relating *what* has been claimed to the person *who* has claimed it. The examples are shown below.

[Nature/12]

> Bone-marrow-derived cells facilitate tumour angiogenesis, but the molecular mechanisms of this facilitation are incompletely understood. **We have previously shown that the related EG-VEGF and Bv8 proteins, also known as prokineticin 1 (Prok1) and prokineticin 2 (Prok2), promote both tissue-specific angiogenesis and haematopoietic cell mobilization. Unlike EG-VEGF, Bv8 is expressed in the bone marrow.** Here we show that implantation of tumour cells in mice resulted in upregulation of Bv8 in CD11b1Gr11 myeloid cells. We identified granulocyte colony-stimulating factor as a major positive regulator of Bv8 expression. Anti-Bv8 antibodies reduced

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CD11b1Gr11 cell mobilization elicited by granulocyte colony-stimulating factor. Adenoviral delivery of Bv8 into tumours was shown to promote angiogenesis. Anti-Bv8 antibodies inhibited growth of several tumours in mice and suppressed angiogenesis. Anti-Bv8 treatment also reduced CD11b1Gr11 cells, both in peripheral blood and in tumours. The effects of anti-Bv8 antibodies were additive to those of anti-Vegf antibodies or cytotoxic chemotherapy. Thus, Bv8 modulates mobilization of CD11b1Gr11 cells from the bone marrow during tumour development and also promotes angiogenesis locally.

[Sciece/71]

Years of intensive investigation have yielded a sophisticated understanding of long-term potentiation (LTP) induced in hippocampal area CA1 by high-frequency stimulation (HFS). These efforts have been motivated by the belief that similar synaptic modifications occur during memory formation, but it has never been shown that learning actually induces LTP in CA1. We found that one-trial inhibitory avoidance learning in rats produced the same changes in hippocampal glutamate receptors as induction of LTP with HFS and caused a spatially restricted increase in the amplitude of evoked synaptic transmission in CA1 in vivo. Because the learning-induced synaptic potentiation occluded HFS-induced LTP, we conclude that inhibitory avoidance training induces LTP in CA1.

4.1.3 Move 1: Situating the research, submove 1C- Extended previous research

There was an occurrence of Move 1: Situating the research, submove 1C-Extended previous research, which was from *Nature*, 0.3%. Following Santos' notion, this moves means that introducing current research might suggest that research article abstracts require a strong challenge statement in order to justify the research to be reported. The example below is an abstract found in this corpus study.

[Nature/47]

Jasmonates are essential phytohormones for plant development and survival. However, the molecular details of their signalling pathway remain largely unknown. **The identification more than a decade ago of COI1 as an F-box protein suggested the existence of a repressor of jasmonate responses that is targeted by the SCFCOI1 complex for proteasome degradation in response to jasmonate.** Here we report the identification of JASMONATE-INSENSITIVE 3 (JAI3) and a family of related proteins named JAZ (jasmonate ZIM-domain), in Arabidopsis thaliana. Our results demonstrate that JAI3 and other JAZs are direct targets of the SCFCOI1 E3 ubiquitin ligase and jasmonate treatment induces their proteasome degradation. Moreover, JAI3 negatively regulates the key transcriptional activator of jasmonate responses, MYC2. The JAZ family therefore represents the molecular link between the two previously known steps in the jasmonate pathway. Furthermore, we demonstrate the existence of a regulatory feed-back loop involving MYC2 and JAZ proteins, which provides a mechanistic explanation for the pulsed response to jasmonate and the subsequent desensitization of the cell.

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4.1.4 Move 1: Situating the research, submove 2- Stating the problem

There were 41 occurrences of Move 1: Situating the research, submove 2- Stating the problem, which were from *Science* = 14 times, 4.6%; *Nature* = 27 times, 7.1%; both = 41 times, 6.0%. Santos stated that problem statements offer some evaluation of the current state of knowledge as outlined in submove 1. These evaluations indicate the degree of topic exploration already performed and the amount of knowledge currently available. In other words, problem statements point out that previous research has not been thoroughly successful or complete. Sub-moves of type 2 take a variety of forms, but generally fall into two categories: (i) statements that previous research is still embryonic; or (ii) statements that, despite long and intense discussion, there is still a continuing debate in current research. Two representative abbreviated examples of the first group are given below.

[Nature/48]

> Spontaneous activity in the developing auditory system is required for neuronal survival as well as the refinement and maintenance of tonotopic maps in the brain. **However, the mechanisms responsible for initiating auditory nerve firing in the absence of sound have not been determined.** Here we show that supporting cells in the developing rat cochlea spontaneously release ATP, which causes nearby inner hair cells to depolarize and release glutamate, triggering discrete bursts of action potentials in primary auditory neurons. This endogenous, ATP-mediated signalling synchronizes the output of neighbouring inner hair cells, which may help refine tonotopic maps in the brain. Spontaneous ATP-dependent signaling rapidly subsides after the onset of hearing, thereby preventing this experience-independent activity from interfering with accurate encoding of sound. These data indicate that supporting cells in the organ of Corti initiate electrical activity in auditory nerves before hearing, pointing to an essential role for peripheral, non-sensory cells in the development of central auditory pathways.

[Science/99]

> Western United States forest wildfire activity is widely thought to have increased in recent decades, yet neither the extent of recent changes nor the degree to which climate may be driving regional changes in wildfire has been systematically documented. **Much of the public and scientific discussion of changes in western United States wildfire has focused instead on the effects of 19thand 20th-century land-use history.** We compiled a comprehensive database of large wildfires in western United States forests since 1970 and compared it with hydroclimatic and land-surface data. Here, we show that large wildfire activity increased suddenly and markedly in the mid-1980s, with higher large-wildfire frequency, longer wildfire durations, and longer wildfire seasons. The greatest increases occurred in mid-elevation, Northern Rockies forests, where land-use histories have relatively little effect on fire risks and are strongly associated with increased spring and summer temperatures and an earlier spring snowmelt.

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4.1.5 Move 2: Presenting the research, submove 1A – Indicating main features

There were 76 occurrences of Move 2: Presenting the research, submove 1A-Indicating main features, which were from *Science* = 32 times, 10.6%; *Nature* = 44 times, 11.6%; both = 76 times, 11.1%. Based on Santos, it could be explained in part by the author's effort to incorporate the abstract into the body of the paper. The study suggests that the main article is viewed as standing apart from the abstract. Examples are given below.

[Science/94]

> PIK3CA, one of the two most frequently mutated oncogenes in human tumors, codes for p110a, the catalytic subunit of a phosphatidylinositol 3-kinase, isoform a (PI3Ka, p110a/p85). **Here, we report a 3.0 angstrom resolution structure of a complex between p110a and a polypeptide containing the p110a-binding domains of p85a, a protein required for its enzymatic activity.** The structure shows that many of the mutations occur at residues lying at the interfaces between p110a and p85a or between the kinase domain of p110a and other domains within the catalytic sub-unit. Disruptions of these interactions are likely to affect the regulation of kinase activity by p85 or the catalytic activity of the enzyme, respectively. In addition to providing new insights about the structure of PI3Ka, these results suggest specific mechanisms for the effect of oncogenic mutations in p110a and p85a.

[Nature/6]

> Although AKT1 (v-akt murine thymoma viral oncogene homologue 1) kinase is a central member of possibly the most frequently activated proliferation and survival pathway in cancer, mutation of AKT1 has not been widely reported. **Here we report the identification of a somatic mutation in human breast, colorectal and ovarian cancers that results in a glutamic acid to lysine substitution at amino acid 17 (E17K) in the lipid-binding pocket of AKT1.** Lys 17 alters the electrostatic interactions of the pocket and forms new hydrogen bonds with a phosphoinositide ligand. This mutation activates AKT1 by means of pathological localization to the plasma membrane, stimulates downstream signalling, transforms cells and induces leukaemia in mice. This mechanism indicates a direct role of AKT1 in human cancer, and adds to the known genetic alterations that promote oncogenesis through the phosphatidylinositol-3-OH kinase/AKT pathway. Furthermore, the E17K substitution decreases the sensitivity to an allosteric kinase inhibitor, so this mutation may have important clinical utility for AKT drug development.

4.1.6 Move 2: Presenting the research, submove 1B – Indicating main purpose

There were 10 occurrences of Move 2: Presenting the research, submove 1B-Indicating main purpose, which were from *Science* = 4 times, 1.3%; *Nature* = 6 times,

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1.6%; both = 10 times, 1.5%. Stated by Santos, the purposive sub-moves contain a mixture of forms that essentially carry the purposive nature via the verb phrase example as given below.

[Nature/14]

> Chromatin allows the eukaryotic cell to package its DNA efficiently. **To understand how chromatin structure is controlled across the Saccharomyces cerevisiae genome, we have investigated tphe role of the ATP-dependent chromatin remodeling complex Isw2 in positioning nucleosomes.** We find that Isw2 functions adjacent to promoter regions where it repositions nucleosomes at the interface between genic and intergenic sequences. Nucleosome repositioning by Isw2 is directional and results in increased nucleosome occupancy of the intergenic region. Loss of Isw2 activity leads to inappropriate transcription, resulting in the generation of both coding and noncoding transcripts. Here we show that Isw2 repositions nucleosomes to enforce directionality on transcription by preventing transcription initiation from cryptic sites. Our analyses reveal how chromatin is organized on a global scale and advance our understanding of how transcription is regulated.

[Science/95]

> Quantum mechanical superexchange interactions form the basis of quantum magnetism in strongly correlated electronic media. **We report on the direct measurement of superexchange interactions with ultracold atoms in optical lattices.** After preparing a spin-mixture of ultracold atoms in an antiferromagnetically ordered state, we measured coherent superexchange-mediated spin dynamics with coupling energies from 5 hertz up to 1 kilohertz. By dynamically modifying the potential bias between neighboring lattice sites, the magnitude and sign of the superexchange interaction can be controlled, thus allowing the system to be switched between antiferromagnetic and ferromagnetic spin interactions. We compare our findings to predictions of a two-site Bose-Hubbard model and find very good agreement, but are also able to identify corrections that can be explained by the inclusion of direct nearest-neighbor interactions.

4.1.7 Move 2: Presenting the research, submove 2 –Hypothesis raising

There were 4 occurrences of Move 2: Presenting the research, submove 2-Hypothesis raising, which were from *Nature* = 4 times, 1.1%; both = 4 times, 0.6%. In hypothesis raising statements, authors outline their research hypothesis or questions. This submove plays a supporting role in the presentation or research as it helps further clarify the main features found in abstracts as in examples given below.

[Nature/19]

> Integrins are important mammalian receptors involved in normal cellular functions as well as pathogenesis of chronic inflammation and cancer. **We propose that integrins are exploited by the gastric pathogen and type-1 carcinogen Helicobacter pylori for injection of the bacterial oncoprotein cytotoxin-associated gene A (CagA) into gastric epithelial cells.** Virulent H.

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> pylori express a type-IV secretion pilus that injects CagA into the host cell; CagA then becomes tyrosine-phosphorylated by Src family kinases. However, the identity of the host cell receptor involved in this process has remained unknown. Here we show that the H. pylori CagL protein is a specialized adhesin that is targeted to the pilus surface, where it binds to and activates integrin a5b1 receptor on gastric epithelial cells through an arginine-glycine-aspartate motif. This interaction triggers CagA delivery into target cells as well as activation of focal adhesion kinase and Src. Our findings provide insights into the role of integrins in H.-pylori-induced pathogenesis. CagL may be exploited as a new molecular tool for our further understanding of integrin signalling.

[Science/42]

> With many genomes sequenced, a pressing challenge in biology is predicting the function of the proteins that the genes encode. When proteins are unrelated to others of known activity, bioinformatics inference for function becomes problematic. **It would thus be useful to interrogate protein structures for function directly.** Here, we predict the function of an enzyme of unknown activity, Tm0936 from Thermotoga maritima, by docking high-energy intermediate forms of thousands of candidate metabolites. The docking hit list was dominated by adenine analogues, which appeared to undergo C6-deamination. Four of these, including 5-methylthioadenosine and S-adenosylhomocysteine (SAH), were tested as substrates, and three had substantial catalytic rate constants (105M21 s21). The X-ray crystal structure of the complex between Tm0936 and the product resulting from the deamination of SAH, S-inosylhomocysteine, was determined, and it corresponded closely to the predicted structure. The deaminated products can be further metabolized by T. maritima in a previously uncharacterized SAH degradation pathway. Structure-based docking with high-energy forms of potential substrates may be a useful tool to annotate enzymes for function.

4.1.8 Move 3: Describing the methodology

There were 75 occurrences of Move 3: Describing the methodology, which were from *Science* = 47 times, 15.6%; *Nature* = 28 times, 7.4%; both = 75 times, 11%. Based on Santos, when the abstract writer has completed the introduction of his/her research, s/he then needs to offer some description of how the research was actually carried out. Thus, this move indicates the design of the study in terms of: subjects, procedures, materials, instruments, variables, according to the type of experimentation. It would be expected that Move 3: Describing the methodology should occur after Move 2: Presenting the research. However, the syntax allows the reversal of the syntactic order of the two moves (Bhatia, 1993). A possible explanation for such embedding and the reversed syntactical sequence of the initial moves may be that the author feels s/he has to compete for the attention of a busy readership, and that if s/he can not attract the interest of his/her reader in the first statement(s), her/her case may

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be lost. The embedding of two (or more) moves is a typical phenomenon across all five moves of the abstract. There are examples given below.

[Nature/2]

> Type 2 diabetes mellitus results from the interaction of environmental factors with a combination of genetic variants, most of which were hitherto unknown. A systematic search for these variants was recently made possible by the development of high-density arrays that permit the genotyping of hundreds of thousands of polymorphisms. **We tested 392,935 single-nucleotide polymorphisms in a French case–control cohort. Markers with the most significant difference in genotype frequencies between cases of type 2 diabetes and controls were fast-tracked for testing in a second cohort.** This identified four loci containing variants that confer type 2 diabetes risk, in addition to confirming the known association with the TCF7L2 gene. These loci include a non-synonymous polymorphism in the zinc transporter SLC30A8, which is expressed exclusively in insulin-producing b-cells, and two linkage disequilibrium blocks that contain genes potentially involved in b-cell development or function (IDE–KIF11–HHEX and EXT2–ALX4). These associations explain a substantial portion of disease risk and constitute proof of principle for the genome-wide approach to the elucidation of complex genetic traits.

[Science/79]

> Structural variation of the genome involves kilobase- to megabase-sized deletions, duplications, insertions, inversions, and complex combinations of rearrangements. **We introduce high-throughput and massive paired-end mapping (PEM), a large-scale genome-sequencing method to identify structural variants (SVs) ~3 kilobases (kb) or larger that combines the rescue and capture of paired ends of 3-kb fragments, massive 454 sequencing, and a computational approach to map DNA reads onto a reference genome.** PEM was used to map SVs in an African and in a putatively European individual and identified shared and divergent SVs relative to the reference genome. Overall, we fine-mapped more than 1000 SVs and documented that the number of SVs among humans is much larger than initially hypothesized; many of the SVs potentially affect gene function. The breakpoint junction sequences of more than 200 SVs were determined with a novel pooling strategy and computational analysis. Our analysis provided insights into the mechanisms of SV formation in humans.

4.1.9 Move 4: Summarizing the results

There were 176 occurrences of Move 4: Summarizing the results, which were from *Science* = 73 times, 24.2%; *Nature* = 103 times, 27.1%; both = 176 times, 25.8%. Based on Santos, the preceding moves contain answers to the questions such as “What was the problem?”, “How did you study the problem?” Move 4 provides an answer to the question “What did you find?” Move 4, thus, summarizes briefly the main findings of the research, and indicates how the data were manipulated as in examples given below.

