PAPERS IN THE DRAWER. ESTIMATING THE DETERMINANTS OF THE PATENT-PUBLICATION LAGS IN EUROPE AND USA.

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1. Introduction

In accordance to the traditional objective of spurring dynamic efficiency in the economic system, the aim of patent law is that of offering a legally-enforceable competitive advantage to the inventors, in exchange of a complete and detailed disclosure of the invention to the general public. While a large and long-lasting theoretical debate has focussed on the definition of optimal patent scope, length and height (Gilbert and Shapiro, 1990; Scotchmer, 1991; Green and Scotchmer, 1995; Denicolò, 1996) fewer contribution have addressed the issue of the non prejudicial disclosure and the so called "grace period", which are also likely to have a non-negligible impact on the pace of knowledge diffusion[2].

Briefly stated, in a system which allows for a grace period, the disclosures made by an inventor does not bar the possibility for him to subsequently apply for a valid patent within a certain period of time. This is presently allowed in some countries, including the US and Japan patent systems, while is banned in the European patent system.

In Europe, any information made public before the filing of the application in whatever form (conferences, articles, etc..) rules-out the possibility for the inventor to be granted a valid patent[3]. This rule holds invariably against the author-inventor, who can be opposed her own article as a prior art destroying the novelty of any subsequent patent application. In the USA, under the first-to-invent regime, inventor's own publications made up to one-year before filing, do not bar the patent (Scotchmer and Green, 1990)[4]. Japan allows for a similar exception for a shorter period (six months). However, even in the American or Japanese systems, problems might arise when an extension of the patent applied under the grace period is desired in countries where the grace period does not exist. In fact, patent examiners of such countries would turn down the patent application for lack of novelty. The discrepancy of regulations being in place, a cautious policy of IPR protection should avoid any communication of results before the filing of a patent, in all national systems. This is especially the case for the wealthiest inventions like drugs or ICTs, for which a global market is expected. As discussed in deeper detail below, the opportunity of allowing or non-allowing inventors for a grace period is the subject of an intense debate within the more general context of the harmonization of national patent systems and international and patent cooperation treaty reforms[5]. Nevertheless, at

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[2] For a general critical analysis of the impact of patent systems' features on the nature and intensity of R&D see Jaffe and Lerner (2004) and Barton (2000) for the US and Kingston (2001). On the specific topic of optimal design of patent granting procedures, see Graham et al. (2003) and Hall et al. (2003).

[3] European Patent Convention, Part II, Chapter I:54. The requirement of *absolute novelty* accepts very few exceptions: in case of 1) evident abuses (the circulation was made contrary to the intentions or interest of the inventor) or 2) for a very limited number of officially recognised international exhibitions, for the six months proceeding the filing (Art.55).

[4] USA Patent Act, Title 35, Part II, Chapter 10:102. European Patent Convention, Part II, Chapter I:54.

[5] The debate has grown around the opportunity to come to an harmonization of international patent law, which, at present are based on the so-called first-to-file system in Europe (IPRs are granted to the first person

present, the debate is being complicated by the overall lack of empirical sound data on the actual use, effectiveness, and impact of either systems on the patenting behaviour.

In this paper we will try to shed light on this specific theme, by collecting an original set of data, which can offer insights on such issues as how extensively the grace period is being used in those systems that allow for it, how long is the average time lag between the patent application and the diffusion of knowledge, and what is the effect of the grace period on this lag. We do so by looking at a sample of patents which includes patents applied to USPTO, EPO and patents extended from the former to the latter.

Our database is made of 567 academic patents, i.e. patents applied for in year 2000 and assigned to an academic institution, of which 230 were matched to a scientific paper. The choice of focussing on academic patents only is motivated by two main reasons. First, for academic patents, the majority of non-patent disclosures take the form of scientific publications, searchable in international databases, while for non-academic patents it is generally impossible to know if and when an invention is communicated, for instance in a catalogue, exhibition or advertised, unless the patent undergoes a trial. Second, the recent increase in the number of university patents, has raised a new wave of petitions in favour of extending the general grace period to the international patent law, as a way to minimize the hang on to scientific publications when the scientists decides to apply for a patent. In recent years, a growing literature has addressed the issue of the patent and publication behaviour of scientists working in academia (Azoulay et al., 2006; Calderini and Scellato, 2005; Calderini et al., 2007; Stephan et al., 2007). The number of academic scientists seeking patent protection for their inventions in increasing on both sides of the Atlantic, encouraged by a large number of national government policies in favour of technology transfer. One of the many concerns raised by this literature is that delays in publication might arise if those scientists comply to the duties of secrecy imposed either by the requirements of patent procedures, or by contractual duties related to IPRs, with negative consequences for the pace of new knowledge diffusion (Dasgupta and David, 1994; Heller and Eisenberg, 1998). Academics -it is argued- face a high opportunity cost of holding a publication in their desk drawer to cope with the timing of patent applications, because their career depends crucially on their publication productivity. In this light, the debate upon a general international introduction of a grace period has acquired new supporters, as a way to enable a prompt disclosure of scientific works, and protect from inadvertently disclosures (Bagley, 2006). Those who advocate in favour of an extension of the grace period maintain that this would increase the rate of disclosure and reduce the lag trespassing from the discovery to the dissemination of results in open science, which would benefits both the progress of science and technology and the adoption rate of

