Writing Scientific Research Articles in Thai and English: Similarities and Differences

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Abstract

This paper analyzed a corpus of biochemistry research articles written in Thai using Swales' genre analysis (2004) to address three objectives: 1) identify moves and their subunits, steps, used in Thai biochemistry research articles; 2) describe the two-tier generic pattern identified in Thai research articles; and 3) to compare the pattern obtained with that in English from Kanoksilapatham's 2005 study. The analysis of the Thai corpus revealed 14 distinct moves: 3 in the Introduction section, 4 in the Methods, 3 in the Results, and 4 in the Discussion sections. The comparison of the generic patterns prevailing in the Thai and English corpora suggested that biochemistry research articles across the two languages shared some resemblances. However, crucial variations were discernible possibly due to a number of factors: the close-knit Thai research community, reflecting the size and expectations of the community members; the scope of research conducted in the Thai context; the national research policy with a focus on practical research; and the specific characteristics of Thai community members. This study's findings would benefit scientists in general and biochemists in particular, providing guidelines for writing research articles, enabling them to effectively disseminate scientific discoveries and better satisfy the expectations of their respective scientific communities.

Key Words **:** research articles; writing; biochemistry; Thai and English

Introduction

Within the realm of scientific publication, research articles play a pivotal role in academic communities. Successful publication can lead to an enhanced reputation, prestige, peer acceptance, and research grants, kindling intellectual interest and career advancement. Therefore, writing for publication has become an integral skill for scientists across disciplines and across languages. Since writing is a manifestation of culture (e.g., Kaplan, 1966; Connor, 1996), writing for publication can be quite a daunting, frustrating, and challenging task for non-native scientists to stake their claims in their respective scientific communities.

A substantial body of research within the field of applied linguistics focuses on the structure of scientific research articles. Swales' genre analysis (1990, 2004), for instance, illuminates the components of the Introduction section of an article through smaller units of texts called *moves*. Each move, in turn, consists of subunits called *steps*. Swales' framework has been widely accepted as demonstrated by a great number of studies on Introductions (e.g., Crookes, 1986; Samraj, 2002; Swales & Najjar, 1987) and, by extension, on the other sections of research articles in multiple academic disciplines (e.g., Anthony, 1999; Hopkins & Dudley-Evans, 1988; Posteguillo, 1999; Yang & Allison, 2003). Swales' revision in 2004 incorporating findings of previous move-based studies allows the model to more accurately account for the features of research article writing.

Most of the genre based studies focus on English language research articles. To the best of our knowledge, there have been no linguistic investigations into the structure of research articles in Thai, except for Jogthong's 2001 study. Her study analyzed and compared Introductions from two different academic disciplines of medicine and education. Since previous genre based studies have shown that disciplinary variation of the structure is discernible (e.g., Brett, 1994; Posteguillo, 1999; Williams, 1999), Jogthong's findings remain inconclusive and need to be substantiated. In

addition, Jogthong's study focused on only one section of research articles, rendering the knowledge of writing research articles fragmentary.

Following Swales' genre analysis, this study identifies the structure of biochemistry research articles written in Thai. Kanoksilapatham's generic structure of biochemistry articles in English (2005) provides the baseline for this study, making comparison of two languages possible. Specific objectives of this study are threefold: 1) to describe the structure of biochemistry articles published in Thai; 2) to outline a basic structural format of these Thai articles; and 3) to identify similarities and differences between the structures of biochemistry articles written in Thai and English. The findings of this study will facilitate Thai scholars' task of writing for publication, promoting and encouraging their participation in the scientific community both locally and internationally. The implications of the study will be useful for didactic purposes, particularly for teaching advanced learners of English.

Methods

Corpus compilation

To make certain that the Thai corpus is comparable to the English one of Kanoksilapatham's 2005 study, a brief description of the English corpus is essential (Kanoksilapatham, 2005: 271). The English corpus consists of 60 biochemistry articles written in English in the year 2000. These articles were randomly selected from the top five journals in the field, based on the impact factors released in 1999. Each journal was represented by 12 articles, resulting in the corpus of 60 articles of about 320,000 words. All articles in the English corpus conformed to the conventional nomenclature of IMRD (Introduction, Methods, Results, and Discussion).

An attempt to make the Thai corpus closely comparable to the English corpus as much as possible was, however, impeded by a

number of contraints: the dearth of specialized Thai journals on biochemistry, the small number of biochemistry articles written in Thai in each journal issue, and the instability of Thai journals in general. Based on the Thai journal impact factors released in 2005 (www.kmutt.ac.th/jif/public_html/history.html), only 13 journals have an impact factor. Of the 13 journals, the journal titles that are apparently unrelated to biochemistry were excluded. Then, because of no specialized journals on biochemistry, the content pages of every issue of the remaining journals published during the years of 2002-2004 were photocopied for two experts in biochemistry to verify only those articles on biochemistry. Only 19 biochemistry articles in Thai were found in the two journals (*Thai Journal of Veterinary Medicine* [V] and *Songklanakarin Journal of Science and Technology* [S]). Based on this finding, the author decided to focus on these two journals and extended the years of their publication to 1997-2004 to obtain as many articles as possible. Finally, the Thai corpus contains 42 articles of approximately 200,000 words; not all articles conform to the typical nomenclature of IMRD. The composition of the corpus featured 42 Introductions, 42 Methods, 36 results, and 26 Discussion. The 42 articles were assigned numbers from 1 to 42 to ease further reference (e.g., [V1] and [S1]).