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[Nature/1]

In mice, pheromone detection is mediated by the vomeronasal organ and the main olfactory epithelium. Male mice that are deficient for Trpc2, an ion channel specifically expressed in VNO neurons and essential for VNO sensory transduction, are impaired in sex discrimination and male–male aggression. **We report here that Trpc22/2 female mice show a reduction in female-specific behaviour, including maternal aggression and lactating behaviour. Strikingly, mutant females display unique characteristics of male sexual and courtship behaviours such as mounting, pelvic thrust, solicitation, anogenital olfactory investigation, and emission of complex ultrasonic vocalizations towards male and female conspecific mice. The same behavioural phenotype is observed after VNO surgical removal in adult animals, and is not accompanied by disruption of the oestrous cycle and sex hormone levels.** These findings suggest that VNO-mediated pheromone inputs act in wild-type females to repress male behaviour and activate female behaviours. Moreover, they imply that functional neuronal circuits underlying male-specific behaviours exist in the normal female mouse brain.

[Science/98]

In flowering plants, the male germline begins with an asymmetric division, after which one of the resulting cells, the generative cell, divides symmetrically to produce two sperm cells. We show here that the male germline is initiated by transcriptional control. **We identify GRSF, germline-restrictive silencing factor, from the lily. GRSF is ubiquitous in nongerm cells and is absent from male germ cells. GRSF recognizes silencer sequences in promoters of genes specific to the germline, stably repressing these genes in cells that are not destined to become germ cells.**

4.1.10 Move 5: Discussing the research

There were 14 occurrences of Move 5: Discussing the research, which were from *Science* = 3 times, 1%; *Nature* = 11 times, 2.9%; both = 14 times, 2.1%. The term discussing the research given by Santos covers both the evaluation of findings, and also the other type of sub-moves which characterizes the linking of the reported research back to the broad research field. In other words, Move 5 makes claims based on reported findings which are typically realized by two sub-moves: submove 1- Drawing conclusions; submove 2- Giving recommendations. At the outset, examples of Move 5: Discussing the research, as illustrated below.

[Nature/2]

Type 2 diabetes mellitus results from the interaction of environmental factors with a combination of genetic variants, most of which were hitherto unknown. A systematic search for these variants was recently made possible by the development of high-density arrays that permit the genotyping of

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hundreds of thousands of polymorphisms. We tested 392,935 single-nucleotide polymorphisms in a French case–control cohort. Markers with the most significant difference in genotype frequencies between cases of type 2 diabetes and controls were fast-tracked for testing in a second cohort. This identified four loci containing variants that confer type 2 diabetes risk, in addition to confirming the known association with the TCF7L2 gene. These loci include a non-synonymous polymorphism in the zinc transporter SLC30A8, which is expressed exclusively in insulin-producing b-cells, and two linkage disequilibrium blocks that contain genes potentially involved in b-cell development or function (IDE–KIF11–HHEX and EXT2–ALX4). **These associations explain a substantial portion of disease risk and constitute proof of principle for the genome-wide approach to the elucidation of complex genetic traits.**

[Science/100]

Natural selection is expected to eliminate genetic incompatibilities from interbreeding populations. We have discovered a globally distributed incompatibility in the primarily selfing species Caenorhabditis elegans that has been maintained despite its negative consequences for fitness. Embryos homozygous for a naturally occurring deletion of the zygotically acting gene zeel-1 arrest if their sperm parent carries an incompatible allele of a second, paternal-effect locus, peel-1. **The two interacting loci are tightly linked, with incompatible alleles occurring in linkage disequilibrium in two common haplotypes.** These haplotypes exhibit elevated sequence divergence, and population genetic analyses of this region indicate that natural selection is preserving both haplotypes in the population. Our data suggest that long-term maintenance of a balanced polymorphism has permitted the incompatibility to persist despite gene flow across the rest of the genome.

4.1.11 Move 5: Discussing the research, submove 1- Drawing conclusions

There were 108 occurrences of Move 5: Discussing the research, submove 1-Drawing conclusions, which were from *Science* = 58 times, 19.2%; *Nature* = 50 times, 13.2%; both = 108 times, 15.8%. Santos stated that conclusion statements are meant to answer the question “What do the findings mean?” There are examples given below.

[Nature/4]

Many parasitic Apicomplexa, such as Plasmodium falciparum, contain an unpigmented chloroplast remnant termed the apicoplast, which is a target for malaria treatment. However, no close relative of apicomplexans with a functional photosynthetic plastid has yet been described. Here we describe a newly cultured organism that has ultrastructural features typical for alveolates, is phylogenetically related to apicomplexans, and contains a photosynthetic plastid. The plastid is surrounded by four membranes, is pigmented by chlorophyll a, and uses the codon UGA to encode tryptophan in the psbA gene. This genetic feature has been found only in coccidian apicoplasts and various mitochondria. The UGA-Trp codon and phylogenies of plastid and nuclear ribosomal RNA genes indicate that the organism is the closest known photosynthetic relative to apicomplexan parasites and that its plastid shares an origin with the apicoplasts. **The discovery of this organism provides a**

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powerful model with which to study the evolution of parasitism in Apicomplexa.

[Science/96]

Some Toll and Toll-like receptors (TLRs) provide immunity to experimental infections in animal models, but their contribution to host defense in natural ecosystems is unknown. We report a dominant-negative TLR3 allele in otherwise healthy children with herpes simplex virus 1 (HSV-1) encephalitis. TLR3 is expressed in the central nervous system (CNS), where it is required to control HSV-1, which spreads from the epithelium to the CNS via cranial nerves. **TLR3 is also expressed in epithelial and dendritic cells, which apparently use TLR3-independent pathways to prevent further dissemination of HSV-1 and to provide resistance to other pathogens in TLR3-deficient patients. Human TLR3 appears to be redundant in host defense to most microbes but is vital for natural immunity to HSV-1 in the CNS, which suggests that neurotropic viruses have contributed to the evolutionary maintenance of TLR3.**

4.1.12 Move 5: Discussing the research, submove 2–Giving recommendations

There were 18 occurrences of Move 5: Discussing the research, submove 2-Giving recommendations, which were from *Science* = 3 times, 1%; *Nature* = 15 times, 3.9%; both = 18 times, 2.6%. Recommendations are meant to answer the question "So what?" Therefore, submove 2 may briefly outline suggestions for future practice or investigation, said Santos, (1996). There are examples given below.

[Nature/5]

Mating in many species induces a dramatic switch in female reproductive behaviour. In most insects, this switch is triggered by factors present in the male's seminal fluid. How these factors exert such profound effects in females is unknown. Here we identify a receptor for the Drosophila melanogaster sex peptide (SP, also known as Acp70A), the primary trigger of post-mating responses in this species. Females that lack the sex peptide receptor (SPR, also known as CG16752), either entirely or only in the nervous system, fail to respond to SP and continue to show virgin behaviours even after mating. SPR is expressed in the female's reproductive tract and central nervous system. The behavioural functions of SPR map to the subset of neurons that also express the fruitless gene, a key determinant of sex-specific reproductive behaviour. **SPR is highly conserved across insects, opening up the prospect of new strategies to control the reproductive and host-seeking behaviours of agricultural pests and human disease vectors.**

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[Science/92]

> Human cancer is caused by the accumulation of mutations in oncogenes and tumor suppressor genes. To catalog the genetic changes that occur during tumorigenesis, we isolated DNA from 11 breast and 11 colorectal tumors and determined the sequences of the genes in the Reference Sequence database in these samples. Based on analysis of exons representing 20,857 transcripts from 18,191 genes, we conclude that the genomic landscapes of breast and colorectal cancers are composed of a handful of commonly mutated gene "mountains" and a much larger number of gene "hills" that are mutated at low frequency. **We describe statistical and bioinformatic tools that may help identify mutations with a role in tumorigenesis.** These results have implications for understanding the nature and heterogeneity of human cancers and for using personal genomics for tumor diagnosis and therapy.

In summary, move 1: Situating the research submove 1A which is the stating current knowledge and move 4 which is the summarizing the results of scientific abstract have become conventional in the discipline of writing. The lower occurrences or lower percentage number of move analysis that indicate research article structure in this corpus, indicates that science research articles do not closely adhere to them. Thus, this confirms linguists' observations about move analysis such as (Bhatia, 1997; Santos, 1966; Swales, 1990) that disciplinary variation seems to play an important role in determining the characteristics of each rhetorical move.

4.2 How do the scientific abstracts in *Science* and *Nature* differ from Santos' pattern?

The results revealed that the moves and submoves of both *Science* and *Nature* were similar to that of Santos' pattern. However, the number of moves and submoves occurred among these sources (*Science, Nature,* Santos' study) were different. The results are as illustrated in Table 4.6.

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Table 4.6 A comparison between moves found in this study and Santos's (1996)

The Five Moves	The present study		Santos's study	
	Frequency	Ranking	Frequency	Ranking
Move 1: Situating the Research	-	-	40	7
Submove 1A – Situating current knowledge	149	2	33	8
and/or				
Submove 1B – Citing previous research	10	10	7	13
and/or				
Submove 1C – Extended previous research	1	12	3	14
and/or				
Submove 2- Stating the problem	41	6	24	10
Move 2: Presenting the Research	-	-	93	1
Submove 1A – Indicating main features	76	4	77	3
and/or				
Submove 1B – Indicating main purpose	10	8	26	9
and/or				
Submove 2 – Hypothesis raising	4	11	18	11
Move 3: Describing the methodology	75	5	92	2
Move 4: Summarizing the results	176	1	75	4
Move 5: Discussing the research	14	8	58	5
Submove 1- Drawing conclusions	108	3	50	6
and/or				
Submove 2 – Giving recommendations	18	7	12	12

Corpus analysis studied by Santos (1996) consisted of 94 research article abstracts selected from three journals in the field of linguistics: *Language Learning*, *Applied Linguistics*, and *TESOL Quarterly*. Santos followed the work of Swales (1990), Dudley-Evans (1986), and Crookes (1986) by skimming each abstract to get the feel of the overall organization. In a preliminary analysis, he tried to relate each sentence of the abstract to one of the four components (Introduction, Method, Results, and Discussion) of the research article. As genres are purposed, staged activities, the *move* was chosen as the unit of analysis. A move is to be considered as a genre stage or part which has a certain, minor communicative purpose of the genre. Then he came up with an extra move of his own which is *Situating the research*. The results found by Santos' study indicated that the discourse organization of research article abstract

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writing in the field of Applied Linguistics Move 2: Presenting the research and Move 3: Describing the methodology is essentially obligatory. As the number of occurrences found in Table 4.6, Move 2: Presenting the research and Move 3: Describing the methodology in his study occurred in large numbers.

4.3 Do the science article abstracts in *Nature* differ from those found in *Science*?

In comparison with the present study which mainly focuses on the science field, all article abstracts were drawn from *Science* and *Nature* journals, the results from analyzing the corpus indicated that Move 1: Situating the research submove 1A- Situating current knowledge and Move 4: Summarizing the results are essentially obligatory. This study considers that any move that occurs less than twenty percent of the time is an *optional* move. Optional moves found that meet this criteria were Move 2: Presenting the research (11.1%), Move 3: Describing the methodology (11 %). Therefore, a move that occurs more than twenty percent of the time is a *mandatory* move which consist of: Move 4: Summarizing the results (25.8%), Move 1: Situating the research submove 1A- Situating current knowledge (21.8%), and Move 5: Discussing the research submove 1- Drawing conclusions (15.8%). In fact, abstract move patterns found in the study were essentially the same, inasmuch as, both Santos' study and this present study revealed the five moves as in the Santos pattern. Santos' (1996) only differed in the number of occurrences of relative moves. The huge number of Move 1: Situating the research submove 1A- Situating current knowledge and Move 4: Summarizing the results were found in this corpus study shown in Table 4.6 firmly confirm the results.

The results revealed that abstracts in *Science* and *Nature* both showed the same moves at the top of Table (mandatory move) and at the bottom of Table (optional). They only differed in terms of the number of occurrences.

From these results it could be implied that scientists focus on drawing the attention of readers by introducing them to the situation of current knowledge in order to inform readers of the importance of how their research needs to be conducted and then show the absolute outcomes of their studies along with giving recommendations for further studies. However, abstract writing usually follows a format which is as a rule closely related to Santos' abstract move pattern. Although, the incidence of certain moves as well as vocabulary use will vary from genre to genre.

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CHAPTER V
DISCUSSION

In this chapter, research discussions are presented regarding the moves found in scientific abstracts collected from two prestigious journals *Science* and *Nature*: an equal amount of fifty from each publication were selected for this research. Santos' abstract move pattern is used as a theoretical framework for this research in order to compare these research findings with previous studies and answer the questions posed at the end of Chapter one. Finally, implications from this research are discussed.

5.1 Discussion of finding one

Which pertains to the first question; what moves were found in scientific abstracts? Most of the moves found in this study shared a similarity with the study by Santos (1996). He began his work by following on from the work of Swales (1990), Dudley-Evans (1986), and Crookes (1986). He studied the overall organization in order to see how researchers offer a summarized vision of their research articles. In a preliminary analysis, he tried to relate each sentence of the abstract to one of the four components (Introduction, Method, Results, and Discussion) of the research article. Santos' notion of move abstracts stated that "A move is to be considered as a genre stage which has a particular, minor communicative purpose to fulfill, which in turn serves the major communicative purpose of the genre. Following identification and marking of the moves or stages that appeared". He dealt with abstracts in journal research articles as a specific genre or text type, which were in the field of applied linguistics in a total of ninety-four abstracts. After careful examination of all those abstracts, he came up with five abstract move patterns which were; *Situating the research*, *Presenting the research*, *Describing the methodology*, *Summarizing the results*, and *Discussing the research*.

This study investigated journal abstract organization in the science field. Most abstracts in this present study were found to have five moves that concur with Santos'

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framework, however all five moves did not follow the order that appeared in Santos' model. Some abstracts included all five moves, while, some did not. This may explain that abstract writing in the fields of science and applied linguistics have the same main core pattern which certainly includes purpose, methodology, results and conclusion. Different fields emphasize different parts of their abstract (Cross & Oppenheim, 2006).

The results of analyzing a hundred scientific journal abstracts from *Science* and *Nature*, reveal an interesting point. On closer inspection, the frequency of the occurrence of moves in the abstracts from both *Science* and *Nature* journal were very similar including both moves and sub-moves. Notwithstanding this similarity, there were obvious differences in the occurrence of Move 3: Describing the methodology. The incidence of Move 3 was used more frequently in *Science* (15.6%) than *Nature* (7.4%). Even though, Move 3 was used far more frequently in *Science* overall move 3 was still used less frequently than other moves found in the abstracts in this study. It is apparent that the trend of scientific abstract writing leans towards using the pattern revealed by this study. The pattern starts from situating the current knowledge, then showing results, and drawing conclusions along with giving suggestions for further study whilst omitting details of research methodology. It may be discussed that *Science* and *Nature* are types of science magazines for multi-disciplinary fields for whoever wants to keep up with the latest scientific news. Therefore, to keep an abstract short and straight to the point, showing results and barely describing methodology would be a means to engage a readers' attention. It also saves the readers time and makes good use of abstract writing space. Moreover, scientists may be familiar in terms of the methodology used in experiments and so could probably be left out in the abstract portion. However, if readers are interested and want to do future research they can look for more details within the paper. Nevertheless, some scientific fields use mostly technical terms or specific language which could cause readers difficulty in comprehending what they are reading. Results of scientific study can result in changes in science and technology worldwide. Scientists emphasize reliable study results in order to aid further study. Experiments in the scientific community are precise, methodical, and accurate and details of the results of each experiment are important and will be there forever. In order to support this discussion, I will show one

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authentic example of an abstract from this study which omits describing the methodology used in the study and focuses only on the results:

[Nature/1]

> In mice, pheromone detection is mediated by the vomeronasal organ and the main olfactory epithelium. Male mice that are deficient for Trpc2, an ion channel specifically expressed in VNO neurons and essential for VNO sensory transduction, are impaired in sex discrimination and male–male aggression. We report here that Trpc22/2 female mice show a reduction in female-specific behaviour, including maternal aggression and lactating behaviour. **Strikingly, mutant females display unique characteristics of male sexual and courtship behaviours such as mounting, pelvic thrust, solicitation, anogenital olfactory investigation, and emission of complex ultrasonic vocalizations towards male and female conspecific mice. The same behavioural phenotype is observed after VNO surgical removal in adult animals, and is not accompanied by disruption of the oestrous cycle and sex hormone levels.** These findings suggest that VNO-mediated pheromone inputs act in wild-type females to repress male behaviour and activate female behaviours. Moreover, they imply that functional neuronal circuits underlying male-specific behaviours exist in the normal female mouse brain.