to file), vs. a first-to-invent system (IPRs are granted to the one who can prove to be first in inventing) in the USA.

innovations by firms. On the contrary, those who oppose this view claim that a grace period would increase the uncertainty of Intellectual Property Rights at the systemic level, because it would extend the time span during which third parties would be unsure whether or not a patent is underway, with a detrimental effect on the incentives to innovate and to adopt new technological solutions.

To cope with this issues, some European countries, such as France, have proposed an amended form of the grace period in the EPO and WIPO which would only cover academic patents. On this respect, it is unclear whether or not a grace period should be limited to scientific communications or perhaps associated only to the academic status of the inventor, and concerns have been raised that this would give an unjustifiable comparative advantage to academic institutions in the race for commercial inventions.

At present, empirical evidence available to support either views and enlighten the debate is hardly available. We have scarcely more than anecdotic reports of delays (or fear of) of publication related to patenting activity. A full discussion of the (legal and strategic) determinants underlying such delays is also missing.

In order to contribute to this debate and offer preliminary empirical evidence, in this paper we make a specific effort to develop a robust and replicable methodology that allows to single out non-patent disclosures and to identify patent and publication pairs (Murray and Stern, 2007; Lissoni and Montobbio 2006), using an algorithm of content-analysis. Content and text analyses are increasingly been used to extract information from large text documents and transform them in mathematical format (Franzoni et al., 2007).

After having estimated patent-publication time lags in our sample of USPTO and EPO patents, we made a set of comparative descriptive statistics aiming at answering the following questions: i) how often is the grace period being used by patents having a US priority; ii) when the grace period is not used, how long does it take to the scientist to publish the content on a scientific article; iii) do time lags differ for US vs. EPO-priority patents; iv) do US patents extended to EPO show a longer (shorter) patent-publication lag; v) is the time lag sector-specific and/or affected by the presence of a firm among the patents assignees.

Results bring relevant implications to clarify the actual effectiveness of the grace period exception in the US, with special focus on patents being extended to the EPO. Implications for a mindful policy of scientific knowledge diffusion are discussed with specific reference to the perspective reforms of the European and the US patent systems.

The paper is organized as follows: in the following section, we offer a review of non-prejudicial disclosures in European and US patent laws, discuss the expected effect of such rules on the patent-publication lags and describe them in the light of the current practices of technology transfer. In section three we present the dataset construction procedure and the original methodology developed to identify the patent-publication pairs and related lags. In section four we show the results of comparative statistics and multivariate analysis. Conclusions and implications are drawn in section five.

2. Disclosure of knowledge and the effect of the "Grace Period"

2.1 Non-prejudicial disclosures and general grace period

For a patent to be held valid at the examination process, the invention should be non-obvious and novel. The issue of non-prejudicial disclosure comes in jointly knit to that of novelty. In every national patent system, the rights to be granted a patent and thus benefit from a temporary exclusivity are accorded to the inventor strictly for those pieces of invention that where not known at the time of the priority. Inventions that were already patented, published or made available at the time the inventor claims her rights (after filing, in the EPO, or after inventing in the USPTO) are to be considered part of the prior art, i.e. the body of information already available to the general public in whatever form (written or oral description, use and any other way), and cannot consequently be taken away from its disposal. In all patent systems, several exceptions are however allowed to the general rule of novelty, which take the name of *non-prejudicial disclosures*, i.e. actions that, despite being recognized as acts of disclosure, are nonetheless being awarded a special treatment that does not ban the rights of the inventor.

