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Conclusions:

1. Sc. & T translation from English into Arabic involves many bewildering problems and difficulties (such as the lack of equivalent terminology in many scientific and technical domains; as well as the translators ' inadequate command of the subject matter of many translated works) .
2. Despite the valuable contribution made by many Arab academies (that were established to face the problem), and the Arab universities and institutes, as well as the co-ordinating bodies, the problem remains unsolved, and further confusion and inconsistencies are sometimes created by the variety of suggestions made by such multiple bodies .
3. It is often the case also that when the translators of the Sc. & T. texts are specialized in the domain from which translation is made, much use of transference (i.e. of S.L. terms) is made; which is inevitable and quite legitimate in many cases .
4. Translators of Sc. & T texts who are specialized in the Sc.&T domain from which they undertake a translation often show a lack of command of the general linguistic terms and expressions with regard to the S.L. &/or T.L. leading to many shortcomings and inaccuracies . Such translators should have a good command of the general language as well .
5. The way of facing this maze seems to be in the hands of Arab universities and institutes by forming highly specialized teams of translators (i.e. specialized in various Sc & T. fields and domains) and contrastive linguists, in order to unify and standardize the Sc. & T terminology and review them from time to time as necessary.

D/: "However to ask such questions about molecules in collections of inanimate matter is irrelevant and meaningless".

يمكن من ناحية ثانية ذكر بعض الأسئلة حول الجزيئات المتعلقة بالمواد الجامدة
الا ان الجزء المتعلق بالمواد الجامدة خال من المعنى)

E/: "They can also carry out other forms of purposeful work such as the mechanical work of locomotion".

(وتستطيع ان تؤدي اشكالا اخرى من العمل الهادف مثل العمل الميكانيكي)

F/: "In fact, inanimate matter usually decays to a more random state when it absorbs external energy such as heat or light".

وبالحقيقة فان المواد الجامدة تتناقص إلى حالة عشوائية اكبر عند امتصاصها
للطاقة الخارجية مثل الحرارة او الضوء .

G/: "This may imply that the nucleus is the real essential of the cell".

(وهذا قد يظهر ما يدل على ان النواة هي ضرورة اساسية للخلية)

H/: "This point of view seems to have been widely adopted.."

(ويبدو ان وجهة النظر هذه قد اخذ بها)

I/: "and they were perhaps also the first to attach a meaning to the term 'cell' "

(وانهما من المحتمل كانا اول من ربط هذا المعنى بمصطلح الخلية)

The inaccuracies and shortcomings of translation in the above examples explicitly fall in the area of general language errors. In the examples A, & F, the cause of error or inaccuracies is failing to select the appropriate equivalent of the S.L. item (s). In 'A' The S.L. verb "approach" has been rendered into Arabic as: *توصل* whereas the appropriate T.L. equivalent is rather *تتاول*. In 'F', the S.L. verb "decay" has been translated as *تتناقص*, whereas it is more appropriate and accurate to render it into the T.L. equivalent *تتحلل*. In 'H', the S.L. structure "widely adopted" has been inaccurately rendered as the adverb "widely" has been neglected. This is also applicable to 'B', & 'C' in which the relative clause "that describe the behaviour of inanimate matter", and the adverb "comparatively" are omitted or neglected respectively. As for the examples 'D', 'E', & 'I', the inaccuracy of rendering seems to have resulted from missing the general signification of each.

From the above examples, it is explicit that a high percentage of inaccurate translation of Sc. & T. texts is caused by the lack of adequate command of the S.L. general (or standard) language. The translator's acquaintance with the Sc. & T. Terminology and subject matter is not a sufficient guarantee against the shortcomings and inaccuracies of translation in the domain of Sc. & T. work.

The Arabic versions of Sc. & T. texts abide in transferred terms (the original form of which is sometimes written to the side of the Arabic transliterations. Let us consider the following examples:

1. "though amino acids and even low molecular weight proteins with a tendency to make microspheres superficially similar to micrococci"

علماء بان الحوامض الامينية وحتى البروتينات الواحدة الوزن الجزئي تميل إلى تكوين كريات دقيقة microspheres تبدو ماثلة للميكروكوسي micrococci

The terms "amino", "proteins", and "micrococci" have been transferred and transliterated into Arabic in the above rendering. The original English terms "microspheres", and "micrococci" are found to the side of the Arabic forms (transliteration. in the case of "micrococci", and translation equivalent in the case of "microspheres").

2. "Living organisms are made of protoplasm".

تكون الكائنات الحية من البروتوبلازم

The term "protoplasm" is transferred and transliterated in the above rendering (into Arabic).

3. "although in the case of viruses we may be approaching the situation where a nucleus or part thereof exists in the presence of a minimum or none of its own cytoplasm, for example, the bacteriophage".