Situating current knowledge is second in importance. According to scientific research methodology, researchers need to review related literatures in order to (1) study previous research, (2) reduce redundant works of others, (3) find evidence to support hypothesis raising, and (4) create novel scientific research (Mcmilian & Shmacher, 1997). Scientists definitely follow traditional scientific research methodology because they know and realize that this is the most effective way to conduct their research. In order to draw readers' attention, scientists need to relate their study to the readers' world situation. Furthermore, scientists want to show readers the importance of their study, and how it could effect or make changes in the world (Ayers, 2008). This was confirmed by Swales who stated that "My knowledge

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is important". In addition, doing research is one means for scientists to introduce new and novel knowledge to the scientific community. Hence, to support this discussion I have selected an example abstract from this study which emphasizes situating the current knowledge before going through other details:

[Nature/24]

> **MicroRNAs are crucial modulators of gene expression, yet their involvement as effectors of growth factor signalling is largely unknown. Ligands of the transforming growth factor-b superfamily are essential for development and adult tissue homeostasis. In early Xenopus embryos, signalling by the transforming growth factor-b ligand Nodal is crucial for the dorsal induction of the Spemann's organizer.** Here we report that Xenopus laevis microRNAs miR-15 and miR-16 restrict the size of the organizer by targeting the Nodal type II receptor Acvr2a. Endogenous miR-15 and miR-16 are ventrally enriched as they are negatively regulated by the dorsal Wnt/b-catenin pathway. These findings exemplify the relevance of microRNAs as regulators of early embryonic patterning acting at the crossroads of fundamental signalling cascades.

Drawing a conclusion is also essential. Scientists as researchers have experience in planning, conducting, and present their research. The cycle of their work runs continually all of their working life as they gain more knowledge and experience. Thus, their conclusions are a need and niche of their scientific field and readers, scientists, or students who want to read or even comply with those conclusions**.** Importantly, their conclusions represent scientists when other researchers conduct new studies in relevant topics. In other words, their names will be recorded in other studies in order to give credit for their previous work. In order to support this discussion an authentic abstract that donates half of the abstract writing space to drawing a conclusion is illustrated below:

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[Science/76]

> Axonal guidance and vascular patterning share several guidance cues, including proteins in the netrin family. We demonstrate that netrins stimulate proliferation, migration, and tube formation of human endothelial cells in vitro and that this stimulation is independent of known netrin receptors. Suppression of netrin1a messenger RNA in zebrafish inhibits vascular sprouting, implying a proangiogenic role for netrins during vertebrate development. **We also show that netrins accelerate neovascularization in an in vivo model of ischemia and that they reverse neuropathy and vasculopathy in a diabetic murine model. We propose that the attractive vascular and neural guidance functions of netrins offer a unique therapeutic potential.**

5.2 Discussion of finding two

How did the findings find differences or similarities to Santos' study? This present research has some differences compared with Santos' study, namely the frequency of occurrence of each move and move order. The study by Santos indicated the majority of moves fall into the area of Move 2: Presenting the research and Move 3: Describing the methodology. It can be implied that these two moves are essential for abstract writing in the field of applied linguistics. Interestingly, based on the finding of this research, which is, scientific abstracts in journals, the research revealed some interesting angles. The results showed a very high percentage occurrence of Move 4: Summarizing the results (25.8%), Move 1: Situating the research submove 1A-Situating current knowledge (21.8%), and Move 5: Disusing the research submove 1- Drawing conclusions (15.8%). It can be surmised that these three moves are obligatory for scientific abstracts writing for the two journals: *Science* and *Nature*. Furthermore, scientists place most emphasis of their research on the results. The results of scientific research either pure or applied science lead to change and development in science and technology. For example, a team of scientists showed how to unlock the sequencing of human DNA which has had a profound effect on the world. Other examples are: vaccines, medicine, surgery, disease resistant crops, and body parts replacement which helps people live longer or can be life saving, nuclear physics which has a huge effect on world politics and the balance of power between

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countries. Vaccines have affected everybody's life, for example, the vaccine against smallpox which has eradicated this awful disease from every continent. To conclude, the results of scientific research help people to live work and study in good health and be happier. The similarity between Santos' study and this present study is that abstract moves fall into the five move pattern as presented by Santos. It has been shown that scientific writers approach the writing of abstracts with more emphasis on the results and conclusions than on methodology. Writers from the arts; linguists, psychologists and the like, place an emphasis on methodology as well as conclusions reached and recommendations for further study. This current study reached certain conclusions about writing abstracts in the field of science. However, a considerable amount of further research into abstract writing is needed across a wide range of writing genres.

5.3 Discussion of finding three

The results of data analysis reveal that the organization of abstracts basically conforms to Santos' tripartite move structure to a great extent in terms of move type and sequence. That is, the five moves identified in the two journals are identical to those stipulated in Santos' model. Moreover, the frequency of these three moves Move 4: Summarizing the results, Move 1: Situating the research submove 1A- Situating the current knowledge, and Move 5: Discussing the research submove 1- Drawing conclusions is high, for the following reason: the results and conclusions are more vital than the method and it could be considered as mandatory. In particular, the five moves found in these scientific abstract occur sequentially, there were only a few abstracts that were not in the expected order. It was noticed that double the percentage of occurrences of Move 3: Describing the Methodology were found in *Science* journal (15.4%) in comparison with *Nature*.

The possible answers that I have for this question could be explained in the following supporting details. First, in the science field, scientists emphasize the outcomes of the research or evidence or counter arguments with previous studies in order to prove the results and make his/her research strong and reliable. Most science results are often explained with tables or graphs, hence are very definitely objective and can be proven with figures. Scientific abstracts often state the current situation to show the readers why this kind of research needs to be undertaken in order to solve the

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current problems. The final move, which is drawing conclusions and suggesting the need for further study, apparently seems to be a dominant feature in scientific journal writing.

In my opinion, it is understandable that scientific abstracts do not emphasize the methodology of the research when writing abstracts because most scientific research methods are very complicated, precise, detailed, and accurate. They have to repeat their experiments under varying circumstances in order to discover the most reliable results. The errors have to be as low as possible. Thus, methods can be verified at all times and at most places. For example, for the development of new medicines, because they will be used on humans, they must be tested over a long period of time in many different locations and among various ethnic groups. Moreover, some scientists may replicate their method thus, scientists need to plan well and conduct their research in a meticulous manner. In order to save space, some journals ask scientists to write only the name of the instruction or method. Hence, scientists prefer to focus on their results and may only briefly mention the methodology. This provided evidence that the move selection in the corpus falls short of an acceptable standard for abstracts, in contrast to abstracts in the applied linguistic field which emphasizes describing their research methodologies as well as results. Besides, scientists do not bother to present their research with elegant words, because it will take a lot of space and makes their abstracts longer than necessary, which goes against the good hallmark of abstract writing. On the other hand, researchers in the applied linguistics field go to great lengths to describe their methodologies as the intended audience is likely to be more able to comprehend the language used in those descriptions. In addition, this study also revealed considerable use of move embedding which substantiated the results in Santos' study. These findings correspond to the study of Cross and Oppenheim (2006) and Santos (1996). This approach allows the writer to organize information in a way that marries the need to impart information succinctly and cohesively in a necessarily condensed document.

Finally, in general, the findings of this study followed a five-move pattern: *relation to other research, purpose, methodology, results and discussion of the research.* The possible obligatory moves of this research are Move 4: Summarizing

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the results and Move 1: Situating the research submove 1A- Stating current knowledge which varys from Santos' study.

5.4 Implications from the study

This present study shows the rhetorical organization of scientific abstracts. The analysis reveals certain similarities and differences in abstracts. At the move level, the two scientific journals are similar with regards to the presence, conventional status, and typical sequence of the five moves. In addition, this present study outcome has similar results to the studies by Santos which were used as a theory framework.

This awareness of prevailing rhetorical patterns has some pedagogical significance and can be explained. First, English is important to the extent that it is now the lingua franca. Consequently, non-native speakers of English (NNSs) are at a disadvantage with respect to reading published journals and publishing their own work in English. These insights into how article abstracts are constructed from this study can increase and facilitate accessibility to disciplinary information for NNSs.

Second, in a class where the learners come from a cross-section of disciplines, the findings of this study will provide the possibility of comparison across disciplines. The comparison facilitates learners' awareness of differences and anomalies and to enhance observation skills when exposed to other varieties of academic discourse.

Third, the rhetorical insights gained from this study can help formulate strategies in teaching the reading and writing of research article abstracts. Teaching techniques and procedures in a genre-based classroom is dependant on the aim and general focus of the lesson. Some procedures might focus on certain aspects of language, whereas others might focus on the context of language use. In particular, to prepare advanced learners adequately for future academic writing as well as to mirror the actual requirements of their academic work in their respective disciplines, making research articles an integral part of the curriculum is of paramount importance in representing authentic teaching/learning materials. It should be to encourage students to understand the choices they make in the composition of particular texts so that they can utilise this information for their own discoursal purposes (Bazerman, 1988). EFL/ESL students who have to write their own theses would discover that this study can be used as a useful source to produce their abstracts. Learners need to have an

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understanding of how features of a situation – such as the participants involved in the communication; the specific purpose(s) of the communication; and a discourse community's values, priorities, and expectations – may have an impact on the choices they make in the formulation and production of a particular genre.

Fourth, the rhetorical structure described in this study provides a flexible organizational paradigm regarding an approach to writing an abstract for scientists as to which rhetorical moves could, or should be used and in what order. Although the rhetorical structure may be stipulated by editorial policy of the journal, the framework will at the very least, make the task of writing an academic article abstract not quite so daunting. Given the flexible nature of the framework, modifications can be, and should be, made to the model to accommodate the specific disciplinary communities learners are entering.

Fifth, an understanding of rhetorical variation in texts from different disciplines yielded by this study can inform decisions concerning the design of academic programs and other related pedagogical issues such as the development of teaching materials, test materials and assessment. Academic research articles can provide a valuable resource for selection of test samples; they comprise language variety that examinees are likely to encounter in higher education. The findings of this study can help enhance face validity, reliability, and content validity of a variety of language tests.

In summary, this study increases our understanding of academic writing and broadens our perspectives of textual variation within research article abstract writing. The study highlights the fact that writing is a complex construct, consisting of a range of knowledge sets and processes. In addition, rhetorical organizations are not static but dynamic, impacted by many factors, including disciplinary conventions, nature of the research, and status of the researchers. Some new sub-moves have emerged, while others are simply disappearing; some are gaining popularity while others attract less attention. Therefore, learners should be trained and encouraged to be observant, analytical, and sensitive to rhetorical patterns when faced with research article abstracts in their respective disciplines.

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CHAPTER VI
CONCLUSION

In today's world of commerce, big business, diplomacy, and education, English has risen to the top and is now indisputably the lingua franca. On the international stage, whether it be negotiation, research or any other form of communication, English is used to either access information or conversely to disseminate information. When a researcher wants to publish a paper on the international stage it is imperative that it is written in English. The vast majority of serious articles are written in English, so as to gain a widespread international readership and acceptance in the discourse field that it is intended to reach.

The key to having a paper published in any prestigious publication is to be able to write in the manner that is expected by the readership and publishers. The science field, in particular, expects that research papers are presented accurately and display linguistic competence and knowledge of genres and forms. Thus, writers need to develop skills that will enable them to acquire a more comprehensive mastery of new genres.

Articles written within the scientific community are aimed at and written by high-brow members of this specialized discourse community, who are considered to be the crème de la crème within this community. Research articles have been studied extensively and are a key conduit for the introduction of novel scientific knowledge to the international scientific community. Linguists have shown great interest in article abstracts and have recognized the need to understand the linguistic mechanisms that are found in these texts. The undeniable importance of abstracts as a tool for managing the ever burgeoning flow of scientific knowledge has fueled this interest.

The primary aim of the present research focuses on abstracts and abstracting in the field of science published by two leading science journals due to their high impact factor namely: *Science* and *Nature*. This research work is intended to explore how communicative purposes are achieved in one science field. Therefore, a hundred

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abstracts that have appeared in *Science* and *Nature* during the period 2006 to 2008 were analyzed. The articles published in those journals belong to various scientific fields. These journals publish multidisciplinary science issues from all around the world. Thus, the content and authors of these articles are not a factor for selecting them. This study explores the move ordering pattern (move structure) of those journals on the grounds of Santos's (1996) abstract move patterns, with the aim of knowing whether there were move variation found in the pattern. The following are the specific research questions that this study aimed to explore.

1. What moves were found in the science article abstracts?
2. How do the scientific abstracts in *Science* and *Nature* differ from Santos' pattern?
3. Do the science article abstracts in *Science* differ from those found in *Nature*?

6.1 Summary of the study

The purpose of the study was to investigate the organization found in research article journal abstracts in the scientific field.

The data in this study were abstracts (100 abstracts) published in two prestigious journals namely: *Science* and *Nature* journals during 2006-2008. They were all collected from the library of Mahidol University at the Salaya Campus.

The findings of the study can be summarized as follows:

Most abstracts in this present study were found to have five moves that concur with Santos' framework, however, all five moves did not follow the same order as appeared in Santos' model.

1. There were fives moves found in the analyzed abstracts: Situating the research, Presenting the research, Describing the methodology, Summarizing the results, Discussing the research. They all differed in frequency of occurrence. The 'Summarizing the results' move occurred most, 'Describing the methodology' occurred least.

2. The results found from this study share similarities with Santos' study which was used as the paradigm for this study. Moves found in scientific abstracts fall into five moves as well as a study by Santos in Applied Linguistics field. Contrasts,

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The move found in scientific abstracts have some differences in a degree of percentage occurrences of move.

3. Article journal abstracts found in *Science* were similar to *Nature* in terms of moves used.

This present research has some differences compared to Santos' study, namely the frequency of occurrence of each move and move order. The study by Santos indicated the majority of moves fall into the area of Move 2: Presenting the research and Move 3: Describing the methodology. It can be implied that these two moves are essential for abstract writing in the field of applied linguistics. Interestingly, based on the finding of this research, which is, scientific abstracts in journals, revealed some interesting angles. The research results showed the enormous percentage of the occurrence of Move 4: Summarizing the results (25.8%), Move 1: Situating the research submove 1A- Situating current knowledge (21.8%), and Move 5: Discussion submove 1- Drawing conclusions (15.8%). It can be explained that these three moves are obligatory for scientific abstracts writing for the two journals: *Science* and *Nature*.

On closer inspection, data reveals that the organization of abstract basically conforms to Santos' tripartite move structure to a great extent in terms of move type, and sequence. That is, the five moves identified in the two journals are identical to those stipulated in Santos' model. Moreover, the frequency of these three moves is high and it could consider as a mandatory. In particular, these five moves found in these scientific abstract occur sequentially, there are only a few abstracts that the moves were not in the expected order. It was noticed that double the occurrence of Move 3: Describing the methodology were found in *Science* journal in comparison.