In the European Patent Convention, disclosures that do not bar establishing rights over an invention are very limited and should strictly fall in either of two codified types (E.P.C., art. 55): a) disclosures in consequence of an abuse, i.e. when the subject for which protection is claimed has been unlawfully disclosed, for instance stolen or disclosed without permission of the author, which was holding it in confidence; and b) if the invention was displayed in an international exhibition that was officially recognized under the Convention on International Exhibitions, and only if the applicant explicitly declares, at the time of filing the application, that the invention had been so displayed[6]. In the United States Patent Act, analogous provisions are made under section 2(4) a) and b) of the 1977 Patent Act. In addition to the latter, non-prejudicial disclosures are allowed in a broader sense, which partially comes as a consequence of the *first-to-invent* principle governing the establishment of rights, which grants the right of exclusivity to the person that first invents, even when he or she was not the first to file the application. Under the § 102 of the U.S. Code, "Conditions for patentability; novelty and loss of right to patent", it is stated that a person shall be entitled to a patent unless a) "the invention was known or used by others in this country, or patented or described in a printed publication in this or a

[6] Last revisions on 1928 and 1972.

foreign country, before the invention thereof by the applicant for patent, or" b) "the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States". While 102 a) states the general requirement of novelty and should be interpreted as applying to everybody, 102 b) applies to everybody besides the inventor, as long as she claims its rights soon enough, by applying for a patent at the competent office. Such statement of novelty and its statutory bars therefore allows that the inventor herself cannot be barred from filing a valid patent even if she published a printed note describing the invention, as long as that happened within the previous 12-months (the so called *general grace period*)[7].

The sense of this broader exception from the general principle of novelty in the US law is that an inventor cannot defeat her own novelty by taking some actions such as publishing an article describing her invention, in accordance to the preference given by the law to the acts of creativity. Therefore, any earlier publication by the same inventor would only proof that she was entitled to her rights of patenting (under a first-to-invent regime) earlier than filing. Even so, the inventor can cause a statutory bar by not taking such action as claiming her rights within the grace period of twelve months. On the contrary, in the European system, any form of disclosure either made by a third party or by the inventor herself before the day of filing will disqualify the invention from patentability.

2.2 Pros and Cons of a General Grace Period for Innovation Incentives

The presence of a grace period is likely to generate relevant effects in terms of incentives and efficiency, which we will try to summarize, both from the point of view of the inventor and from the point of view of society.

From the point of view of the inventor, the first obvious advantage of the grace period is that the inventor is protected against incautious disclosures made before filing that might compromise her rights simply by mistake. Secondly, during the grace period, the inventor can hold up the filing while she acquires useful information for instance on the market value of her invention and later decide whether or not the patent is worth filing. In this sense, the grace period has a clear option value to the inventor, whose disclosure becomes prior art to every third party, including independent inventors, while allows her to wait up to 12 months before applying for a valid patent. Lastly, an additional advantage relates to those inventors, such as researchers and scientists, who earn additional

[7] For a comprehensive discussion of the US legal patent system, see for instance Halpern et al., 2007 or Merges and Duffy, 2002.

and independent returns from other forms of disclosures, such as, for instance, articles on scientific journals, presentations to conferences, and disclosures to open science at large. Scientists, of course, depend on scientific publications and from the reputation of peers more than on everything else for their own career, and the grace period allows them to earn a reputation from what they know as soon as they know it, and before filing a patent, an action that would compromise (at the cost of a patent option) a patent validity, in the absence of a grace period.

Disclosure under the grace period exception, however, also comes at some cost for the inventor. The major cost relates to the risk that, in the absence of a property right protection, a third party may make use of the invention and further develop and patent some improved version of it. In that case, the latter patent would become prior-art and ban a subsequent patent of the basic invention, even if the initial inventor files an application within the following year. This is because the 102 b) works as an exception to the general rule of novelty, but does not protect against the lawful actions by third parties as in 102 a)[8]. In other words, in case an improved invention was patented before the filing of the basic one, the law would rather protect the reasonable expectation of the second inventor, who, having acquired the information publicly disclosed by the first inventor, relied in good faith on their free use.

From the point of view of the third parties, or the general public, the advantage of allowing for a grace period can be summarized as follows. First, in certain circumstances, a grace period might result in an earlier disclosure. Second, if the inventor comes to know that the invention has no commercial value, she would avoid overloading the patent offices with worthless patents. At the same time, the grace period brings also potential detrimental effects related to the higher uncertainty to third parties. This is due to the fact that a patent application is kept under secrecy by the patent offices for 18-months after filing[9], a period of time during which third parties are uncertain on their rights to use a certain innovation freely. The grace period in practice extends this period of uncertainty up to additional 12 months, at the inventor's will. It is arguable if such extension of the period of time under which inventions might or might not be clear of rights would offset the balance between the right of the inventor and the right of the public too much in favour of the former.

Besides, the longer the period of uncertainty, the more likely it is that two or more inventors come up with some infringing applications[10].