Genre analysis

The corpus was then subjected to genre analysis, a technique developed by Swales (1990, 2004) to analyze texts into a hierarchical schematic structure of move-step model. For instance, the Introduction section usually consists of a set of *moves* which, in turn, are subdivided into several *steps*.

Swales' revised model for Introductions (Swales, 2004: 230, 232)

Move 1: Establishing a territory (citations required)[***] **via**
Topic generalizations of increasing specificity

Move 2: Establishing a niche (citations possible)[***] **via**
Step 1A: Indicating a gap **or**
Step 1B: Adding to what is known
Step 2: Presenting positive justification (optional)

Move 3: Presenting the present work via
Stop1: Announcing present research descriptively and/or purposively (obligatory)
Step 2: Presenting research questions or hypotheses[*] (optional)
Step 3: Definitional clarifications (optional)[*]
Step 4: Summarizing methods (optional)[*]
Step 5: Announcing principal outcomes [**]
Step 6: Stating the value of the present research [**]
Step 7: Outlining the structure of the paper [**]

[*] Optional and less fixed in order
[**] Probable in some academic disciplines
[***] Possible cyclical patterning of moves particularly in longer Introductions

The proposed model identifies the typical sequence of moves and steps that forms the structural organization of Thai articles. The model also indicates cyclical patterning and sporadic occurrences of certain moves, as observed in previous studies (e.g., Brett, 1994; Nwogu, 1997; Posteguillo, 1999).

The following excerpt from the Introduction section of V15 illustrates how a Thai biochemistry text is segmented into moves in this study. By the way, all excerpts presented in this article are Thai-to-English translated versions, verified by a Thai specialist in biochemistry to be equivalent to the Thai original versions.

(1) **(S1)** *Epidemiological studies of Leptospirosis outbreaks can be conducted using either DNA–based subtyping or DNA fingerprinting.* **(S2)** *Each method has many techniques that are useful in identifying the strain causing the epidemic.* **(S3)** *The examples of DNA fingerprinting of Leptospira spp. include DNA hybridization (R), Restriction Fragment Length Polymorphism (RFLP) (R), Pulse-Field Gel Electrophoresis (PFGE) and Randomly Amplified Polymorphic DNA (RAPD) (R).* **(S4)** *In addition, Repetitive Sequence-based Polymerase Chain Reaction (rep-PCR) which is one technique of DNA fingerprinting of many types of bacteria (R).* **(S5)** *However, there has been no report on the use of rep-PCR in NA fingerprinting of Leptospira spp.* **(S6)** *This study presents an account on the use of rep-PCR in DNA fingerprinting for strain tracking in molecular epidemiological investigations in Thailand.* [V15]

As shown above, the excerpt consists of six sentences. The first four sentences establish the importance of the research topic by extensively providing the background information related to the study of *Leptospira spp.* (Move 1). Sentence 5 addresses the gap of research that the current study addresses (Move 2), and the last sentence briefly describes the study (Move 3).

Upon the completion of move analysis, to determine the stability of a move and to be in accordance with Kanoksilapatham's 2005 study, a move is considered obligatory if its frequency exceeds 60% of the corpus. Conversely, if a move occurs less than 60% of the corpus, the move is optional. Finally, the structural organization of the Thai corpus was outlined and compared with that of the English corpus to determine similarities and differences across the two languages.

Inter-coder reliability analysis

At this juncture, it is noted that, due to the semantically driven characteristic of genre analysis, it is possible that two different individuals may assign different move boundaries. This limitation crucially calls for the integration of inter-coder reliability analysis, a solution to help boost the strength of the analysis. In this study, five experts in biochemistry serve as coders to verify that move boundaries can be agreed upon across individuals. All of the five coders completed their PhD either in the United States or Thailand. At the time of study, they were the faculty members in the Faculty of Science or the Faculty of Pharmacy at a public university in Thailand. As a part of this procedure, a coding protocol was devised, based on the initial genre analysis of the Thai corpus. The coding protocol consists of all moves and steps illustrated by examples taken from the corpus.

The coders were trained how to use the coding protocol to carry out genre analysis. Following training, brainstorming, discussing, and questioning, the coders were asked to independently analyze a subset of the corpus (15 articles). Upon completion, the intercoder reliability was assessed by Cohen's kappa (k) and percentage (0.79 to 0.93 and 88% to 96%, respectively), indicating the satisfactory agreement level between the researcher and each of the five coders. Tables 1 and 2 display the results of the inter-coder reliability analysis.

Table 1 Inter-coder reliability analysis in percentage

	Introduction	**Methods**	**Results**	**Discussion**	**Mean**
Expert 1	96.66	84.02	100.00	88.88	**92.39**
Expert 2	97.28	91.10	97.06	83.55	**92.25**
Expert 3	96.17	96.66	92.46	89.08	**93.59**
Expert 4	96.66	96.68	96.66	89.74	**94.94**
Expert 5	93.00	91.56	95.17	88.29	**90.56**
Mean	**95.95**	**91.56**	**95.17**	**88.29**	

Table 2 Inter-coder reliability in Cohen's kappa (k)

	Introduction	Methods	Results	Discussion	Mean
Expert 1	.95	.82	.82	.75	**.87**
Expert 2	.89	.71	.93	.74	**.82**
Expert 3	.88	.94	.95	.85	**.91**
Expert 4	.96	.91	.97	.86	**.93**
Expert 5	.96	.92	.93	.73	**.89**
Mean	**.93**	**.86**	**.94**	**.79**	