However, there are slight differences and similarities between *Science* and *Nature*. Similarity; Move 3: Describing the methodology from those journals was used less than other moves. Differently; the incidence of move 3 was used more frequently in *Science* (15.6%) than *Nature* (7.4%).

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6.2 Recommendations for further studies

From the findings of the present project, further studies should be carried out to gain a deeper understanding and application as recommended below:

1. Genre study

There should be an investigation of the whole article of these scientific journals, in order to get the whole picture of how scientific articles are constructed. In order to produce a useful pedagogical resource for scientists, scholars, and interested parties who wish to publish their research paper in those prestigious journals.

1.2 There should be an investigation of other linguistic features such as the tenses, active voice, and passive voice.

1.3 There should be an investigation of the articles in both journals in order to compare and contrast between them. Knowing the similarities and differences of these journals must be helpful for publishing articles in those journals.

1.4 Other sources of abstract writing should be conducted in a field other than science in order to provide a valuable resource for ESL/EFL students who have to deal with abstract writing when thesis writing time comes.

2. Experimental teaching writing from the results of this study and from existing text bases and results of genre analysis for each ESP. The results from this study provide useful pedagogical and authentic material for teachers who teach academic writing for EFL/ESL. There should be an experimental study using commercial material and the outcomes from research teaching abstract writing, in order to find out the effective teaching method or approach to abstract writing.

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BIBLIOGRAPHY

Ad Hoc Working group for Critical Appraisal of the Medical Literature. (1987). *Annals of Internal Medicine*, *106*(4), 598-604.

Aicken, F. (1991). *The nature of science*. Portsmouth: NH: Heinemann.

Akinaso, F. N. (1982). On the differences between spoken and written language. *Language and Speech, 25*, 97-125.

Anderson, J. R. (2000). *Cognitive psychology and its implications*. NY: Worth Publishers.

Armstrong, C. J., & Wheatley, A. (1998). Writing abstracts for online databases: Results of an investigation of database producers' guidelines. *Program, 32*(4), 359-371.

Atkinson, D. (1992). The evolution of medical research writing from 1735 to 1985: The case of the Edinburgh Medical Journal. *Applied Linguistics, 13*(4), 337-374.

Atkinson, D. (1996). The philosophical transactions of the royal society of London, 1675-1975: A sociohistorical discourse analysis. *Language in Society, 25*, 333-371.

Ayers, G. (2008). The evolutionary nature of genre: An investigation of the short text accompanying research articles in the scientific journal *Nature*. *English for Specific Purposes, 27*, 22-24.

Bakhtin, M. M. (1986). The problem of speech genres [Translated by V.W.Mcgee]. In C. Emerson & M. Holquist (Eds.), *Speech genres and other late essays.* (pp. 60-102). Austin, Texas University of Texas Press.

Baldauf, R., & Jernudd, J. (1983). Language of publication as a variable in scientific communication. *Australian Review of Applied Linguistics, 6*, 97-108.

Bazerman, C. (1988). *Shaping written knowledge: The genre and activity of the experimental article in science*. Madison, WI: University of Wisconsin Press.

Berkenkotter, C., & Huckin, N. T. (1995). *Genre knowledge in disciplinary communication: cognition, culture, power*. Hillsdale, NJ: Lawrence Erlbaum.

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Bhatia, V. K. (1993). *Analysing genre: Language use in professional settings*. London: Longman.

Bhatia, V. K. (1997). Genre-mixing in academic introductions. *English for Specific Purposes, 16*(3), 181-195.

Biber, D. (1986). Spoken and written textual dimensions in English: Resolving the contradictory findings. *Language, 62*(2), 384-414.

Biber, D., Conrad, S., & Reppen, R. (1998). *Corpus linguistics: Investigating language structure*. Cambridge: Cambridge University Press.

Blakeborough, L., & Oppenheim, C. (1980). The readability and information content of new law abstracts and old law abridgements. *Journal of Chartered Institute of Patent Agents, 10*, 86-92.

Bloor, M. (1996). Academic writing in computer science: A comparison of genre. In Eija Ventola & A. Mauranen. (Eds.), *Academic writing: Intercultural and textual issue.* (pp. 59-88). Amsterdam: John Benjamins.

Bonn, V. S., & Swales, M. J. (2007). English and French journal abstracts in the language sciences: Three exploratory studies. *English for Specific Purposes, 6*, 93-108.

Brett, P. (1994). A genre analysis of the results section of sociology articles. *English for Specific Purposes, 13*(1), 47-59.

Brown, G., & Yule., G. (1983). *Discourse Analysis*. Cambridge: Cambridge University Press.

Busch-Lauer, I. A. (1995). Abstracts in German medical journals: A linguistic analysis. *Information Processing & Management, 31*(5), 769-776.

Carter-Tomas, S., & Rowley-Jolivet, E. (2001). Syntactic differences in oral and written scientific discourse: The role of information structure. *ASp 31*(33), 19-37.

Carter, R., & McCarthy, M. (1995). Grammar and the spoken language. *Applied Linguistics, 16*, 38-55.

Chafe, W. (1982). Integration and involment in speaking, writing, and oral literature. In D. Tannen. (Ed.), *Spoken and Written language: Exploring orality and literacy.* (pp. 35-54). Norwood, NJ: Ablex.

Copyright by Mahidol University

Cheung, M. B. K. (1993). Small corpora concordancing in ESL teaching and learning. *Hongkong papers in Linguistics and Language Teaching, 16*, 11-30.

Connor, U. (2000). Variation in rhetorical moves in grant proposals of US humanists and scientists. *Text, 20*(1), 1-20.

Connor, U., Davis, K., & De Rycker, T. (1995). Correctness and clarity in applying for overseas jobs: A cross cultural analysis of US and Flemish applications. *Text, 15*, 45-476.

Connor, U., Precht, K., & Upton, T. (2002). Business English: Learner data from Belgium, Finland, and the US. In S. Granger, J. Hung & S. Precht (Eds.), *Computer learner corpora, second language acquisition, and foreign language teaching* (pp. 175-194). Amsterdam: Benjamins.

Cope, B., & Kanlantzis., M. (1993). Introduction: How a genre approach to literacy can transform the way writing is taught. In Bill Cope & M. Kalantzis. (Eds.), *The powers of literacy: A genre approach to teaching writing.* (pp. 1-21). Pittsburgh: University of Pittsburgh Press.

Crookes, G. (1986). Towards a validated analysis of scientific text structure. *Applied Linguistics, 7*(57-70).

Cross, C., & Oppenheim, C. (2006). A genre analysis of scientific abstracts. *Journal of Documentation, 62*(4), 428-446.

Crossley, S. (2007). A chronotopic approach to genre analysis: An exploratory study. *English for Specific Purposes, 26*, 4-24.

Crystal, D. (1987). *The Cambridge Encylopedia of language*. Cambridge, England: Cambridge University Press.

Day, R. A. (1988). *How to write and publish a scientific paper*. Cambridge: Cambridge University Press.

Devitt, A. (2004). *Writing Genres.* Carbondale, IL: Southern Illinois University Press.

Dixon, J. (1987). The question of genres. In I. Reid. (Ed.), *The place of genre in learning: current debates* (pp. 9-21). Deakin University: Centre for Studies in Literary Education.

Dudley-Evans, T. (1986). Genre analysis: An investigation of the introduction and discussion sections of M.Sc. dissertations. In M. Coulthard. (Ed.), *Talking*

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about text (pp. 128-145). Birmingham, UK: English language research, Birmingham University.

Duschl, R. A. (1990). *Restructuring science education: The importance of theories and their development*. NY: Teachers College Press.

Eggins, S., & Martin, J. R. (1997). Genres and registers of discourse. In T. V. Dijk (Ed.), *Discourse studies a multidisciplinary introduction* (pp. 230-256). London: Sage Publication.

Eisenberg, A. (1982). *Effective technical communication*. NY: McGraw Hill.

Endres-Niggemeyer, B. (1998). *Summarizing Information: Including CD-Rom "SimSun", Simulation of Summarizing for Macintosh and Windows*. Berlin: Springer.

Flowerdew, J. (1993a). Concordanceing as a tool in course design. *System, 21*(2), 231-244.

Flowerdew, J. (1993b). An educational, or process, approach to the teaching of professional genres. *ELT Journal, 47*(4), 305-316.

Fox, C., & Hartley, J. (2003). Abstracts, introductions and discussions: How far do they differ in style? *Scientometrics, 57*(7), 389-398.

Garfield, E. (1983). Talking Science (review). *Nature*, 303-354.

Golebiowski, Z. (1998). Rhetorical approaches to scientific writing: An English-Polish contrastive study. *Text, 18*(1), 67-102.

Gosden, H. (1992). Discourse functions of marked theme in scientific research articles. *English for Specific Purposes, 11*, 207-224.

Gunawardena, C. N. (1989). The present perfect in the rhetorical divisions of biology and biochemistry journal articles. *English for Specific Purposes, 8*, 265-275.

Halliday, M. A. K. (1989). *Spoken and written language*. NY: Oxford University Press.

Hartley, J. (1994). Three ways to improve the clarity of journal abstracts. *British Journal of Educational psychology, 64*, 331-343.

Hartley, J. (1999). Applying ergonomics to applied ergonomics: Using structured abstracts. *Applied Ergonomics, 30*, 535-541.

Hartley, J. (2000a). Clarifying the abstracts of systemic reviews. *Bulletin of the Medical Library Association, 88*(4), 332-337.

Copyright by Mahidol University

Hartley, J. (2000b). Are structured abstracts more or less accurate than traditional ones? A study in the psychological literature. *Journal of Information Science, 26*, 273.

Hartley, J. (2002). Do structured abstracts take more space? And does it matter? *Journal of Information Science, 28*, 417.

Hartley, J., Pennebaker, W., & Fox, C. (2003). Abstracts, introductions and discussions: How far do they differ in style? *Scientometrics, 57*(3), 389-398.

Hartley, J., & Sydes, M. (1995). Structured abstracts in the social sciences: Presentation, readability, recall. Boston Spa: British Library.

Henry, A., & Roseberry, R. L. (1998). An evaluation of a genre-based approach to the teaching of EAP/ESP writing. *TESOL Quarterly, 32*, 147-156.

Henry, A., & Roseberry, R. L. (2001). A narrow angled corpus analysis of moves and strategies of the genre: Letter of application. *English for Specific Purposes, 20*, 153-167.

Holmes, R. (1997). Genre analysis and the social sciences an investigation of the structure of research article discussion sections in three disciplines. *English for Specific Purposes, 16*(4), 321-337.

Hopewell, S., Eisinga, A., & Clarke, M. (2007). Better reporting of randomized trials in biomedical journal and conference abstracts. *Journal of Information Science, 34*, 162.

Hopkins, A., & Dudley-Evans, T. (1988). A genre-based investigation of the discussion sections in article and dissertation. *English for Specific Purposes, 7*, 113-122.

Huckin, T. N., & Olsen., L. A. (1991). *English for science and technology: A handbook for nonnative speakers*. Auckland, New Zealand: McGraw-Hill.

Hunston, S. (2002). *Corpora in applied linguistics*. Cambridge: Cambridge University Press.

Huth, E. J. (1987). Structures abstracts for papers reporting clinical trials *Annals of Internal Medicine, 106*, 626-627.

Hyland, K. (1994). Hedging in academic textbooks and EAP. *English for Specific Purposes, 13*, 239-256.

Copyright by Mahidol University

Hyland, K. (1996a). Talking to the academic: Forms of hedging in science research articles. *Written Communication, 13*(2), 251-281.

Hyland, K. (1996b). Writing without conviction? Hedging in science research article. *Applied Linguistics, 17*(4), 433-454.

Hyland, K. (1996c). Nurturing hedges in the ESP curriculum. *English for Specific Purposes, 24*(4), 477-490.

Hyland, K. (1998). Persuasion and context: The pragmatics of academic metadiscourse. *Journal of Pragmatics, 30*, 437-455.

Hyland, K. (1999). Disciplinary discourses: writer stance in research articles. In C. N. Candlin. & K. Hyland. (Eds.), *Writing: text, processes and practices* (pp. 99-119). NY: Addison Wesley Longman.

Hyland, K. (2000). *Disciplinary discourses: Social interactions in academic writing*. London: Longman.

Hyland, K. (2004). *Genre and Second Language Writing*. Ann Arbor, MI: The University of Michigan Press.

Hyon, S. (1996). Genre in three traditions: Implications for ESL. *TESOL Quarterly, 30*, 693-722.

Hyon, S. (2001). Long-term effects of genre-based instruction: A follow-up study of an EAP reading course. *English for Specific Purposes, 2*, 417-438.

Hyon, S. (2002). *Genre and ESL reading: a classroom study. To appear in A.M. Johns, Genre and pedagogy: multiple perspectives*. Mahwah, NJ: Lawrence Erlbaum.

Johns, A. M. (2002). *Genre in the classroom: Multiple Perspectives*. Mahwah, NJ: Lawrence Erlbaum.

Johns, A. M. (2003). Genre and ESL/EFL composition instruction. In B. Kroll (Ed.), *Exploring the dynamics of second language writing* (pp. 195-217). Cambridge, UK: Cambridge University Press.

Jordan, M. P. (1991). The linguistic genre of abstracts. In A. D. Volpe (Ed.), *The seventeenth LACUS forum 1990* (pp. 507-527). Lake Bluff, IL: Linguistic Association of Cananda and the United States.

Journal Citation Reports: Science Edition. 2006. (Windows Version 1.1996). Philadelphia, PA: Institute for Scientific Information.

Copyright by Mahidol University

Kaewphamgam, C. B., & Soranasataporn, S. (2002). Corpus-based analysis: Guidelines for getting practic language input in material development. *SLLT, 11*, 16-32.

Kanoksilapatham, B. (2003). *A corpus-based investigation of scientific research articles: Linking move analysis and multidimensional analysis.* Unpublished PhD. dissertation, Georgetown University.

Kanoksilapatham, B. (2005). Rhetorical structure of biochemistry research articles. *English for Specific Purposes, 24*, 269-292.

Kaplan, R., Cantor, S., Hagstrom, C., Lia, D., Shiotani, Y., Zimmerman, C. B., et al. (1994). On abstract writing. *Text, 14*(2), 401-426.

Kaplan, R. E. (1986). Culture and written language. In M. V. Joyce (Ed.), *Culture bound: Bridging the cultural gap in language teaching* (pp. 8-19). Cambridge, England: Cambridge University Press.

Kay, H., & Dudley-Evans, T. (1998). Genre: what teachings think? *ELT Journal, 52*, 308-314.

Kemper, J. K., Dreyer, P. B., & Casey, R. (1997). Improving participation and inter-rater agreement for abstracts submitted to the Ambulatory Pediatric Association. *Ambulatory Child Health, 3*(1), 35-41.

King, R. (1976). A comparison of the readability of abstracts with their source documents. *Journal of the American Society of Information Science, 27*(2), 118-121.

Kuo, C. H. (1999). Can numbers talk?: Data management of a corpus. *RELC Journal, 30*(1), 1-18.

Lancaster, F. W. (2003). *Indexing and abstracting in theory and practice* London: Facet.

Leech, G. (1997). Teaching and language corpora: a convergence. In C. N. Candlin. (Ed.), *Teaching and language corpora* (pp. 1-23). NY: Longman.

Lemke, J. J. (1995). *Textual politics: Discourse and social dynamics.* London: Taylor and Francis/Falmer Press.

Lores, R. (2004). On RA abstracts: From rhetorical structure to thematic organization. *English for Specific Purposes, 23*, 280-302.