والشيء الذي لا يشك فيه حالة الرواشح حيث تقترب إلى حالات توجد فيها نواة أو جزء منها بوجود قليل من السايوتوبلازم أو عدم وجوده كما في ملتهيمات البكتيريا

The term "cytoplasm" is transferred and transliterated into Arabic in the above example.

4. "Enucleate protoplasts either fail to carry on life processes at all"..

«والبروتوبلاستات المجردة النوى اما ان تفشل في مواصلة أفعالها الحيوية كلياً ..»

The term "protoplasts" is also transferred and transliterated into Arabic in the above rendering.

From the above examples, one finds out that the process of transliteration (and transference) is often employed when the translator is short of T.L. Sc. & T. equivalents (which is often the case when

This process is called 'Al-Naht' :

e.g. asymmetry:	اللاتناظر	;	hydroelectric :	كهرومائي
Space-time:	الزمكان	;	electromagnetic:	كهروطيسي
photoelasticity:	الصومرونة	;	Aerobia:	الحيهوائيات
Hypodermic:	تجلدي	;	subsoil:	تحتربه

Al-Naht, however, is not encouraged by the Arab academies.

D. Transference:

Transference is encouraged by innovators when no equivalent T.L. item is found; but detested by purists, who accept it as a temporary measure till new Arabic Sc & T. terms are coined later. The Arab academies have succeeded in replacing some transferred terms by Arabic equivalent ones as in the case of :

“telephone”: هاتف , تلفون ; “microscope”: مايكروسكوب , مجهر
“thermometer”: مقياس حرارة , ثرمومتر ; “microwave”: مايكرويف , موجة دقيقة
“tractor”: جرار , تراكتور ; “barometer”: منواء , بارومتر

In some other cases, the suggested Arabic terms do not seem to be successful (such as: oxygen: المصدى , اوكسجين), because some transferred terms have been in use for a long time, and have thus acquired formal and contextual Arabic meanings, and have also been naturalized according to Arabic grammar (i.e. have acquired new derivative forms in accordance with the Arabic rules) as in the case of :

“متلفز , تلفز , تلفزة , تلفزيون”
“ممنط , ممنط , ممنطة , ممنطيس”
“بروتوبلازمية , بروتوبلازمي , بروتوبلازم”

Such words should rather be treated as Arabic terms since they have acquired Arabic syntagmatic and paradigmatic relations.

In certain cases, the new transferred term is given a brief paraphrase to make it more comprehensible, as in the case of:

“ohm”:	اوم	(وحدة المقاومة الكهربائية)
“amu”:	آمو	(وحدة قياس الكتلة الذرية)
“phon”:	فون	(وحدة قياس الصوت)
“dioptr”:	ديوبتر	(وحدة قياس العدسة)
“dyne”:	داين	(وحدة قياس القوة)
“gauss”:	كاوس	(وحدة مجال)
“vector”:	فيكتور	(وحدة استقطاب)
“farrad”:	فاراد	(وحدة السعة الكهربائية)
“magneton”:	مغنطيوم	(وحدة العزم المغناطيسي)

Transference (into Arabic) is not free from problems, because the some terms are transferred from English into the Arabic of the Middle East Arab countries), whereas other terms come from French (into the Arabic of North African Arab countries) since English is the second language learnt in the Middle Eastern countries and French is the second language in the North African countries.

The solutions suggested by the Arab Academies concerning the problem of scientific terminology in English – Arabic translation (or French–Arabic translation) are:

1. The translators are advised to use the classical scientific Arabic terminology wherever applicable whether those terms that have been transferred into many European languages (such as: alcohol, alkali, القلي, alembic, الامبيق, elixer, الألكسيد, meri, المرى, nucha, النخاع, corona, القرنية, borax, البوراكس, arsenic, الزرنيخ, etc), or such terms that may be considered the equivalent of foreign Sc. terminology (such as:

الشب for 'alum', الامونيا for 'amonia', الجير المنطفىء for 'calcium hydroxide', الاشعة for 'rays', حامض الكبريتيك for 'sulphuric acid', العصب البصري for 'optic nerve', الترشيح for 'filtration', شبكة العين for 'retina of the eye', التبلور for 'crystalization' .

2. When no such equivalent classical Arabic scientific term is found, the translator is advised to follow one of the following procedures:
 - A. The process of what is usually referred to as "Majaz" in which a new denotation is assigned to a classical Arabic term (as in the case of قطار i.e. train, which originally denoted a caravan of camels; سيارة i.e . car , which originally denoted all moving things; دبابة i.e. military tank , which originally signified crawling animals or creatures that live on earth).
 - B. To make use of the derivational potential of Arabic which has a variety of derivational forms:

"mafCal"	:	مكوى ومرصد و مدفع
"mifCal"	:	مزرع وجبهر ومشرب
"mifC-al"	:	مشقاب و منشار و محرار
"fa-Cila"	:	رافعة و شاحنة و طائرة و ماسحة و كاسحة
"faCC-ala"	:	كسارة و دراجة و نفثة و غواصة
"faCC-al"	:	طراد و غواص و نفاث و جرار
 - C. Making compound terms by combining the roots of more than one word.