Cohen's kappa value (k) guided interpretation (Orwin, 1994)

k < 0.4	means unsatisfactory	k 0.4 – 0.59	means satisfactory
k 0.6 – 0.74	means good	k >0.75	means excellent

Results

The analysis of the Thai corpus revealed the identification of 14 moves, as opposed to 15 moves in the English corpus (Kanoksilapatham, 2005). These moves were numbered, chronologically in the order in which they most often appeared. The two corpora are similar sharing the same number of moves in Introductions (3 moves), Methods (4 moves), and Discussions (4 moves). The Results section of the Thai corpus consists of 3 moves, whereas there are 4 moves in the English corpus. The following sections describe individual moves and steps found in each section. The moves and steps are accompanied by excerpts taken directly from the corpus. To faciliate the comparison of the moves and steps identified from the two corpora, excerpts from the Thai and English corpora were concurrently presented. Citations used in the original texts were replaced by (R). The frequencies of occurrence of all the moves identified are presented in Table 3.

Moves and Steps in Introduction

The general function of the Introduction section is to introduce the topic, furnishing the rationale for the study being reported. Within this Introduction section of both Thai and English corpora, three common moves were identified, namely, ***Move 1: Announcing the importance of the field, Move 2: Preparing for the study,*** and ***Move 3: Introducing the present study.*** Across the two corpora, Moves 1 and 3 are always present (100%). Move 2 occurs less frequently, 64.29% in the Thai corpus and 66.66% in the English corpus. Based on the cut-off of a 60% occurrence rate, all moves identified in Introductions of biochemistry are conventional.

Move 1: Announcing the importance of the field is usually at the beginning of the Introduction section, introducing the topic of the study and claiming its significance. The introduction of the study can be relatively general or specific, as shown by the excerpts (2-3) and (4-5), respectively.

Move 1: Announcing the importance of the field (general)

(2) *The ovaries of prepuberal native-Thai calves consist of a considerable number of primodial germ cells (R), important sources of oocytes.* [Thai, V4]

(3) *Iron-sulfur (Fe-S) cluster prosthetic groups play a key role in a wide range of enzymatic reactions, as well as serving as regulatory switches.* [MCB6]

Move 1: Announcing the importance of the field (specific)

(4) *Siamese crocodiles, under the scientific name of Crocodylus saimensis, belong to the class Reptilia, order Crododilia, family Crocodylicade, and subfamily Crododylinae (R). They can be found in most areas of Thailand, with the exception of the south.* [Thai, V6]

(5) *Double-stranded RNA (dsRNA) induces potent cellular responses in diverse biological systems (R)[4].* [MC11]

The second move found in this section in both corpora is ***Move 2: Preparing for the study.*** It usually follows ***Move 1: Announcing the importance of the field.*** The common strategy used across the two corpora is to prepare readers by addressing gaps in previous research.

Move 2: Preparing for the study

(6) *However, presently, there are no reports on the use of rep-PCR in DNA fingerprinting of Leptospira spp.* [Thai, V15]

(7) *The mechanism of processing the nature, 184nt 6S RNA from its precursor has not been characterized.* [C6]

The last move found in Introductions of the two corpora is ***Move 3: Introducing the present study.*** After addressing gaps in previous research, the present study is introduced as a means to fill in the gap earlier identified. Unlike the first two moves of the section, a total of five steps of Move 3 were used across the two corpora. Move 3, Steps 1 and 2 are common in both corpora. However, Steps 3 and 5 are uniquely found in the Thai corpus, whereas Step 4 only in English.

Move 3: Introducing the present study

Move 3, Step 1: Stating objectives

(8) *The objective of this study is to examine relationships among cancer types.* [Thai, V30]

(9) *The present study was designed to evaluate whether the efficiency and carrier ligand specificity of replicative by pass past Pt-DNA abducts… could be determined by the mode of translesion synthesis and whether…* [JBC4]

Move 3, Step 2: Detailing procedures

(10) *… by comparing the tissues that are pathologenic to non-pathologenic tissues.* [Thai, V6]

(11) *In the study presented herein, we investigated proteins from S. cerevisiae that exhibit strong homology to the bacterial IscA product of the isc gene cluster.* [MCB6]

Move 3, Step 3: Justifying decisions made ***(only in Thai)***

(12) *(…by using RT-PCR). This technique was reported to be highly sensitive, specific, and applicable to clinical use.* [Thai, V9]

Move 3, Step 4: Presenting findings ***(only in English)***

(13) *Our results show that U2snRNP is functionally associated with the E complex and is also required for its assembly.* [MC5]

Move 3, Step 5: Stating implications ***(only in Thai)***

(14) *The detection of aflatoxin B1 contamination in medicinal plant materials will be useful for the avoidance of consuming medicinal plants contaminated with aflatoxin B1.* [Thai, V9]

Moves and Steps in Methods

The Methods section articulates a question or a series of questions and stipulates means to answering the questions addressed. This section of both corpora identically consists of four main moves: ***Move 4: Specifying Materials, Move 5: Describing procedures, Move 6: Setting apparatus,*** and ***Move 7: Detailing statistical analyses.*** The frequencies of occurrence of the Methods moves are similar across the two corpora. That is, Moves 4 and 5 are always present (100%) and considered conventional in the two corpora. The occurrences of Moves 6 and 7, however, are much less. Move 6 is recognized in only 14.29% of the Thai corpus and 10.00% of the English corpus, whereas Move 7 is present 52.38% and 13.32% in the Thai and English corpora, respectively. The homogeneity of the Methods moves across the two corpora also lies at the step level. As shown in (15-30), this section is quite technical and objectively presented.