Copyright by Mahidol University

Love, A. M. (1991). Process and product in geology: An investigation of some discourse features of two introductory textbooks. *English for Specific Purposes, 10*, 89-109.

Maher, J. (1990). *International Medical Communication in English*. Edinburg: Edinburg University Press.

Maizell, R. E., & Smith, J. F. (1970). *Abstracting scientific and technical literature*. North Carolina: Hickory.

Martin-Martin, P., & Burgess, S. (2004). The rhetorical management of academic criticism in research article abstracts. *Text, 24*(2), 171-195.

Martin, M. P. (2003). A genre analysis of English and Spanish research paper abstracts in experimental social sciences. *English for Specific Purposes, 22*, 25-43.

McMillan, H. J., & Shumacher, S. (1997). *Research in Education: A conceptual introduction*. Verginia: Longman.

Melander, B., Swales, J. M., & Friedrickson, K. M. (1997). Journal abstracts from three academic fields in the United States and Sweden. National or disciplinary proclivities? In A. Duszak (Ed.), *Culture and styles of academic discourse* (pp. 251-272). NY: Mouton de Gruyter.

Montesi, M., & Urdiciain, B. G. (2005a). Abstracts: problems classified from the user perspective. *Journal of Information Science, 31*(6), 515-526.

Montesi, M., & Urdiciain, B. G. (2005b). Recent linguistics research into author abstracts. *Knowledge Organization, 32*, 64-78.

Mulrow, C. D. (1987). The medical review article: State of the science. *Annals of Internal Medicine, 106*, 485-488.

Nwogu, K. N. (1990). *Discourse variation in medical texts: Schema, theme and cohesion on professional and journalistic accounts*. Nottingham: Department of English Studies, University of Nottingham.

Nwogu, K. (1991). Structure of science popularizations: A genre-analysis approach to the schema of popularized medical texts. *English for Specific Purposes, 10*(2), 111-123.

Nwogu, K. (1997). The medical research paper: Structure and functions. *English for Specific Purposes, 16*(2), 119-138.

Copyright by Mahidol University

O' Neill, D. K. (1997). *Bluffing their way into science: Analyzing students' appropriation of the research article genre*. Paper presented at the annual meeting of the American Educational Research Association, March 24-28, 1997.

Ohg, W. (1982). *Orality and literacy: the technologizing of the word*. London: Routledge.

Paltridge, B. (1996). Genre, text type, and the language learning classroom. *ELT Journal, 50*, 237-243.

Phantama, P. (2000). *The organization and the linguistic features of the abstracts of medical journals.* Unpublished master's thesis, Faculty of Graduate Studies, Mahidol University, Thailand.

Pinto, M. (1994). Interdisciplinary approaches to the concept and practice of written text documentary content analysis (WTDCA). *Journal of Documentation, 50*(2), 111-133.

Pinto, M. (2003). Abstracting/abstract adaptation to digital environments: Research trends. *Journal of Documentation, 59*(5), 581-608.

Pinto, M., & Galvez, C. (1999). Paradigms for abstracting systems. *Journal of Information Science, 25*, 365.

Posteguillo, S. (1999). The schematic structure of computer science research articles. *English for Specific Purposes, 18*(2), 139-158.

Pueyo, I. G., & Val, S. (1996). The construction of technicality in the field of plastics: A functional approach towards teaching technical terminology. *English for Specific Purposes, 15*(4), 251-278.

Putipat, A. (1998). *Scientific writing and publishing in English in Thailand: The perceptions of Thai scientists and editors.* Unpublished PhD dissertation, Columbia University.

Rashidi, L. S. (1992). Toward an understanding of the notion of theme: An example from Darin. In M. Davies & L. Ravelli (Eds.), *Advances in Systemic Linguistics: Recent theory and Practice* (pp. 192). NY: Printer.

Roseberry, L. (1997). An investigation of the functions, strategies and linguistic features of the introductions and conclusions of essays. *System, 25*, 279-495.

Copyright by Mahidol University

Rothkegel, A. (1995). Abstracting from the perspective of text production. *Information Processing & Management, 31*(5), 777-784.

Rowley, J. E. (1988). *Abstracting and Indexing*. London: Bingley.

Ruiying, Y., & Allison, D. (2004). Research articles in applied linguistics: Structures from a functional perspective. *English for Specific Purposes, 23*, 264-279.

Sager, J. C., Dungworth, D., & McDonald, P. F. (1980). *English special language: Principles and practice in science and technology*. Wiesbaden, Germany: Oscar Brandstetter Verlag KG.

Salager-Meyer, F. (1990). Discoursal flaws in medical English abstracts: A genre analysis per research and text-type. *Text, 10*(4), 365-384.

Salager-Meyer, F. (1992). Discoursal movements in medical English abstracts and their linguistic exponents: A genre analysis study. INTERFACE. *English for Specific Purposes, 11*(2), 93-113.

Salager-Meyer, F. (1994). Hedges and textual communicative function in medical English written discourse. *English for Specific Purposes, 13*(2), 149-170.

Samraj, B. (2002). Introductions in research articles: Variations across disciplines. *English for Specific Purposes, 21*, 1-17.

Samraj, B. (2005). An exploration of a genre set: Research article abstracts and introductions in two disciplines. *English for Specific Purposes, 24*, 141-156.

Santos, M. B. (1996). The textual organisation of research paper abstracts in applied linguistics. *Text, 16*(4), 481-499.

Santos, M. B. (2002). Genre analysis of business letters of negotiation. *English for Specific Purposes, 21*, 167-199.

Sawyer, W., & Watson, K. (1987). Question of genre. In I. Reid (Ed.), *The place of genre in learning: current debates* (pp. 46-57). Deakin University: Centre for Studies in Literary Education.

Sengupta, S., Forey, G., & Hamp-Lyons, L. (1999). Supporting effective English communication within the context of teaching and research in a tertiary institute: A genre model for consciousness raising. . *English for Specific Purposes, 18*, 7-22.

Copyright by Mahidol University

Shi, L., & Kubota, R. (2007). Patterns of rhetorical organization in Canadian and American language arts textbooks: An exploratory study. *English for Specific Purposes, 26,* 180-202.

Shohamy, E., Gordon, C. M., & Kraemer, R. (1992). The effect of raters' background and training on the reliability of direct writing tests. *Modern Language Journal, 76,* 27-33.

Skulstad, A. S. (1996). Rhetorical organization in chairmen's statements. *International Journal of Applied Linguistics, 6,* 43-63.

Skulstad, A. S. (1997). *Established and emerging business genres: genre analysis of corporate annual reports and corporate environmental reports.* Unpublished Ph. D. thesis, University of Bergen.

Skulstad, A. S. (1999). Genre awareness in ESP teaching: issues and implications. *International Journal of Applied Linguistics, 9*(2), 285-297.

Snizek, W. E., Oehler, K., & Mullins, N. C. (1991). Textual and non-textual characteristics of scientific papers. *Scientometrics, 20*(1), 23-35.

Soler, V. (2007). Writing titles in science: an exploratory study. *English for Specific Purposes, 26,* 90-102.

Sternberg, R. J. (2003). *Cognitive Psychology*. London: Wadsworth.

Stubbs, M. (1999). *Society, education and language: the last 2,000 (and the next 20?) years of language teaching. Plenary lecture given at the 32nd* Paper presented at the Annual meeting of the British Association for Applied Linguistics, University of Edinburgh.

Sutarsyah, C., Nation, P., & Kennedy, G. (1994). How useful is EAP vocabulary for ESP? A corpus based case study. *RELC Journal, 25*(2), 34-50.

Swales, J. M. (1981). *Aspects of article introductions (Aston ESP Research Report 1).* Birmingham, England: University of Aston in Birmingham, Language Studies Unit.

Swales, J. M. (1987). Utilising the literatures in teaching the research paper. *TESOL Quarterly, 21*(1), 41-86.

Swales, J. M. (1990). *Genre analysis: English in academic and research settings.* Cambridge: Cambridge University Press.

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Swales, J. M. (2004a). Genre analysis and the advanced second language writer. In E. Barton & G. Stygall. (Eds.), *Genre in the classroom: Multiple perspectives* (pp. 105-119). Mahwah, NJ: Lawrence Erlbaum.

Swales, J. M. (2004b). *Research genres: Explorations and applications*. Cambridge, UK: Cambridge University Press.

Swales, J. M., & Feak, C. B. (1994). *Academic writing for graduate students*. The United States of America: The University of Michigan Press.

Swales, J. M., & Najjar, H. (1987). The writing of research article introductions. *Written Communication, 4*, 175-192.

Taddio, A., Pain, T., Fassos, F. F., Boon, H., Ilersich, A. L., & Einarson, T. R., et al. (1994). Quality of nonstructured and structured abstracts of original research articles in the British Medical Journal, the Canadian Medical Association Journal and the Journal of the American Medical Association. *Canadian Medical Association Journal, 150*(10), 1611-1618.

Tarone, E., Dwyer, S., Gillette, S., & Icke, V. (1981). On the use of passive in two astrophysics journal papers. *English for Specific Purposes, 1*, 123-140.

Tenopir, G., & Jasco, P. (1993). Quality of abstracts. *Online, 17*(3), 44-55.

Thompson, D. (1993). Arguing for experimental facts in science. *Written Communication, 10*(1), 106-128.

Thompson, G. (1994). *Reporting. Cobuild Guides* 5. London: HarperCollins.

Thurstan, J., & Candlin, C. N. (1998). Concordancing and the teaching of the vocabulary of academic English. *English for Specific Purposes, 17*(3), 267-280.

Tibbo, H. (1992). Abstracting across the disciplines: A content analysis of abstracts from the natural sciences, the social sciences, and the humanities with implications for abstracting standards and online information retrieval. *LISR, 14*, 31-56.

Tibbo, H. (1993). *Abstracting, information retrieval and the humanities: providing access to historical literature*. London: American Library Association.

Tobias, S., & Tomizuka, T. C. (1992). *Breaking the science barrier: How to explore and understand the sciences*. NY: College Entrance Examination Board.

Copyright by Mahidol University

Trask, R. L. (1993). *A dictionary of grammatical terms in linguistics*. London: Toutledge.

Ulijin, J. M., & Pugh, A. K. (1985). *Reading for professional purposes: Methods and material for teaching language*. Leuven, Belgium: Acco press.

Ventola, E. (1989). Problems of modeling and applied issues within the framework of genre. *Word, 40*, 129-161.

Ventola, E. (1994). Abstracts as an object of linguistic study. In S. Cmejrkova, F. Danes & F. Havlova (Eds.), *Writing vs. speaking: Language, text, discourse, communication* (pp. 333-352). Tübingen: Gunter Narr.

Ventola, E. M. (1984). Orientation to social semiotics in foreign language teaching. *Applied Linguistics, 15*, 275-286.

Vongvanit, T. (2001). *An investigation of the organization and linguistic features of one genre: research article abstracts in the field of English language learning and teaching (ELLT)*. Unpublished master's thesis, Faculty of Graduate Studies, Mahidol University, Thailand.

Wang, Y., & Bai, Y. (2007). A corpus-based syntactic study of medical research article titles. *English for Specific Purposes, 35*, 388-399.

Weissberg, B. (1993). The graduate seminar: Another research-process genre. *English for Specific Purposes, 12*, 23-35.

Weissberg, R., & Buker, S. (1990). *Writing up research*. Englewood Cliffs, NJ: Prentice Hall Regents.

Wheatley, A., & Armstrong, C. J. (1997). Metadata, recall and abstracts. *Aslib Proceedings, 49*(8), 206-213.

Wood, A. (1982). An examination of the rhetorical structures of authentic chemistry texts. *Applied Linguistics, 3*(2), 121-143.

Yunxia, Z. (1997). An analysis of structural moves in Chinese sales letters. *Text, 17*(4), 543-566.

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APPENDIX

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APPENDIX A

Article abstracts move patterns used as a theoretical framework by Santos (1996)

The Five Moves
Move 1: Situating the Research
Submove 1A – Situating current knowledge
and/or
Submove 1B – Citing previous research
and/or
Submove 1C – Extended previous research
and/or
Submove 2- Stating the problem
Move 2: Presenting the Research
Submove 1A – Indicating main features
and/or
Submove 1B – Indicating main purpose
and/or
Submove 2 – Hypothesis raising
Move 3: Describing the methodology
Move 4: Summarizing the results
Move 5: Discussing the research
Submove 1- Drawing conclusions
and/or
Submove 2 – Giving recommendations

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APPENDIX B

Articles used for the analysis

1. Tali Kimchi1, Jennings Xu1 & Catherine Dulac1(2007). **A functional circuit underlying male sexual behaviour in the female mouse brain.** *Nature Journal, Vol. 448,* August.

2. Robert Sladek1,2,4, Ghislain Rocheleau1*, Johan Rung4*, Christian Dina5*, Lishuang Shen1, David Serre1, Philippe Boutin5, Daniel Vincent4, Alexandre Belisle4, Samy Hadjadj6, Beverley Balkau7, Barbara Heude7, Guillaume Charpentier8, Thomas J. Hudson4,9, Alexandre Montpetit4, Alexey V. Pshezhetsky10, Marc Prentki10,11, Barry I. Posner2,12, David J. Balding13, David Meyre5, Constantin Polychronakos1,3 & Philippe Froguel5,14 (2007). **A genome-wide association study identifies novel risk loci for type 2 diabetes.** *Nature Journal, Vol. 445, February.*

3. Ronald Kaminsky1, Pierre Ducray2, Martin Jung1, Ralph Clover3, Lucien Rufener1,4, Jacques Bouvier1, Sandra Schorderet Weber1, Andre Wenger1, Susanne Wieland-Berghausen2, Thomas Goebel2, Noelle Gauvry2, Franc¸ois Pautrat2, Thomas Skripsky2, Olivier Froelich1, Clarisse Komoin-Oka5, Bethany Westlund3, Ann Sluder3 & Pascal Ma¨ser4 (2008). **A new class of anthelmintics effective against drug-resistant nematodes.** *Nature Journal, Vol. 452, March.*

4. Robert B. Moore1,2*, Miroslav Oborní´k3*, Jan Janouš˘kovec3,Toma´s˘ Chrudimsky´3, Marie Vancova´3, David H. Green4, Simon W. Wright5, Noel W. Davies6, Christopher J. S. Bolch7, Kirsten Heimann8, Jan S˘lapeta9, Ove Hoegh-Guldberg10, John M. Logsdon Jr2 & Dee A. Carter1 (2008). **A photosynthetic alveolate closely related to apicomplexan parasites.** *Nature Journal Vol. 451, February.*

5. Nilay Yapici1*, Young-Joon Kim1*, Carlos Ribeiro1 & Barry J. Dickson1 (2008). **A receptor that mediates the post-mating switch in Drosophila reproductive behavior.** *Nature Journal Vol. 451, January.*

6. John D. Carpten1, Andrew L. Faber2, Candice Horn2, Gregory P. Donoho2, Stephen L. Briggs3, Christiane M. Robbins1, Galen Hostetter1, Sophie Boguslawski2, Tracy Y. Moses1, Stephanie Savage1, Mark Uhlik2, Aimin Lin4, Jian Du2, Yue-Wei Qian4, Douglas J. Zeckner2, Greg Tucker-Kellogg5, Jeffrey Touchman1, Ketan Patel5, Spyro Mousses6, Michael Bittner1, Richard Schevitz3, Mei-Huei T. Lai2, Kerry L. Blanchard2 & James E. Thomas2 (2007). **A transforming mutation in the pleckstrin homology domain of AKT1 in cancer.** *Nature Journal, Vol. 448, July.*

7. Zheng Qing Fu1*, Ming Guo1*, Byeong-ryool Jeong1, Fang Tian1,2, Thomas E. Elthon2,3, Ronald L. Cerny4, Dorothee Staiger5 & James R. Alfano1. (2007). **A**

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type III effector ADP-ribosylates RNA-binding proteins and quells plant immunity. *Nature Journal, Vol. 447, May.*

8. Chuan-Zhou Liu1,2,3, Jonathan E. Snow2,4, Eric Hellebrand2,5, Gerhard Bru¨gmann2, Anette von der Handt2,5, Anette Bu¨chl2 & Albrecht W. Hofmann2.**Ancient, highly heterogeneous mantle beneath Gakkel ridge, Arctic Ocean.** *Nature Journal, Vol. 452, March.*

9. Stephen B. Long1{, Xiao Tao1, Ernest B. Campbell1 & Roderick MacKinnon1 (2007). **Atomic structure of a voltage-dependent K1 channel inalipidmembrane- like environment.** *Nature Journal, Vol. 450. November.*

10. Vero^nica A. Grieneisen1, Jian Xu2, Athanasius F. M. Mare´e1, Paulien Hogeweg1& Ben Scheres2 (2007). **Auxin transport is sufficient to generate a maximumand gradient guiding root growth.** *Nature Journal, Vol. 449, October.*

11. Jr-Kai Yu1,4, Yutaka Satou2, Nicholas D. Holland1, Tadasu Shin-I3, Yuji Kohara3,Noriyuki Satoh2, Marianne Bronner-Fraser4 & Linda Z. Holland1 (2007). **Axial patterning in cephalochordates and the evolution of the organizer.** *Nature Journal, Vol. 445, February.*

12. Farbod Shojaei1, Xiumin Wu1, Cuiling Zhong1, Lanlan Yu1, Xiao-Huan Liang1, Jenny Yao1, Dominique Blanchard1, Carlos Bais1, Franklin V. Peale1, Nicholas van Bruggen1, Calvin Ho1, Jed Ross1, Martha Tan1, Richard A. D. Carano1, Y. Gloria Meng1 & Napoleone Ferrara1. (2007). **Bv8 regulates myeloid-cell-dependent tumour angiogenesis.** *Nature Journal, Vol. 450, December*.