It has often been the case that a Sc. or T. term has been given different renderings by different bodies or authorities, and thus creating further confusion and inconsistency in the translation of Sc. & T. language. Let us consider the following examples:

<i>The SL Term:</i>	Arabic Equivalent (as suggested by the Journal of the Iraqi Academy, vol. 23 1973)	Arabic Equivalent (as suggested by the Morroccan Journal al-Lisan al-Arabi vol. 8, No. 3, 1971)
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volatility	تطاير	تصعيد
alkaline earth	اتربة قلووية	اقلاء ارضية
flow	جريان	سيلان
gravity	جاذبية	ثقل
power	قدرة	قوة
radial	شعاعي	نصف قطري
angular momentum	العزم الزاوي	الزخم الزاوي
carburetor	مبخر	منفعم
clutch	جهاز تعشيق	واصل
coil	وشيعة الاشتعال	ملف
hub cap	غطاء المحور	غطاء البطيخة
rack	ترس	شبكة

In an attempt to overcome the problem of multiple Arabic renderings for the same Sc. & T. term, two co-ordinating organizations were established: The Bureau for co-ordination of Arabization in the Arab World in Rabat (Morrocco); and The Association of Arab Academies in Cairo to co-ordinate the efforts of Arab Academies (Sieny, 1985).

Since translators rarely restrict themselves to dictionaries or glossaries produced by official bodies or Arab academies, and often coin their own terms or equivalents, the co-ordinating efforts exerted by official or non-official bodies and authorities become a two-edged weapon; for in their endeavour to unify scientific terminology, they have themselves produced and disseminated different terminology. The situation thus becomes a vicious circle. This is not only applicable to the national level, but also true of the situation of Sc. translation within the same country owing to the lack of serious and practical co-ordinating measures. A translator would resort to transference when no T.L. equivalent is found for a certain S.L. item.

What adds oil to the flames is that Sc. terms increase nowadays by leaps and bounds. In the previous decade, the number of newly coined Sc. terms per day was estimated about 100 terms (Khan, 1979).

English – Arabic Sc. translation is almost always uni-directional (i.e. from English into Arabic), and problematic, because English is the linguistic medium of a scientifically developed nation; where as Arabic is the linguistic medium of a scientifically developing nation. To find correct and consistent Arabic equivalent Sc. terms for the English Sc. terms is in fact a major problem in English–Arabic translation and this is responsible for a high percentage of errors and inaccurate renderings of such texts .

In an attempt to cope with such problems of translation (and Arabization), some Arab Academies were established (The Arabic Language Academy in Damascus, 1919; The Arabic Language Academy in Cairo 1932; The Iraqi Scientific Academy in Baghdad, 1947; The Arabic Language Academy of Jordan in Amman, 1976; and The Academy of Baït al-Hikma in Tunis in 1983), all of which have been engaged with terminological issues and problems. In other Arab countries, research institutes were established, which became involved in the production of Sc. & T. terminology (The Institute for Studies and Research for Arabization in Morocco; The Kuwait Research Institute, The Arab Development Institute, etc). Many ministries of Culture (and/or Information in the Arab world (such as Iraq, Syria) have undertaken the promotion of translation into Arabic as well as the compilation and production many specialized dictionaries and glossaries. Many Arab Universities (such as the Technological University in Baghdad, the Unuversity of Mosul (Iraq), King Abdulaziz University and King Faisal University in Saudi Arabia)); as well as many publishing houses (such as al-Ahram Establishment in Cairo, Librairi du Liban in Beirut, and Dar al-Mammoon in Baghdad), have followed pace in producing Sc. dictionaries and glossaries in various fields. Some foreign oil companies too, have produced and compiled their own dictionaries and glossaries in the fields of oil industry, finance, and administration (as did ARAMCO in Dahrn Saudi Arabia). Mass Media, as well as individual efforts on the part of translators, have produced and introduced their own adhoc Sc. T. terms too, and influenced other individual translators.

Comparing the above S.L. text and its equivalent T. L. version shows the main features and characteristics of Sc. texts (simplicity and neutrality of style, the prevalence of subject matter, and Sc. terms, the lucidity of expression and verbal accuracy, etc.). The translator has managed to reproduce the S.L. information in his rendering (despite the fact that the two Languages are formally different which is explicit from the longer sentences and different structures used by the translator).

What Is Sc. & T. Translation & What are the problems of English-Arabic Sc. & T. Translation?:

Sc & T. translation is a process in which S.L. Sc. & T. text is replaced by T.L. Sc. & T. text that is found to be its equivalent.