Move 4: Specifying materials

Move 4, Step 1: Naming materials

(15) *Sixteen swamp buffaloes were used in this experiment.* [Thai, V5]

(16) *Bacterial strains used in this study and their origin are listed in Table 3.* [C8]

Move 4, Step 2: Identifying sources of materials

(17) *The 16 swamp buffaloes used in this experiment are the property of the Department of Livestock.* [Thai, V5]

(18) *COS-7 cells were obtained from S. Brandt (Vanderbilt University, Nashville, Tenn).* [MCB4]

Move 4, Step 3: Providing background information of materials

(19) *These cows are 5 to 17 years of age and have been bred at least once. The cows grazed during daytime hours. At night, they were kept in pounds where they consumed fresh grass, concentrated dietary supplements, water, and minerals.* [Thai, V5]

(20) *The fun 12 strains J130 and J133 were described previously (R).* [MC10]

Move 5: Describing procedures

Move 5, Step 1: Documenting established procedures

(21) *Typing of Leptospira spp. was conducted while using both bacteriological methods and polymerase chain reactions.* [Thai, V15]

(22) *Detection employed the ECL kit (American Pharmacia Biotech) according to the manufacturer's specification.* [MCB6]

Move 5, Step 2: Detailing procedures

(23) *The identifcation of the unknown was performed by growing the organisms in Feltcher medium (R) at temperatures ranging from 28 to 30 degrees celcius for periods of 3 to 13 weeks.* [Thai, V15]

(24) *Proteins in both fractions were precipitated by the addition of 4 volumes of cold acetone, collected by centrifugation, and resuspended in electrophoresis sample buffer.* [MBC7]

Move 5, Step 3: Providing background information of materials

(25) *Because the slaughterhouse could not complete the dissection of all 16 cows in one day, injecting hormones to induce superovulatory treatments was performed in three sessions.* [Thai, V5]

(26) *They were referred to as Cre-Mate mice, since the nature of the gene targeted for conditional ablation in the epidermis was irrelevant for that study.* [C1]

Move 6: Setting apparatus

(27) *Morphology and organelle of red blood cells and blood platelets were examined using TEM with 5,000 – 20,000 magnification power.* [Thai, V13]

(28) *Images were recorded through a Hamamatsu C-2400 New vicon camera using a 10 x objective and brightfield optics. Video images were digitized at a rate of 6 frames/ min as described above.* [MBC8]

Move 7: Describing statistical analyses

(29) *Using Tukey's procedure, a paired comparison was conducted via a computer program called SYSTAT by Wilkinson et al. (1992).* [Thai, S3]

(30) *The data were fitted to the Michaelis-Menten Equation 1 by using a non-linear least squares approach and the kinetic constants+- S.E.* [JBC7]

Moves and Steps in Results

The Results section presents findings of the study. This section is most often one of the most important sections of research articles for it displays the outcome of research. Interestingly, it is the only section that displays discrepancies with regard to the number of moves found. Three moves were found in the Thai corpus, and four moves in the English corpus. Move 10, the most central move of the Results section, is always present across the two corpora. However, the frequencies of occurrence of Moves 8 and 11 are notable in the two corpora. Both of them occur infrequently in the Thai corpus (22.22%) but

frequently in the English corpus (95.07% and 91.01% for Moves 8 and 9, respectively).

It is worth noting that even though the main function of the section is to present findings generated by the study, biochemists customarily contextualize the study by providing information regarding materials and methods. The section, as revealed by the analysis, also displays comments made on the findings being reported.

Move 8: Restating procedural issues

Move 8, Step 1: Restating objectives

(31) *To collect data for the genome database and to search for restriction enzymes that are appropriate for PCR production, … .* [Thai, S9]

(32) *To determine whether these GTPases participate in the phagocytosis of P. aeruginosa, we...* [JBC1]

Move 8, Step 2: Restating procedures

(33) *The chickens immunized with Newcastle disease virus (NDV) in Group 1 were 6 weeks of age. Twenty-four hours after inocculation, the first chicken was killed and dissected. The infected internal organs, such as the chorioallantoic membrane, cryostal sections of tracheal epithelium, heart, lung, liver, spleen, Bursa of Fabricius, and intestine, were examined using a direct FA test.* [Thai, S8]

(34) *P19 cytoplasmic extracts were incubated with double-stranded CACGTG oligonucleotides immobilized on beads and following extensive washing, retention of MondoA Mlx heterodimers on the DNA beads was determined by Western blotting.* [MCB12]

Move 9: Providing justifications for the choice of procedures (only in English)

Move 9, Step 1: Citing established knowledge of procedures

(35) *(We chose the more precisely defined LSTer region over*

the RSTer region for analysis.) LSTer region contains two approximately equivalent arrest sites, LSTer 2, separated by about 27 kbp (R) [MC12]

Move 9, Step 2: Referring to previous research

(36) *However, both identified murine GBPs had C20-type Cax motifs, and the mGBP1 protein appeared to be successfully C20 modified (R).* (Therefore, mGBP1 was examined to determine if it would also be C20 modified or might instead be farnesylated.) [MBC7]

Move 10: Stating results

Move 10, Step 1: Reporting results

(37) *The findings of this study revealed that the tilapias that were fed with three formulated organic feeds, supplemented with phytase enzymes and inorganic phos phates, did not display any physical abnormalities.* [Thai, S7]

(38) *We were not able to target the endogenous E. coli 6S RNA with antisense oligonucleotides. Secondary structure predictions and the observation that 6S RNA in extracts is relatively resistant to nuclease digestion suggest that...* [C6]