13. Natalie A. Borg1, Kwok S. Wun1, Lars Kjer-Nielsen2, Matthew C. J. Wilce1, Daniel G. Pellicci2, Ruide Koh1, Gurdyal S. Besra3, Mandvi Bharadwaj2, Dale I. Godfrey2, James McCluskey2 & Jamie Rossjohn1. (2007). **CD1d–lipid-antigen recognition by the semi-invariant NKT T-cell receptor.** *Nature Journal, Vol. 448, July*.

14. Iestyn Whitehouse1, Oliver J. Rando3, Jeff Delrow2 & Toshio Tsukiyama1. (2007). **Chromatin remodelling at promoters suppresses antisense transcription.** *Nature Journal, Vol. 450, December.*

15. Kendra King Frederick1, Michael S. Marlow1, Kathleen G. Valentine1 & A.Joshua Wand1. (2007). **Conformational entropy in molecular recognition by proteins.** *Nature Journal, Vol. 448, July.*

16. Raphae¨l Me´tivier1, Rozenn Gallais1, Christophe Tiffoche1, Christine Le Pe´ron1, Renata Z. Jurkowska2, Richard P. Carmouche3, David Ibberson3, Peter Barath1{,Florence Demay1 George Reid3, Vladimir Benes3, Albert Jeltsch2, Frank Gannon3{& Gilles Salbert. (2008) **Cyclical DNA methylation of a transcriptionally active promoter.** *Nature Journal, Vol. 452, March.*

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17. Anastasia Nijnik1, Lisa Woodbine2, Caterina Marchetti2,3, Sara Dawson4, Teresa Lambe1, Cong Liu2, Neil P. Rodrigues5, Tanya L. Crockford1, Erik Cabuy6, lessandro Vindigni3, Tariq Enver5, John I. Bell1, Predrag Slijepcevic6, Christopher C. Goodnow4*, Penelope A. Jeggo2* & Richard J. Cornall1*. (2007). **DNA repair is limiting for haematopoietic stem cells during ageing.** *Nature Journal, Vol. 447, June.*

18. Tomas Lundqvist1*, Stewart L. Fisher2*, Gunther Kern2, Rutger H. A. Folmer1, Yafeng Xue1, D. Trevor Newton2, Thomas A. Keating2, Richard A. Alm2 & Boudewijn L. M. de Jonge. (2007). **Exploitation of structural and regulatory diversity in glutamate racemases.** *Nature Journal, Vol. 447, June.*

19. Terry Kwok1{, Dana Zabler1, Sylwia Urman3, Manfred Rohde4, Roland Hartig2, Silja Wessler5, Rolf Misselwitz6{, Ju¨rgen Berger7, Norbert Sewald3, Wolfgang Ko¨nig1 & Steffen Backert1. (2007). **Helicobacter exploits integrin for type IV secretion and kinase activation.** *Nature Journal, Vol. 449, October.*

20. Bin Qian1*, Srivatsan Raman1*, Rhiju Das1*, Philip Bradley1, Airlie J. McCoy2, andy J. Read2 & David Baker1. (2007). **High-resolution structure prediction and the crystallographic phase problem.** *Nature Journal, Vol. 450, November.*

21. Manabu Soda1,2, Young Lim Choi1, Munehiro Enomoto1,2, Shuji Takada1, Yoshihiro Yamashita1, Shunpei Ishikawa5, Shin-ichiro Fujiwara1, Hideki Watanabe1, Kentaro Kurashina1, Hisashi Hatanaka1, Masashi Bando2, Shoji Ohno2, Yuichi Ishikawa6, Hiroyuki Aburatani5,7, Toshiro Niki3, Yasunori Sohara4, Yukihiko Sugiyama2 & Hiroyuki Mano1,7. (2007). **Identification of the transforming EML4–ALK fusion gene in non-small-cell lung cancer**. *Nature Journal, Vol. 448, August.*

22. Christopher D. Harvey1,2 & Karel Svoboda1,2. (2007). **Locally dynamic synaptic learning rules in pyramidal neuron dendrites.** *Nature Journal, Vol. 450, December.*

23. Saurabh Paliwal1, Pablo A. Iglesias1,2, Kyle Campbell3, Zoe Hilioti1, Alex Groisman3 & Andre Levchenko1. (2007). **MAPK-mediated bimodal gene expression and adaptive gradient sensing in yeast.** *Nature Journal, Vol. 446, March.*

24. Graziano Martello1, Luca Zacchigna1, Masafumi Inui1, Marco Montagner1, Maddalena Adorno1, Anant Mamidi1, Leonardo Morsut1, Sandra Soligo1, Uyen Tran2, Sirio Dupont1, Michelangelo Cordenonsi1, Oliver Wessely2 & Stefano Piccolo1. (2007). **MicroRNA control of Nodal signaling.** *Nature Journal, Vol. 449, September.*

25. Ilan Wapinski1,2,3, Avi Pfeffer3, Nir Friedman4 & Aviv Regev1,5. (2007).**Natural history and evolutionary principles of gene duplication in fungi**. *Nature Journal, Vol. 449, September.*

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26. Christopher Greenman1, Philip Stephens1, Raffaella Smith1, Gillian L. Dalgliesh1, Christopher Hunter1, Graham Bignell1, Helen Davies1, Jon Teague1, Adam Butler1, Claire Stevens1, Sarah Edkins1, Sarah O'Meara1, Imre Vastrik2, Esther E. Schmidt2, Tim Avis1, Syd Barthorpe1, Gurpreet Bhamra1, Gemma Buck1, Bhudipa Choudhury1, Jody Clements1, Jennifer Cole1, Ed Dicks1, Simon Forbes1, Kris Gray1, Kelly Halliday1, Rachel Harrison1, Katy Hills1, Jon Hinton1, Andy Jenkinson1, David Jones1, Andy Menzies1, Tatiana Mironenko1, Janet Perry1, Keiran Raine1, Dave Richardson1, Rebecca Shepherd1, Alexandra Small1, Calli Tofts1, Jennifer Varian1, Tony Webb1, Sofie West1, Sara Widaa1, Andy Yates1, Daniel P. Cahill3, David N. Louis3, Peter Goldstraw4, Andrew G. Nicholson4, Francis Brasseur5, Leendert Looijenga6, Barbara L. Weber7, Yoke-Eng Chiew8, Anna deFazio8, Mel F. Greaves9, Anthony R. Green10, Peter Campbell1, Ewan Birney2, Douglas F. Easton11, Georgia Chenevix-Trench12, Min-Han Tan13, Sok Kean Khoo13, Bin Tean Teh13, Siu Tsan Yuen14, Suet Yi Leung14, Richard Wooster1, P. Andrew Futreal1 & Michael R. Stratton1,9. (2007). **Patterns of somatic mutation in human cancer genomes.** *Nature Journal, Vol. 446, March*.

27. Siler H. Panowski1, Suzanne Wolff1, Hugo Aguilaniu1{, Jenni Durieux1 & Andrew Dillin1. (2007). PHA-4/Foxa mediates diet-restrictioninduced longevity of C. elegans. *Nature Journal, Vol. 447, May*.

28. J. F. Prather1, S. Peters2, S. Nowicki1,2 & R. Mooney1. (2008). **Precise auditory–vocal mirroring in neurons for learned vocal communication.** *Nature Journal, Vol. 451, January.*

29. Kathryn D. Kavanagh1{, Alistair R. Evans1 & Jukka Jernvall1,2. (2007). **Predicting evolutionary patterns of mammalian teeth from development.** *Nature Journal, Vol. 449, September.*

30. Eran Segal1*, Tali Raveh-Sadka1*, Mark Schroeder2, Ulrich Unnerstall2 & Ulrike Gaul2. (2008). **Predicting expression patterns from regulatory sequence in Drosophila segmentation.** *Nature Journal, Vol. 451, January.*

31. Tianming Yang1 & Michael N. Shadlen1. (2007). **Probabilistic reasoning by neurons.** *Nature Journal, Vol. 447, June*.

32. J. A. Byrne1{, D. A. Pedersen1, L. L. Clepper1, M. Nelson3, W. G. Sanger3, S. Gokhale3, D. P. Wolf1 & S. M. Mitalipov1,2. (2007). **Producing primate embryonic stem cells by somatic cell nuclear transfer.** *Nature Journal, Vol. 450, November.*

33. Christine Guerlin1, Julien Bernu1, Samuel Dele´glise1, Cle´ment Sayrin1, Se´bastien Gleyzes1, Stefan Kuhr1{, Michel Brune1, Jean-Michel Raimond1 & Serge Haroche1,2. (2007). **Progressive field-state collapse and quantum non-demolition photon counting.** *Nature Journal, Vol. 448, August*.

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34. May H. Han1*, Sun-Il Hwang3*, Dolly B. Roy4*, Deborah H. Lundgren3, Jordan V. Price1, Shalina S. Ousman1, Guy Haskin Fernald5, Bruce Gerlitz6, William H. Robinson2, Sergio E. Baranzini5, Brian W. Grinnell6, Cedric S. Raine7, Raymond A. Sobel8, David K. Han3 & Lawrence Steinman1. (2008). **Proteomic analysis of active multiple sclerosis lesions reveals therapeutic targets.** *Nature Journal, Vol. 451, February.*

35. Jung-Hyun Min1 & Nikola P. Pavletich1,2. (2007). **Recognition of DNA damage by the Rad4 nucleotide excision repair protein.** *Nature Journal, Vol. 449, October.*

36. Mariusz Nowacki1, Vikram Vijayan2, Yi Zhou1, Klaas Schotanus1, Thomas G. Doak1 & Laura F. Landweber1. (2008). **RNA-mediated epigenetic programming of a genome-rearrangement pathway.** *Nature Journal, Vol. 451, January.*

37. Winfried Ro¨mer1,5, Ludwig Berland2,6, Vale´rie Chambon1,5, Katharina Gaus8,9, Barbara Windschiegl10, Danie`le Tenza3,5, Mohamed R. E. Aly4,7, Vincent Fraisier5, Jean-Claude Florent4,7, David Perrais11, Christophe Lamaze1,5, Grac¸a Raposo3,5, Claudia Steinem10, Pierre Sens12, Patricia Bassereau2,6&Ludger Johannes1,5. (2007). **Shiga toxin induces tubular membrane invaginations for its uptake into cells.** *Nature Journal, Vol. 450, November.*

38. Victor I. Klimov1, Sergei A. Ivanov1, Jagjit Nanda1, Marc Achermann1, Ilya Bezel1, John A. McGuire1 & Andrei Piryatinski1. (2007). **Single-exciton optical gain in semiconductor nanocrystals.** *Nature Journal, Vol. 447, May.*

39. Dmitry G. Vassylyev1, Marina N. Vassylyeva1, Jinwei Zhang2, Murali Palangat3, Irina Artsimovitch5 & Robert Landick3,4. (2007). **Structural basis for substrate loading in bacterial RNA polymerase.** *Nature Journal, Vol. 448, July.*

40. Tongqing Zhou1, Ling Xu1, Barna Dey1, Ann J. Hessell3, Donald Van Ryk2, Shi-Hua Xiang4, Xinzhen Yang4, Mei-Yun Zhang5, Michael B. Zwick3, James Arthos2, Dennis R. Burton3, Dimiter S. Dimitrov5, Joseph Sodroski4, Richard Wyatt1, Gary J. Nabel1 & Peter D. Kwong1. (2007). **Structural definition of a conserved neutralization epitope on HIV-1 gp120.** *Nature Journal, Vol. 445, February.*

41. Minhajuddin Sirajuddin1, Marian Farkasovsky1{, Florian Hauer2, Dorothee Ku¨hlmann1, Ian G. Macara3, Michael Weyand1, Holger Stark2 & Alfred Wittinghofer1. (2007). **Structural insight into filament formation by mammalian septins.** *Nature Journal, vol. 449, September.*

42. Johannes C. Hermann1, Ricardo Marti-Arbona2, Alexander A. Fedorov3, Elena Fedorov3, Steven C. Almo3, Brian K. Shoichet1 & Frank M. Raushel2. (2007).

Copyright by Mahidol University

Structure-based activity prediction for an enzyme of unknown function. *Nature Journal, Vol. 448, August.*

43. Lynn Jo Pillitteri1, Daniel B. Sloan1, Naomi L. Bogenschutz1 & Keiko U. Torii1,2,3. (2007). **Termination of asymmetric cell division and differentiation of stomata.** *Nature Journal, Vol. 445, February.*

44. Stuart J. D. Neil1, Trinity Zang1 & Paul D. Bieniasz1. (2008). **Tetherin inhibits retrovirus release and is antagonized by HIV-1 Vpu.** *Nature Journal, Vol. 451, January.*

45. Matthew J. Ferrari1, Rebecca F. Grais4, Nita Bharti2, Andrew J. K. Conlan5, Ottar N. Bjørnstad3,6, Lara J. Wolfson7, Philippe J. Guerin4, Ali Djibo8 & Bryan T. Grenfell2,6. (2008). **The dynamics of measles in sub-Saharan Africa.** *Nature Journal, Vol. 451, February.*

46. Nicole King1,2, M. Jody Westbrook1*, Susan L. Young1*, Alan Kuo3, Monika Abedin1, Jarrod Chapman1, Stephen Fairclough1, Uffe Hellsten3, Yoh Isogai1, Ivica Letunic4, Michael Marr5, David Pincus6, Nicholas Putnam1, Antonis Rokas7, Kevin J. Wright1, Richard Zuzow1, William Dirks1, Matthew Good6, David Goodstein1, Derek Lemons8, Wanqing Li9, Jessica B. Lyons1, Andrea Morris10, Scott Nichols1, Daniel J. Richter1, Asaf Salamov3, JGI Sequencing3, Peer Bork4, Wendell A. Lim6, Gerard Manning11, W. Todd Miller9, William McGinnis8, Harris Shapiro3, Robert Tjian1, Igor V. Grigoriev3 & Daniel Rokhsar1. (2008). **The genome of the choanoflagellate Monosiga brevicollis and the origin of metazoans.** *Nature Journal, Vol. 451, February*.