According to Catford's classification of types of translation (1965) it may be classified as "Total" according to the notion of "Level"; and perhaps "Literal" in accordance with the notion of "Rank"; and "Full" (when no transference is involved) according to the notion of "Extent". It also matches what Nida calls "Formal Equivalence", and what Newmark calls "Semantic Translation", since the main emphasis in Sc. & T translation is on the message or signification rather than on the general stylistic niceties of the medium.

The classification of this variety of translation as "Sc. & T." translation is in fact by virtue of dealing with the domain of science or scientific register (in contrast to "Literary Translation" which is related to the domain of literature or literary register; "Legal Translation" which is related to the domain of law or legal register, etc).

Since scientific translation is a process performed on Sc. & T. texts, the convergence of Sc. standards and progress between the S.L. & the T.L. plays an essential role in facilitating (or otherwise) complicating Sc. translation between any pair of languages.

Scientific terminology is specialized, and is not intelligible but to scientists and students of science. This is tantamount to saying that a translator would face many difficulties unless he has a general knowledge of the subject matter, and the T.L. has a developed equivalent Sc. register (and/or sub-registers). In developed countries, Sc. register is sometimes further divided into specialized sub-registers (e.g. civil engineering, mechanical engineering, electrical engineering, etc.). This does not seem to be the case in developing (or under-developed) countries.

derations of the linguistic medium, because Sc. & T. texts are not read for any sensuous pleasure or artistic grandeur and mastery (as in the case of literary texts), but for the information they contain (which is usually expressed in a language characterized with lucidity of expression and verbal accuracy, as well as simple or neutral style). The original author's main concern in his use of language is to facilitate the comprehension of his text for the reader .

It is common knowledge that the translator of SC. & T. texts requires in the first place a general knowledge of the scientific discipline he translates from (with regard to the subject matter and specialized terminology of the relevant domain) .

Let us consider the following English passage (from the domain of Biology), and its Arabic version:

Cytology May Be defined as that branch of Science which deals with the morphology and physiology of the cell . This definition raises the question, "What is a cell?" The answer normally given is purely descriptive and a cell constructed according to this definition would be difficult if not impossible to find in nature; indeed it is doubtful that such a cell could even exist. A cell defined by a cataloguing of its contents, valuable as such a definition may be from the point of view of classification, scarcely provides a fundamental concept. Further, such a definition, accepted uncritically may stimulate a degree of knowledge not consistent with the facts. A cell, whatever its morphological peculiarities may be, is an integrated and continuously changing system.

يمكن تعريف علم الخلية Cytology بأنه ذلك الفرع من العلوم الذي يتناول دراسة شكل وفسلجة الخلية . ويشير لنا هذا التعريف التساؤل عن ماهية الخلية . ويكون الجواب عادة وصفيًا تمامًا وتكون الخلية الممينة حسب هذا الوصف صعبة الوجود ان لم تكن مستحيلة في الطبيعة وفي الحقيقة هناك شك كبير بإمكان وجود مثل هذه الخلية . ان الخلية المعرفة اعتماداً على محتوياتها والتي تكون ذات قيمة من وجهة نظر التصنيف نادراً ما تعبر عن المفهوم الاساسي للخلية . والاكثر من ذلك فان قبول هذا التعريف على علته سوف لا يتفق لحد ما مع الحقائق الثابتة . ومهما تكن خواص الخلية من حيث الشكل فهي جهاز متكامل ومتغير باستمرار .

ENGLISH-ARABIC
SCIENTIFIC & TECHNICAL TRANSLATION

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Different scholars have divided texts into certain varieties according to their subject matter, such as scientific, legal, literary, etc. As to the functions of language, they have been classified into such varieties as the informative function (or referential, denotative, cognitive, descriptive,) the vocative function (or social, rhetorical, affective), and the expressive function (or subjective). Among the minor functions of language, the phatic, metalingual, and aesthetic are mentioned (Newmark, P. 1982). Crippen and Widdowson (1975) mention seven types of such functions: the referential, the expressive, the emotive, the phatic, the cognitive, the contextual, the metalinguistic, and the poetic.

In the case of scientific (and technical) texts, the main function of language is informative (or referential, cognitive, denotative); and the usual style in which information is expressed is neutral and objective. the translator of such texts should therefore pay adequate attention to this aspect when reproducing the original information in the Target Language (Henceforth: T.L.).

Scientific and Technical (Henceforth Sc.& T.) texts are in the first place concerned with expressing facts, hypotheses, experiments, techniques, and /or theories. Sc. & T. terms differ from plain terminology since they do not accumulate emotional associations and implications. This is why the translation of Sc. & T. texts is supposed to be more direct, with fewer alternatives, and freer from aesthetic obligations or requisites. In other words, subject matter takes priority over stylistic consi