Move 10, Step 2: Comparing results

(39) *No significant difference was found between brood and progeny stocks of the strains of Pla nil Chitralada 3 at any locus, at any per locus average, or at overall polymorphic loci.* [Thai, S3]

(40) *However, there is a 6S-like RNA in the genomic sequence of Haemophilus influenzae that has an insertion of 13 nt at the end of the predicted stem of the E. coli6SRNA.* [C6]

Move 11: Commenting results

Move 11, Step 1: Explaining results

(41) *P. merguiensis DNA fragment sizes of 142 bp and152 bp are similar; therefore, they cannot be separated by*

agarose gel electrophoresis. [Thai, S9]

(42) *We presume that the localization of GFP-tagged Ste18p is representative of native Ste18p because the wild-type fusion protein rescues mating in a ste18 strain.* [MBC3]

Move 11, Step 2: Making generalizations

(43) *This demonstrates that the rep-PCR, using primer ERIC IR and ERIC II, is quite capable of differentiating Leptospira species and can be applied to study genetic characteristics of Leptospira species.* [Thai, V15]

(44) *These results suggest that proteolysis of c-Myc is proteasome dependent.* [MCB4]

Move 11, Step 3: Evaluating results ***(only in English)***

(45) *As expected, puncta also stained with anti-alpha cetenin and anti-beta catenin, but not desmosome-specific markers.* [C1]

Move 11, Step 4: Stating limitations

(46) *Given the unavailability of the data regarding age, the spread to lymph nodes or internal organs, and the after-treatments records, statistical analysis was not possible.* [Thai, V29]

(47) *The molecular mechanisms governing telomere length regulation in Tetrahymena are unknown. It is therefore difficult to propose an explicit, molecual-level model to explain why telomeres become longer in the absence of p80/p95.* [MC10]

Move 11, Step 5: Summarizing results

(48) *In conclusion, the comparison of heterozygosity at overall polymorphic loci did not reveal any statistical significance.* [Thai, S3]

(49) *Together, these results demonstrate that reg A- cells are capable of assessing the direction of a spatial gradient of cAMP and moving in a directed manner, but …* [MBC8]

Moves and Steps in Discussion

The Discussion section accomplishes its function through the use of four common moves across the corpora. These moves are ***Move 12: Contextualizing the study, Move 13: Consolidating results, Move 14: Stating limitations,*** and **Move 15: Suggesting further research.** Move 13 is always present (100%) in the two corpora, whereas Move 12, occurring frequently, is present in 84.62% and 89.94% of the Thai and English corpora. Move 15, an optional move in both the Thai and English corpora, occurs in only 46.15% and 53.33%, respectively. The difference lies in Move 14, which occurs infrequently in the Thai corpus (46.15%) but frequently in the English corpus (80.00%).

Move 12: Contextualizing the study

Move 12, Step 1: Describing established knowledge

(50) *Lesions of this disease can be found in all types of animals, including humans. The lesions usually co-occur with abnormalities in reproductive systems.* [Thai, V10]

(51) *Type III secretion systems translocate proteins out of cells and often require chaperones specific for each of the secreted substrates.* [C7]

Move 12, Step 2: Making generalizations

(52) *The use of chloramphenical antibiotics and sulfonamide antimicrobial agents in veterinary science is usually in the form of chloramphenical sodium succinate and sulphadimethylpyridine-trimethoprim. These antibiotics and antimicrobiotial agents should not be used for periods longer than 2-4 weeks.* [Thai, V1]

(53) *A detailed understanding of the catalytic mechanisms and substrate selectivity of HAT enzymes is an important component of defining the molecular basis of their biological functions.* [JBC7]

Move 13: Consolidating results

Move 13, Step 1: Restating methodology

(54) *The comparative study of the use of chloramphenical sodium succinate and sulphadimethylpyridine-trimethoprim in dogs … .* [Thai, V1]

(55) *To identify the mechanism by which kinesin-I binds axonal cargo, we screened for novel axonal transport mutants in Drosophila.* [C11]

Move 13, Step 2: Stating selected findings

(56) *The study shows that the average sugar level decreased within 3-7 days after treatment.* [Thai, V1]

(57) *We show that the essential Gpi11 and Gpi13 proteins are involved in late stages in the formation of the yeast GPIs, and we identify and characterize three new candidates GPI precursors.* [MBC5]

Move 13, Step 3: Referring to previous literature

(58) *However, prolonged use of such medicines in dogs with abnormalities related to lacrimal glands or with abnormalities of drug excretion may cause Keratoconjunctivitis sicca or KCS (R).* [Thai, V1]

(58) *The experiments presented here confirm the previously reported data (R), showing that polβ can catalyze extensive bypass of platinum-DNA adducts in a single-stranded region of DNA.* [JBC4]

Move 13, Step 4: Explaining differences in findings

(60) *The differences might be due to certain techniques, sample sizes, or specific dog breeds….* [Thai, V3]

(61) *…they were not easily distinguished in centroid tracks of regA- cells (Figure 4, D-F), primarily because the peak velocities of regA- cells were in many cases depressed and the tracks were not as persistent and directional during period of increased velocity.* [MBC8]

Move 13, Step 5: Making claims

(62) *Therefore, the injection of hormones on day 4, subsequent to the CID-R injection, was considered appropriate because it is the time period that new follicles begin to grow.* [Thai, S5]

(63) *…Simply changing the CaaX motif of mGBP1 to a form recognized by Ftase significantly improved mGBP1 modification. This result also indicates that the CaaX motif of mGBP1 is not likely to be buried within the structure of the protein, because such masking would presumably impede interaction with either Ftase or GGTase I.* [MBC7]