47. A. Chini1*, S. Fonseca1*, G. Ferna´ndez1*, B. Adie1, J. M. Chico1, O. Lorenzo1{, G. Garcı´a-Casado2, I. Lo´pez-Vidriero2, F. M. Lozano3, M. R. Ponce3, J. L. Micol3 & R. Solano1,2. (2007). **The JAZ family of repressors is the missing link in jasmonate signaling.** *Nature Journal, Vol. 448, August.*

48. Nicolas X. Tritsch1, Eunyoung Yi2, Jonathan E. Gale3, Elisabeth Glowatzki1,2 & Dwight E. Bergles1,2. (2007). **The origin of spontaneous activity in the developing auditory system.** *Nature Journal, Vol. 450, November.*

49. Masato Furuhashi1, Gu¨rol Tuncman1, Cem Z. Go¨rgu¨n1, Liza Makowski1,4, Genichi Atsumi1{, Eric Vaillancourt1, Keita Kono1, Vladimir R. Babaev2, Sergio Fazio2, MacRae F. Linton2, Richard Sulsky3, Jeffrey A. Robl3, Rex A. Parker3 & Go¨khan S. Hotamisligil1. (2007). **Treatment of diabetes and atherosclerosis by inhibiting fatty-acid-binding protein aP2.** *Nature Journal, Vol. 447, June.*

50. Li Ma1, Julie Teruya-Feldstein2 & Robert A. Weinberg1. (2007). **Tumour invasion and metastasis initiated by microRNA-10b in breast cancer.** *Nature Journal, Vol. 449, October.*

Copyright by Mahidol University

51. Vasily V. Vagin,1,2* Alla Sigova,1* Chengjian Li,1 Herve´ Seitz,1 Vladimir Gvozdev,2 Phillip D. Zamore1†. (2006). **A Distinct Small RNA Pathway Silences Selfish Genetic Elements in the Germline.** *Science Journal, Vol. 313, July*.

52. Katsuhiko Tabuchi, et al. (2007). **A Neuroligin-3 Mutation Implicated in Autism Increases Inhibitory Synaptic Transmission in Mice**. *Science Journal, Vol. 318, October.*

53. Shosei Yoshida,* Mamiko Sukeno, Yo-ichi Nabeshima. (2007). **A Vasculature-Associated Niche for Undifferentiated Spermatogonia in the Mouse Testis.** *Science Journal, Vol. 317, September*.

54. Henrike Berkefeld,1* Claudia A. Sailer,1,3* Wolfgang Bildl,1,2 Volker Rohde,2 Jörg-Oliver Thumfart,1 Silke Eble,1 Norbert Klugbauer,4 Ellen Reisinger,1 Josef Bischofberger,1 Dominik Oliver,1 Hans-Günther Knaus,3 Uwe Schulte,2† Bernd Fakler1†. (2006). **BKCa-Cav Channel Complexes Mediate Rapid and Localized Ca 2+-Activated K+ Signaling.** *Science Journal, Vol. 314, October.*

55. Vidhya Chakrapani,1 John C. Angus,1* Alfred B. Anderson,1 Scott D. Wolter,2 Brian R. Stoner,3 Gamini U. Sumanasekera4. (2007). **Charge Transfer Equilibria Between Diamond and an Aqueous Oxygen Electrochemical Redox Couple.** *Science Journal, Vol. 318, November.*

56. Rudolph Kuper and Stefan Kro¨ pelin*. (2006). **Climate-Controlled Holocene Occupation in the Sahara:Motor of Africa's Evolution.** *Science Journal, Vol. 313, August.*

57. Georg Zeller,1,2,5* Paul Shinn,6 Norman Warthmann,1 Tina T. Hu,4 Glenn Fu,7 David A. Hinds,7 Huaming Chen,6 Kelly A. Frazer,7 Daniel H. Huson,5 Bernhard Schölkopf,3 Magnus Nordborg,4 Gunnar Rätsch,2 Joseph R. Ecker,6,8 Detlef Weigel1,8†. (2007). **Common Sequence Polymorphisms Shaping Genetic Diversity in Arabidopsis thaliana.** *Science Journal, Vol. 317, July.*

58. Holly Baden-Tillson, Jayshree Zaveri, Timothy B. Stockwell, Anushka Brownley, David W. Thomas, Mikkel A. Algire, Chuck Merryman, Lei Young, Vladimir N. Noskov, John I. Glass, J. Craig Venter, Clyde A. Hutchison III, Hamilton O. Smith*. (2008). **Complete Chemical Synthesis, Assembly, and Cloning of a Mycoplasma genitalium Genome.** *Science Journal, Vol. 319, February.*

59. Francoise Kidwingira,1 J. D. Strand,1 D. J. Van Harlingen,1* Yoshiteru Maeno2. (2006). **Dynamical Superconducting Order Parameter Domains in Sr2RuO4.** *Science Journal, Vol. 314, November.*

60. Eduardo M. Torres,1 Tanya Sokolsky,1* Cheryl M. Tucker,2 Leon Y. Chan,1 Monica Boselli,1Maitreya J. Dunham,2 Angelika Amon1† (2007). **Effects of Aneuploidy on Cellular Physiology and Cell Division in Haploid Yeast.** *Science Journal, Vol. 317, August.*

Copyright by Mahidol University

61. Hal Alper,1,3 Joel Moxley,1 Elke Nevoigt,1,2 Gerald R. Fink,3 Gregory Stephanopoulos1* (2006). **Engineering Yeast Transcription Machinery for Improved Ethanol Tolerance and Production**. *Science Journal, Vol. 314, December.*

62. Ivan Vilotijevic and Timothy F. Jamison* (2007). **Epoxide-Opening Cascades Promoted by Water.** *Science Journal, Vol. 317, August.*

63. Carole Lartigue, John I. Glass,* Nina Alperovich, Rembert Pieper, Prashanth P. Parmar, Clyde A. Hutchison III, Hamilton O. Smith, J. Craig Venter Genome (2007). **Transplantation in Bacteria: Changing One Species to Another.** Science *Journal, Vol. 317, August.*

64. Daniel M. Rosenbaum,1* Vadim Cherezov,2* Michael A. Hanson,2 Søren G. F. Rasmussen,1 Foon Sun Thian,1 Tong Sun Kobilka,1 Hee-Jung Choi,1,3 Xiao-Jie Yao,1 William I. Weis,1,3 Raymond C. Stevens,2† Brian K. Kobilka1† (2007). **GPCR Engineering Yields High-Resolution Structural Insights into b2-Adrenergic Receptor Function.** *Science Journal, Vol. 318, November.*

65. Ange´lique Deleris,1 Javier Gallego-Bartolome,1 Jinsong Bao,2 Kristin D. Kasschau,2 James C. Carrington,2 Olivier Voinnet (2006). **Hierarchical Action and Inhibition of Plant Dicer-Like Proteins in Antiviral Defense**. *Science Journal, Vol. 313, July.*

66. Esther Herrmann,1* Josep Call,1 María Victoria Hernández-Lloreda,2 Brian Hare,1,3 Michael Tomasello1 (2007). **Humans Have Evolved Specialized Skills of Social Cognition: The Cultural Intelligence Hypothesis.** *Science Journal, Vol. 317, September.*

67. Boris Worm,1* Edward B. Barbier,2 Nicola Beaumont,3 J. Emmett Duffy,4 Carl Folke,5,6 Benjamin S. Halpern,7 Jeremy B. C. Jackson,8,9 Heike K. Lotze,1 Fiorenza Micheli,10 Stephen R. Palumbi,10 Enric Sala,8 Kimberley A. Selkoe,7 John J.Stachowicz,11 Reg Watson12 (2006). **Impacts of Biodiversity Loss on Ocean Ecosystem Services.** *Science Journal, Vol. 314, November.*

68. Abraham L. Brass,1,2 Derek M. Dykxhoorn,3* Yair Benita,4* Nan Yan,3 Alan Engelman,5 Ramnik J. Xavier,2,4 Judy Lieberman,3 Stephen J. Elledge1† (2008). **Identification of Host Proteins Required for HIV Infection Through a Functional Genomic Screen.** *Science Journal, Vol. 319, February.*

69. Ji-Hwan Ryu,1* Sung-Hee Kim,1* Hyo-Young Lee,1,2 Jin Young Bai,1 Young-Do Nam,3 Jin-Woo Bae,3 Dong Gun Lee,4 Seung Chul Shin,1,5 Eun-Mi Ha,1 Won-Jae Lee1† (2008). **Innate Immune Homeostasis by the Homeobox Gene Caudal and Commensal-Gut Mutualism in Drosophila**. *Science Journal, Vol. 319*

70. Jonathan H. Lin,1,2,3* Han Li,1,2 Douglas Yasumura,4 Hannah R. Cohen,2 Chao Zhang,1,5 Barbara Panning,2 Kevan M. Shokat,1,5 Matthew M. LaVail,4 Peter

Copyright by Mahidol University

Walter1,2 (2007). **IRE1 Signaling Affects Cell Fate During the Unfolded Protein Response.** *Science Journal, Vol. 318, November.*

71. Jonathan R. Whitlock,1,2* Arnold J. Heynen,1* Marshall G. Shuler,1 Mark F. Bear1† (2006). **Learning Induces Long-Term Potentiation in the Hippocampus.** *Science Journal, Vol. 313, August.*

72. Vishakha S. Mangale,1* Karla E. Hirokawa,2* Prasad R. V. Satyaki,1* Nandini Gokulchandran,1* Satyadeep Chikbire,1 Lakshmi Subramanian,1 Ashwin S. Shetty,1 Ben Martynoga,1 Jolly Paul,1 Mark V. Mai,3 Yuqing Li,4 Lisa A. Flanagan,5 Shubha Tole,1† Edwin S. Monuki2,5† (2008). **Lhx2 Selector Activity Specifies Cortical Identity and Suppresses Hippocampal Organizer Fate.** *Science Journal, Vol. 319, January.*

73. R. Dietmar Müller,1* Maria Sdrolias,1 Carmen Gaina,2 Bernhard Steinberger,2 Christian Heine1†(2008). **Long-Term Sea-Level Fluctuations Driven by Ocean Basin Dynamics.** *Science Journal, Vol. 319, March.*

74. Ben E. K. Sugerman,1* Barbara Ercolano,2 M. J. Barlow,2 A. G. G. M. Tielens,3 Geoffrey C. Clayton,4 Albert A. Zijlstra,5 Margaret Meixner,1 Angela Speck,6 Tim M. Gledhill,7 Nino Panagia,1 Martin Cohen,8 Karl D. Gordon,9 Martin Meyer,1 Joanna Fabbri,2 Janet. E. Bowey,2 Douglas L. Welch,10 Michael W. Regan,1 Robert C. Kennicutt Jr.11 (2006). **Massive-Star Supernovae as Major Dust Factories.** *Science Journal, Vol. 313, July.*

75. Anoop Kumar,1* James W. Godwin,1* Phillip B. Gates,1 A. Acely Garza-Garcia,2 Jeremy P. Brockes1† (2007). **Molecular Basis for the Nerve Dependence of Limb Regeneration in an Adult Vertebrate.** *Science Journal, Vol. 318, November.*

76. Brent D. Wilson,1,2* Masaaki Ii,7*† Kye Won Park,1,3* Arminda Suli,4* Lise K. Sorensen,2 Fre´deric Larrieu-Lahargue,1 Lisa D. Urness,1,2 Wonhee Suh,1‡ Jun Asai,7 Gerhardus A.H. Kock,7§ Tina Thorne,7 Marcy Silver,7 Kirk R. Thomas,1,5 Chi-Bin Chien,4,6 Douglas W. Losordo,7 Dean Y. Li3 (2006). **Netrins Promote Developmental and Therapeutic Angiogenesis.** *Science Journal, Vol. 313, August.*

77. Ehud Cohen,1* Jan Bieschke,2* Rhonda M. Perciavalle,1 Jeffery W. Kelly,2 Andrew Dillin1† (313) (2007). **Opposing Activities Protect Against Age-Onset Proteotoxicity.** *Science Journal, Vol. 313, September.*

78. David Jablonski,1* Kaustuv Roy,2 James W. Valentine3 (2006). **Out of the Tropics: Evolutionary Dynamics of the Latitudinal Diversity Gradient.** *Science Journal, Vol. 314, October.*

79. Jan O. Korbel,1,2* Alexander Eckehart Urban,3* Jason P. Affourtit,4* Brian Godwin,4 Fabian Grubert,5 Jan Fredrik Simons,4 Philip M. Kim,1 Dean Palejev,5 Nicholas J. Carriero,6 Lei Du,4 Bruce E. Taillon,4 Zhoutao Chen,4 Andrea

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Tanzer,7,8,9 A. C. Eugenia Saunders,3 Jianxiang Chi,10 Fengtang Yang,10 Nigel P. Carter,10 Matthew E. Hurles,10 Sherman M. Weissman,5 Timothy T. Harkins,11 Mark B. Gerstein,1,6,12 Michael Egholm,4† Michael Snyder1,3† (2007). **Paired-End Mapping Reveals Extensive Structural Variation in the Human Genome.** *Science Journal, Vol. 318, October.*

80. Arnold Bakker,1 C. Brock Kirwan,2 Michael Miller,3 Craig E. L. Stark1,4* (2008). **Pattern Separation in the Human Hippocampal CA3 and Dentate Gyrus.** *Science Journal, Vol. 319, March.*

81. Brett M. Tyler,1* Sucheta Tripathy,1 Xuemin Zhang,1 Paramvir Dehal,2,3 Rays H. Y. Jiang,1,4 Andrea Aerts,2,3 Felipe D. Arredondo,1 Laura Baxter,5 Douda Bensasson,2,3,6 Jim L. Beynon,5 Jarrod Chapman,2,3,7 Cynthia M. B. Damasceno,8 Anne E. Dorrance,9 Daolong Dou,1 Allan W. Dickerman,1 Inna L. Dubchak,2,3 Matteo Garbelotto,10 Mark Gijzen,11 Stuart G. Gordon,9 Francine Govers,4 Niklaus J. Grunwald,12 Wayne Huang,2,14 Kelly L. Ivors,10,15 Richard W. Jones,16 Sophien Kamoun,9 Konstantinos Krampis,1 Kurt H. Lamour,17 Mi-Kyung Lee,18 W. Hayes McDonald,19 Mo´ nica Medina,20 Harold J. G. Meijer,4 Eric K. Nordberg,1 Donald J. Maclean,21 Manuel D. Ospina-Giraldo,22 Paul F. Morris,23 Vipaporn Phuntumart,23 Nicholas H. Putnam,2,3 Sam Rash,2,13 Jocelyn K. C. Rose,24 Yasuko Sakihama,25 Asaf A. Salamov,2,3 Alon Savidor,17 Chantel F. Scheuring,18 Brian M. Smith,1 Bruno W. S. Sobral,1 Astrid Terry,2,13 Trudy A. Torto-Alalibo,1 Joe Win,9 Zhanyou Xu,18 Hongbin Zhang,18 Igor V. Grigoriev,2,3 Daniel S. Rokhsar,2,7 Jeffrey L. Boore2,3,26,2 (2006). **Phytophthora Genome Sequences Uncover Evolutionary Origins and Mechanisms of Pathogenesis.** *Science Journal, Vol. 313, September.*

82. Nicholas Meskhidze1*† and Athanasios Nenes1,2 (2006). **Phytoplankton and Cloudiness in the Southern Ocean.** *Science Journal, Vol. 314, December.*

83. Koen J. T. Venken,1 Yuchun He,2,3 Roger A. Hoskins,4 Hugo J. Bellen1,2,3,5* (2006). **P[acman]: A BAC Transgenic Platform for Targeted Insertion of Large DNA Fragments in D. melanogaster**. *Science Journal, Vol. 314, December*.