Move 13, Step 6: Exemplifying

(64) *…such as viral encephalitis, demyelination. IB was found in some canines, demonstrating that canine distemper had spread to the brain. Lymphocytic pericascular cuffing was usually found in the meninge as well as the brain gliosis and demyelination.* [Thai, V9]

(65) *This is not meant to imply that protein substrate recognition by PCAF would not be influenced by the non-catalytic domains of PCAF. For example, a 25-amino acid peptide derived from the known acytelation site of p53 is a very weak PCAF (full-length), …* [JBC7]

Move 14: Stating limitations

(66) *The DNA fingerprinting in this study was not used to distinguish Leptospira spp. at the level of serovars.* [Thai, V15]

(67) *Our data do not address the possibility that intermediate filaments and lysosomes are transported by conventional kinesin because Drosophila lack intermediate filament proteins and because lysosomes in the Drosophila tissues that we analyzed have not been characterized.* [MBC4]

Move 15: Suggesting further studies

(68) *Therefore, when using RT-PCR, the sample should be sufficient in volume and collected from areas where clear lesions are located.* [Thai, V9]

(69) *In the future, it will be challenging to assess what contribution DNA unwinding makes to the distribution of replication start sites in vivo.* [MC4]

Comparison of structural organizations in Thai and English

The comparison results of the structural organizations identified in the two corpora are summarized in Table 3.

Table 3 Summarized comparison results

Move/Step	**Frequency**	
	Thai	**English**
Introduction (42 Thai, 60 English)		
Move 1: Announcing the importance of the field*	100.00	100.00
Move 2: Preparing for the study*	64.29	66.66
Move 3: Introducing the present study	100.00	100.00
• Stating objectives	Yes	Yes
• Detailing procedures	Yes	Yes
• Justifying decisions made	Yes	No
• Presenting findings	No	Yes
• Stating implications	Yes	No
Methods (42 Thai, 60 English)		
Move 4: Specifying Materials*	100.00	100.00
• Naming materials	Yes	Yes
• Identifying sources of materials	Yes	Yes
• Providing background information of materials	Yes	Yes
Move 5: Describing procedures*	100.00	100.00
• Documenting established procedures**	Yes	Yes
• Detailing procedures**	Yes	Yes
• Providing background information of materials**	Yes	Yes
Move 6: Setting apparatus	14.29	10.00

Move 7: Detailing statistical analyses	52.38	13.32
Results (36 Thai, 60 English)		
Move 8: Restating procedural issues*	22.22	95.07
• Restating objectives	Yes	Yes
• Restating procedures	Yes	Yes
Move 9: Providing justifications for the choice of procedures*	0	71.59
• Citing established knowledge of procedures	N/A	
• Referring to previous research	N/A	
Move 10: Stating results*	100.00	100.00
• Explaining results	Yes	Yes
• Comparing results	Yes	Yes
Move 11: Commenting results*	22.22	91.01
• Explaining results	Yes	Yes
• Making generalizations**	Yes	Yes
• Evaluating results	No	Yes
• Stating results	Yes	Yes
• Summarizing	Yes	Yes
Discussion (26 Thai, 60 English)		
Move 12: Contextualizing the study	84.62	89.94
• Describing established knowledge	Yes	Yes
• Making generalizations	Yes	Yes
Move 13: Consolidating results*	100.00	100.00
• Restating methodology	Yes	Yes
• Stating major findings	Yes	Yes
• Referring to previous literature**	Yes	Yes
• Explaining differences in findings**	Yes	Yes
• Making claims	Yes	Yes
• Exemplifying Yes Yes		
Move 14: Stating limitations	46.15	80.00
Move 15: Suggesting further studies	46.15	53.33

* *Cyclical patterning of moves*

** *Less fixed in order*

Table 3 illustrates the two-tier comparison of structural organizations of biochemistry research articles in Thai and English, featuring the presence of moves and steps in each section of the corpora, the typical sequence of moves and steps as used, the frequency of occurrence for each move, and possible cyclical patternings of certain moves.

In general, both structural organizations delineated in Table 3 display similarities across the two languages in terms of the moves identified and the general move sequence within each section. Only the Results section displays differences featuring three moves in the Thai corpus and four in the English one. ***Move 9: Providing justifications for the choice of procedures*** was not found in Thai but frequently used (71.69%) in the English corpus. This move was first identified at a high frequency (93.75%) by Thompson (1993) who analyzed 16 English biochemistry research articles in English. Although this move's frequency in Kanoksilapatham's (2005) study was only 71.00%, the occurrence of this move in both Thompson's and Kanoksilapatham's studies indicates that biochemist authors need to convince readers that the procedure chosen was justifiable.

Some moves do not substantially vary in their frequency of occurrence. For instance, in the Thai and English corpora, ***Move 2: Preparing for the study*** and ***Move 12: Contextualizing the study*** were found 64.29% and 66.66%, and 84.62% and 89.94%, respectively, and both are considered obligatory. Meanwhile, ***Move 6: Setting apparatus*** was optional and found in 14.29% and 10.00% of the Thai and English corpora. Other moves vary distinctively in terms of their occurrence across the two corpora. ***Move 8: Restating procedural issues***, for instance, provides readers with background information of the research to facilitate and encourage the appreciation of the findings presented. This move's frequency drastically differs across the corpora, only 22.22% and 95.07% in the Thai and English corpora, respectively, rendering the move optional in the Thai corpus and obligatory in the other.

So is ***Move 11: Commenting results*** in the Results section.

The differences were not only found at the move level but also at the step level. For example, three out of five steps of Move 3 differentiate the two corpora. That is, *Move 3, Step: Presenting findings*, one of the five steps, was found only in the English corpus and completely absent in the Thai corpus, a distinct discrepancy. Conversely, *Move 3, Step: Justifying decisions made* and *Move 3, Step: Stating implications* were used in the Thai corpus but absent in the English one. The differences found across the two corpora can be summarized as follows:

At the move level

1. ***Move 9: Providing justifications for the choice of procedures*** was not found in the Thai corpus.

2. ***Moves 8: Restating procedural issues, Move 11: Commenting results***, and ***Move 14: Stating limitations*** are optional in Thai, but obligatory in English.

At the step level

1. *Step: Justifying decisions made* and *Step: Stating implications* of Move 3 were found in Thai, but not in English.

2. *Step: Presenting findings* of Move 3 was found in English, but not in Thai.

These discrepancies will be discussed in detail in the following section.

Discussion

This study has the objectives of describing biochemistry research articles in Thai and outlining their typical structural organization. The Thai corpus of 42 biochemistry research articles was compiled and analyzed by Swales' genre analysis (2004). The structural organization of the Thai biochemistry articles was outlined and compard with that of the English ones to determine similarities and differences between the two organizations of the articles in the two languages. The scrutiny of the findings demonstrate possible factors contributing to such discrepancies.

Expectations and size of the scientific community

Swales' model of Introductions reflects the competitive characteristics of scientific communities, particularly those in America and the western countries. Scientists in these countries compete for research grants which are awarded solely on the merit basis. Therefore, when writing an article, scientists are expected to showcase the entire study highlighting major findings of the study (Move 3, Step: Presenting findings) to demonstrate succinct contribution to the field as early as possible. In contrast, given the much smaller size of the Thai scientific community, competition might not be that high. As a result, principal findings, although important, are delayed and presented in the Results section.

The size of the scientific communities also impacts the community members' expectations. The larger the community is, the higher expectations are from the community members in terms of the quality of the research study. Given that the English corpus of this study represents the top quality articles in biochemistry as assessed by the top five journal impact factors, it is clear that these published articles are carefully selected, demonstrating the study's unique contribution to fulfill its members' high expectations.

Another attempt to assure members in the English speaking community that the study benefits the field is by justifying the choice of procedures (Move 9). Through the use of this move, the credibility of the study is enhanced, indicating that the choice of scientific procedure is not automatic but results from systematic planning. In contrast, the absence of Move 9 in the Thai corpus possibly indicates that the procedure chosen and its purpose is commonly known to those in the field. Therefore, justifications for the choice of procedure is deemed redundant.

Likewise, the much more frequent use of Move 11 (Commenting results) in the English corpus provides another piece of evidence that community members do not expect the results to speak for themselves. Instead, they expect authors to contextualize the results by, for example, comparing the results gained from the

current study with those from previous studies or making generalizations based on the findings. Another example is the frequent use of Move 14 (Limitations) in the English corpus indicating that a study tends to have weaknesses, and the authors are expected to announce limitations for the benefits of those in the field to be aware of, and, take into consideration those limitations for future studies. In contrast, the relatively low frequencies of the two moves (commenting results and stating limitations) in Thai articles suggest Thai scientists' strong adherence to the label of the section "Results".

The frequent use of Move 8 (Restating procedural issues) is another strategy commonly used by English-speaking biochemists (95.07%). However, this move was infrequently found in the Thai corpus (22.22%). This discrepancy might be explained by the fact that the study reported in the English corpus is relatively complex addressing several research questions, and, consequently reporting several findings. To encourage appreciation and understanding of the findings, each major finding is accompanied by background statements recounting the objectives and main procedures of the study. In contrast, Thai articles are of interest locally, not internationally. The studies reported are relatively smaller in scale; as a result, the study might not be complex. Therefore, Move 8 might not be needed to remind Thai readers of the objectives and procedures of the study.

Scope of research

Discrepancies in structural organizations of articles in the two languages can be due to the scope of an individual study. As known, English is an international language being used around the world by both native and non-native speakers of English. Research articles published in English are thus of international interest. Meanwhile, research work published in Thai is geared towards Thai scientists. The topics of research studies are specifically contextualized in a Thai context, satisfying and fulfilling the local wisdom within expectations.

Renowned scholars are obviously inclined to publish their work in international journals, rather than local ones due to the prestige and recognition earned in return. Therefore, publishing studies in Thai journals is likely to be a venue for novice scholars due to relatively more relaxed or less demanding criterion in evaluating manuscripts. As shown by this study, the Thai articles do not use a number of moves as frequently as the English ones do. For instance, in the Results section, Thai articles do not frequently restate procedural issues or Move 8, nor comment results or Move 11 (only 22.22% for both moves) and do not provide justifications for the decision made. Given the small scale and scope of the studies presented in Thai articles that entail a small number of objectives, research questions, or hypotheses addressed, these details are not restated. Similarly, no justification of selecting one procedure is needed because such a choice is more or less established in the field.

In contrast, the articles published in English journals always addressed the objectives of the study in the Methods section (Move 5, 100%). In the Results section, to remind readers of those multiple objectives, they are frequently restated (Move 8, 95.06%). Similarly, justifications for procedures (Move 9, 91.01%) are provided to assure each step of the entire procedures was carefully planned and implemented. In short, it is very likely that the scope of the study being presented in the two languages contributes to distinct discrepancies in the use of certain moves.