84. Brendan E. Depue,1,2* Tim Curran,1,2,3 Marie T. Banich1,2,3,4 (2007). **Prefrontal Regions Orchestrate Suppression of Emotional Memories via a Two-Phase Process.** *Science Journal, Vol. 317, July.*

85. Nicholas H. Putnam, Mansi Srivastava, Uffe Hellsten, Bill Dirks, Jarrod Chapman, Asaf Salamov,1 Astrid Terry,1 Harris Shapiro,1 Erika Lindquist,1 Vladimir V. Kapitonov,3 Jerzy Jurka,3 Grigory Genikhovich,4 Igor V. Grigoriev,1 Susan M. Lucas,1 Robert E. Steele,5 John R. Finnerty,6 Ulrich Technau,4 Mark Q. Martindale,7 Daniel S. Rokhsar1,2* (2007). **Sea Anemone Genome Reveals Ancestral Eumetazoan Gene Repertoire and Genomic Organization.** *Science Journal, Vol. 317, July.*

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86. Johannes Krause,4 Joe Alessi,1 Feng Chen,1 Darren Platt,1 Svante Pääbo,4 Jonathan K. Pritchard,3 Edward M. Rubin1,2* (2006). **Sequencing and Analysis of Neanderthal Genomic DNA.** *Science Journal, Vol. 314, November.*

87. Daniel J. Klein and Adrian R. Ferre´-D'Amare´* (2006). **Structural Basis of glmS Ribozyme Activation by Glucosamine-6-Phosphate.** *Science Journal, Vol. 313, September.*

88. Liang Feng,1* Hanchi Yan,1* Zhuoru Wu,1* Nieng Yan,1 Zhe Wang,2 Philip D. Jeffrey,1 Yigong Shi1† (2007). **Structure of a Site-2 Protease Family Intramembrane Metalloprotease.** *Science Journal, Vol. 318, December.*

89. William E. Walden,1 Anna I. Selezneva,1 Jérôme Dupuy,2 Anne Volbeda,2 Juan C. Fontecilla-Camps,2 Elizabeth C. Theil,3 Karl Volz1* (2006). **Structure of Dual Function Iron Regulatory Protein 1 Complexed with Ferritin IRE-RNA.** *Science Journal, Vol. 314, December.*

90. Steven J. Karpowicz,1 George B. Witman,5 Astrid Terry,2 Asaf Salamov,2 Lillian K. Fritz-Laylin,6 Laurence Maréchal-Drouard,7 Wallace F. Marshall,8 Liang-Hu Qu,9 David R. Nelson,10 Anton A. Sanderfoot,11 Martin H. Spalding,12 Vladimir V. Kapitonov,13 Qinghu Ren,14 Patrick Ferris,15 Erika Lindquist,2 Harris Shapiro,2 Susan M. Lucas,2 Jane Grimwood,16 Jeremy Schmutz,16 Chlamydomonas Annotation Team,† JGI Annotation Team,† Igor V. Grigoriev,2 Daniel S. Rokhsar,2,6‡ Arthur R. Grossman17‡ (2007). **The Chlamydomonas Genome Reveals the Evolution of Key Animal and Plant Functions.** *Science Journal, Vol. 318, October.*

91. Tobias Sjo¨blom,1* Sia^n Jones,1* Laura D. Wood,1* D. Williams Parsons,1* Jimmy Lin,1 Thomas D. Barber,1† Diana Mandelker,1 Rebecca J. Leary,1 Janine Ptak,1 Natalie Silliman,1 Steve Szabo,1 Phillip Buckhaults,2 Christopher Farrell,2 Paul Meeh,2 Sanford D. Markowitz,3 Joseph Willis,4 Dawn Dawson,4 James K. V. Willson,5 Adi F. Gazdar,6 James Hartigan,7 Leo Wu,8 Changsheng Liu,8 Giovanni Parmigiani,9 Ben Ho Park,10 Kurtis E. Bachman,11 Nickolas Papadopoulos,1 Bert Vogelstein,1‡ Kenneth W. Kinzler,1‡ Victor E. Velculescu1‡ (2007). **The Consensus Coding Sequences of Human Breast and Colorectal Cancers.** *Science Journal, Vol. 314, October.*

92. Rebecca J. Leary,1 Dong Shen,1 Simina M. Boca,1,2 Thomas Barber,1‡ Janine Ptak,1Natalie Silliman,1 Steve Szabo,1 Zoltan Dezso,3 Vadim Ustyanksky,3 Tatiana Nikolskaya,3,4Yuri Nikolsky,3 Rachel Karchin,5 Paul A. Wilson,5 Joshua S. Kaminker,6 Zemin Zhang,6Randal Croshaw,7 Joseph Willis,8 Dawn Dawson,8 Michail Shipitsin,9 James K. V. Willson,10Saraswati Sukumar,11 Kornelia Polyak,9 Ben Ho Park,11 Charit L. Pethiyagoda,12P. V. Krishna Pant,12 Dennis G. Ballinger,12 AndrewB. Sparks,12§ James Hartigan,13Douglas R. Smith,13 Erick Suh,13 Nickolas Papadopoulos,1 Phillip Buckhaults,7 Sanford D. Markowitz,14Giovanni Parmigiani,1□ Kenneth W. Kinzler,1□ Victor E. Velculescu,1□ Bert Vogelstein (2007). **The Genomic Landscapes of Human Breast and Colorectal Cancers.** *Science Journal, Vol. 318, November.*

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93. C.A. Hidalgo,1*† B. Klinger,2* A.-L. Barabási,1 R. Hausmann2 (2007). **The Product Space Conditions the Development of Nations.** *Science Journal, Vol. 317, July.*

94. Chuan-Hsiang Huang,1,3 Diana Mandelker,2 Oleg Schmidt-Kittler,2 Yardena Samuels,2* Victor E. Velculescu,2 Kenneth W. Kinzler,2 Bert Vogelstein,2† Sandra B. Gabelli,1† L. Mario Amzel1† (2007). **The Structure of a Human p110a/p85a Complex Elucidates the Effects of Oncogenic PI3Ka Mutations.** *Science Journal, Vol. 318, December.*

95. S. Trotzky,1* P. Cheinet,1* S. Fölling,1 M. Feld,1,2 U. Schnorrberger,1 A. M. Rey,3 A. Polkovnikov,4 E. A. Demler,3,5 M. D. Lukin,3,5 I. Bloch1† (2008). **Time-Resolved Observation and Control of Superexchange Interactions with Ultracold Atoms in Optical Lattices.** *Science Journal, Vol. 319, January.*

96. Shen-Ying Zhang,1,2,3 Emmanuelle Jouanguy,1,2,3 Sophie Ugolini,4 Asma Smahi,5 Gaëlle Elain,6 Pedro Romero,7 David Segal,8 Vanessa Sancho-Shimizu,1,2 Lazaro Lorenzo,1,2 Anne Puel,1,2 Capucine Picard,1,2,9 Ariane Chapgier,1,2 Sabine Plancoulaine,1,2 Matthias Titeux,10 Céline Cognet,4 Horst von Bernuth,1,2 Cheng-Lung Ku,1,2 Armanda Casrouge,1,2 Xin-Xin Zhang,3 Luis Barreiro,11 Joshua Leonard,8 Claire Hamilton,1,2 Pierre Lebon,12 Bénédicte Héron,13 Louis Vallée,14 Lluis Quintana-Murci,11 Alain Hovnanian,10 Flore Rozenberg,12 Eric Vivier,4 Frédéric Geissmann,6 Marc Tardieu,15 Laurent Abel,1,2 Jean-Laurent Casanova1,2,3,16* (2007). **TLR3 Deficiency in Patients with Herpes Simplex Encephalitis.** *Science Journal, Vol. 317, September.*

97. S. W. Squyres,1 A. H. Knoll,2 R. E. Arvidson,3 B. C. Clark,4 J. P. Grotzinger,5 B. L. Jolliff,3 S. M. McLennan,6 N. Tosca,6 J. F. Bell III,1 W. M. Calvin,7 W. H. Farrand,8 T. D. Glotch,9 M. P. Golombek,9 K. E. Herkenhoff,10 J. R. Johnson, 10 G. Klingelho¨ fer,11 H. Y. McSween,12 A. S. Yen (2006). **Two Years at Meridiani Planum: Results from the Opportunity Rover.** *Science Journal, Vol. 313, September.*

98. Farzad Haerizadeh, Mohan B. Singh, Prem L. Bhalla* (2006). **Transcriptional Repression Distinguishes Somatic from Germ Cell Lineages in a Plant.** *Science Journal, Vol. 313, July.*

99. A. L. Westerling,1,2* H. G. Hidalgo,1 D. R. Cayan,1,3 T. W. Swetnam (2006). **Warming and Earlier Spring Increase Western U.S. Forest Wildfire Activity.** *Science Journal, Vol. 313, August.*

100. Hannah S. Seidel,*† Matthew V. Rockman,*† Leonid Kruglyak* (2008). **Widespread Genetic Incompatibility in C. Elegans Maintained by Balancing Selection.** *Science Journal, Vol. 319, February.*

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APPENDIX C

Abstract samples

1.

In mice, pheromone detection is mediated by the vomeronasal organ and the main olfactory epithelium. Male mice that are deficient for Trpc2, an ion channel specifically expressed in VNO neurons and essential for VNO sensory transduction, are impaired in sex discrimination and male–male aggression. We report here that Trpc22/2 female mice show a reduction in female-specific behaviour, including maternal aggression and lactating behaviour. Strikingly, mutant females display unique characteristics of male sexual and courtship behaviours such as mounting, pelvic thrust, solicitation, anogenital olfactory investigation, and emission of complex ultrasonic vocalizations towards male and female conspecific mice. The same behavioural phenotype is observed after VNO surgical removal in adult animals, and is not accompanied by disruption of the oestrous cycle and sex hormone levels. These findings suggest that VNO-mediated pheromone inputs act in wild-type females to repress male behaviour and activate female behaviours. Moreover, they imply that functional neuronal circuits underlying male-specific behaviours exist in the normal female mouse brain.

(From Nature Journal No. 1 [see Appendix B])

2.

In the Drosophila germline, repeat-associated small interfering RNAs (rasiRNAs) ensure genomic stability by silencing endogenous selfish genetic elements such as retrotransposons and repetitive sequences. Whereas small interfering RNAs (siRNAs) derive from both the sense and antisense strands of their double-stranded RNA precursors, rasiRNAs arise mainly from the antisense strand. rasiRNA production appears not to require Dicer-1, which makes microRNAs (miRNAs), or Dicer-2, which makes siRNAs, and rasiRNAs lack the 2′,3′ hydroxy termini characteristic of animal siRNA and miRNA. Unlike siRNAs and miRNAs, rasiRNAs function through the Piwi, rather than the Ago, Argonaute protein subfamily. Our data suggest that rasiRNAs protect the fly germline through a silencing mechanism distinct from both the miRNA and RNA interference pathways.

(From Science Journal No. 51 [see Appendix B])

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3.

Type 2 diabetes mellitus results from the interaction of environmental factors with a combination of genetic variants, most of which were hitherto unknown. A systematic search for these variants was recently made possible by the development of high-density arrays that permit the genotyping of hundreds of thousands of polymorphisms. We tested 392,935 single-nucleotide polymorphisms in a French case–control cohort. Markers with the most significant difference in genotype frequencies between cases of type 2 diabetes and controls were fast-tracked for testing in a second cohort. This identified four loci containing variants that confer type 2 diabetes risk, in addition to confirming the known association with the TCF7L2 gene. These loci include a non-synonymous polymorphism in the zinc transporter SLC30A8, which is expressed exclusively in insulin-producing b-cells, and two linkage disequilibrium blocks that contain genes potentially involved in b-cell development or function (IDE–KIF11–HHEX and EXT2–ALX4). These associations explain a substantial portion of disease risk and constitute proof of principle for the genome-wide approach to the elucidation of complex genetic

(From Nature Journal No. 2 [see Appendix B])

4.

Autism spectrum disorders (ASDs) are characterized by impairments in social behaviors that are sometimes coupled to specialized cognitive abilities. A small percentage of ASD patients carry mutations in genes encoding neuroligins, which are postsynaptic cell-adhesion molecules. We introduced one of these mutations into mice: the Arg451→Cys451 (R451C) substitution in neuroligin-3. R451C mutant mice showed impaired social interactions but enhanced spatial learning abilities. Unexpectedly, these behavioral changes were accompanied by an increase in inhibitory synaptic transmission with no apparent effect on excitatory synapses. Deletion of neuroligin-3, in contrast, did not cause such changes, indicating that the R451C substitution represents a gain-of-function mutation. These data suggest that increased inhibitory synaptic transmission may contribute to human ASDs and that the R451C knockin mice may be a useful model for studying autism-related behaviors.

(From Science Journal No. 52 [see Appendix B])

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APPENDIX D

Form for five raters to code abstracts

1. A functional circuit underlying male sexual behaviour in the female mouse brain						
Sentence No.	**Sentence**	**Rater No. 1**	**Rater No. 2**	**Rater No. 3**	**Rater No. 4**	**Rater No. 5**
1	In mice, pheromone detection is mediated by the vomeronasal organ and the main olfactory epithelium.					
2	Male mice that are deficient for Trpc2, an ion channel specifically expressed in VNO neurons and essential for VNO sensory transduction, are impaired in sex discrimination and male–male aggression.					
3	We report here that Trpc22/2 female mice show a reduction in female-specific behaviour, including maternal aggression and lactating behaviour.					
4	Strikingly, mutant females display unique characteristics of male sexual and courtship behaviours such as mounting, pelvic thrust, solicitation, anogenital olfactory investigation, and emission of complex ultrasonic vocalizations towards male and female conspecific mice.					
5	The same behavioural phenotype is observed after VNO surgical removal in adult animals, and is not accompanied by disruption of the oestrous cycle and sex hormone levels.					
6	These findings suggest that VNO-mediated pheromone inputs act in wild-type females to repress male behaviour and activate female behaviours					
7	. Moreover, they imply that functional neuronal circuits underlying male-specific behaviours exist in the normal female mouse brain.					

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2. A genome-wide association study identifies novel risk loci for type 2 diabetes						
Sentence No.	**Sentence**	**Rater No. 1**	**Rater No. 2**	**Rater No. 3**	**Rater No. 4**	**Rater No. 5**
8	Type 2 diabetes mellitus results from the interaction of environmental factors with a combination of genetic variants, most of which were hitherto unknown.					
9	A systematic search for these variants was recently made possible by the development of high-density arrays that permit the genotyping of hundreds of thousands of polymorphisms.					
10	We tested 392,935 single-nucleotide polymorphisms in a French case–control cohort.					
11	Markers with the most significant difference in genotype frequencies between cases of type 2 diabetes and controls were fast-tracked for testing in a second cohort.					
12	This identified four loci containing variants that confer type 2 diabetes risk, in addition to confirming the known association with the TCF7L2 gene.					
13	These loci include a non-synonymous polymorphism in the zinc transporter SLC30A8, which is expressed exclusively in insulin-producing b-cells, and two linkage disequilibrium blocks that contain genes potentially involved in b-cell development or function (IDE–KIF11–HHEX and EXT2–ALX4).					
14	These associations explain a substantial portion of disease risk and constitute proof of principle for the genome-wide approach to the elucidation of complex genetic traits.					

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