National policy to promote research

Biochemistry is the study of the chemical composition of living organisms. It is a fast-growing field as reflected by the large number of specialized journals published worldwide (261 journals, *Journal Citation Reports*, 2004). The importance of the field of study cannot be disputed; it has a great impact on our present and future lives. Due to the obvious significance particularly to biochemists, after reporting major results, English articles do not state the implications of the study, a step of Move 3, in

Introductions.

Interestingly, the Thai articles prefer not to report findings in Introductions but to state the implications of the study. This proclivity can be explained by the research scenario in Thailand that tends to promote applied research rather than basic research. Consequently, although the implications of biochemistry research is imminent, Thai biochemists feel obliged to make explicit statements claiming the values of the study to comply with the national policy of Thailand.

Specific characteristics of Thai society

Every culture has its own preferred writing style, as originally claimed by Kaplan in 1966. A multitude of studies on writing across languages, to a certain extent, support Kaplan's statement (e.g., Ahmad, 1997; Clyne, 1987; Duzsak, 1994; Mauranen, 1993; Najjar, 1990; Taylor & Chen, 1991). Although Move 2 was similarly frequent (64.29% and 66.66% in the Thai and English corpora), a scrutiny of excerpts representing Move 2s from the two corpora is revealing.

(69) ***No research*** *in Thailand has integrated the information on beta and kappa casein genotypes with the breeding of dairy cattle.* [Thai, V2$_2$]

(70) *There are* ***no reports*** *for a need for this type of fish as a source for fatty acids.* [Thai, S1]

(71) ***No one*** *has conducted a microscopic investigation of the internal organ system of the Siamese crocodile.* [Thai, V6]

(86) *Progress in determining the specific timing of events has been* ***hampered****, in part because it has not been possible to isolate spliceosomal complexes that are both highly purified and functional.* [MC5]

(87) *Drawing conclusions from these studies is* ***problematic*** *because the proteins were divergent in characteristics that have been implicated in metabolic turnover.* [JBC6]

Move 2s generally share the communicative function of preparing for the current study. The examples of Move 2s in Thai articles congruently show that the current research is triggered by the absence of such studies in Thailand. The English Move 2s, in contrast, specifically pinpoint the flaws of previous studies. In fact, no instance of Move 2s in Thai negatively evaluated previous studies.

This phenomenon can be explained by the "critique culture" which is deeply rooted in the Western world. In academia, particularly in an English-speaking scientific community, an individual scientist's critical comments and evaluations are regarded pivotal, not only providing the driving forces for the progress of the discipline but also enhancing the recognition of individual achievement. Therefore, being critical is a positive trait instilled in scientists to enable them to fully engage in research projects.

Interestingly, Western critique culture is in conflict with basic social interaction expected in Thai society and might seem unduly harsh by Thais for a number of reasons. First, Thai people hold strong traditional beliefs regarding family. For Thais, the family includes not only those related by blood but also non-related persons who have established close social relationships. Within this system, age plays a salient role: the greater a person's age, the greater the respect extended. Based on this notion, the language used to speak about an elder must be appropriate. In the milieu of research article writing, despite apparent weaknesses prevailing in previous studies conducted by professors or senior fellows, showing perceived disrespect to, or expressing negative comments about, one's elders is not encouraged in the close-knit Thai society.

Another institution that plays a key role in suppressing the adoption of critique culture by Thai scholars is Buddhism - it teaches Thais to be modest and humble. Therefore, in the Thai scientific discourse community, modesty and humility are both appreciated and expected in academia. As a result, while announcing the flaws

of a prior study to the public to promote or justify the existence of one's own research is anticipated in English-speaking research communities, such a practice is condemned in Thai society.

Through the comparison of the strategies commonly used in the two corpora, the study has shown that the discrepancies across languages are due to a number of factors. In addition, different strategies are selectively employed to satisfy the demands and expectations of their respective scientific communities.

Conclusion

This study reports on an analysis conducted on the Thai corpus of biochemistry research articles to describe and identify the structural organization preferred by the Thai community members. Given the baseline structure of research articles representing the most prestigious journals in the field in English (Kanoksilapatham, 2005), the structural organizations of the two languages were compared. Similarities and differences of the two languages were found at the move and step levels. A number of factors contributing to such discrepancies include the size and expectations of the research communities, the scope of the study, the national research policy, and the typical characteristics of Thai society influenced by the Thai family system and Buddhism. The description and the knowledge gained from this study facilitates the teaching of English for specific purposes in general and particularly to Thai learners and novice scientists to be able to fully participate in the scientific community in terms of both updating information gained from reading articles and disseminating their scientific discovery.

The structural organizations presented in this study reflect an attempt to describe how biochemists speaking two different languages write their research articles. The study does not, by all means, intend to prescribe scientific writing. This study also indicates that acquiring proficiency in writing research articles involves, among many things, an awareness of which

communicative functions are appropriate to the targeted context, purpose, and audience. However, caveats are in order. First, despite efforts in making the two corpora equal in terms of size and representativeness, the corpora are somewhat disperate due to, for example, the absence of specialized journals in Thai, the instability of Thai journals, and the small numbers of articles written in Thai. Second, this study focuses on meaning or semantic components as an indicator for segmenting texts into moves; linguistic features were not taken into account. Therefore, it is possible that different sets of linguistic features were used to express the same move of the corpora. Third, genre analysis is a product oriented approach. Therefore, investigation into the process by interviewing Thai and native speaker biochemists regarding how they approach writing for publication might be elucidating.

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