At the level of the economic system, such increased uncertainty has a negative impact on innovation incentives, especially in the light of the constant increase in patent litigations experienced in recent years (Bessen and Meurer, 2005, 2006). The issue becomes more problematic when we consider the

[8] U.S. Code Title 35, Part II, Chapter 10, §102.
[9] For patents filed after 29 November 2000 in the US.
[10] In the US this would result in interference procedures.

international patent law, because the majority of national patent systems do not recognize the general grace period, as in the European patent law described before and patents applied to could not be extended under the International Patent Treaty.

At present, given the non harmonization of national patent systems such as those of USPTO and JPO from the one side and that of EPO from the other, the following situation might arise. For instance, an inventor who has applied for a patent in the US, using the general grace period, and holds a valid US patent, will be opposed his own early disclosure when he tries to extend the patent outside the US, say to the EPO. This also means that, whenever the potential market for the invention is broader than the US only, such as for drugs and chemicals, and nowadays for the majority of inventions, no general grace period should be used by the US inventor. For this reason, it is reported that even in the US, Property Rights Offices, not least those of universities, have adopted the practice of banning their researchers from publishing patentable material at least until a provisional application is being filed, in case the invention will eventually earn international attention (Bagley, 2006:245). Consequently, whatever the benefit of allowing for a general grace period seems to be conditional to a widespread international application of the rule. In our analysis we will focus extensively on this issue by comparing a set of US patents extended vs non-extended abroad.

The issue is non-trivial, because, even after having filed a patent, there are other reasons to procrastinate a publication. During the patent procedure, in fact, patent consultants and attorneys do extensive refinement of the claims, references and description of the invention offered in the patent document until the application is finally published. A wise refinement of the document is in most of cases extremely valuable to enhance the value of the future patent, by maximising its breadth and its potential to face successfully a litigation (Buzzacchi and Scellato, 2008). In practice, the area of refinement is very delicate and suffers of what has been meanwhile disclosed in other unprotected forms. Hence, despite publications occurred after filing cannot in principle be used against the patent filed, in practice, holding the knowledge base unpublished until the patent application is finally made public holds a number of advantages in terms of degrees of freedom in the process of refinement. As a result, it is not uncommon for universities to adopt a policy of non-disclosure of material undergoing patent application, which extends the lag under which a piece of knowledge will be set free for a scientist to circulate. A survey conducted among American firms and TTOs, for instance, revealed that a high proportion of firm-university agreement for joint research included explicit clauses of delayed disclosure of 4 month on average after a patent was filed, going up to one year of non-disclosure clause in some cases (Jensen et al., 2003). Corporate policies are clearly more strict with regard to publication and dissemination of results to protect their competitive advantage as much as possible.

3. Data and Methodological issues

The objective of the empirical analysis is to see if and when the content of a patent is communicated through a scientific publication and to measure the time lag trespassing from the filing of a patent to the publication of a scientific article. The lag would be negative in case of use of the grace period.

The first task to be accomplished to this aim is to find a match between a patent and a scientific article, having at least one author in common.

We started from extracting all patents granted by the USPTO and the EPO that listed among the assignees at least one academic institution, or Public Research Organization (PRO) and had the first priority date in year 2000. Search was done through Delphion Thompson proprietary database. The query resulted in 3857 granted patents, of which 421 were granted by the EPO and 3436 by the USPTO. After drops of duplicates, we kept all patents assigned by the EPO (which were fewer) and drew a random sample of USPTO patents to obtain a final sample of 632 patents evenly split between EPO and USPTO granted. We then used the list of patent inventors' names to search for articles published in scientific journals in the Institute for Scientific Information (ISI) Science Citation Index database. We extracted all records (74.615 article-patent pair) that listed at least one of the inventors' names among the article authors in the time span that included the year of patent priority and the two years after it for the EP original priorities and for a time span of 5 years [t_{-2}; t_{+2}] for the US original priorities (including EPO patents with US priority). The average number of articles retrieved per patent was 130.67 (st.dev. = 233.97) and for 61 patents no published article was found, which left us with a final sample of 567 patents. Articles were stored as standard reference record, plus the full abstract.

We then proceeded by applying our methodology of patent-paper search of "resonance", i.e. the degree to which two texts describe the same meaning. Resonance search was based on comparing the content of patents and articles titles and abstracts. The content analysis and resonance estimate has been performed by means of a software (Crawdad Text Analysis System 1.2), which works on a natural language processing algorithm, based on both stemmed words co-occurrence and influence measure. The software calculates a measure of influence of each term, depending on the structural position of the word within a text, and captures how people create coherence in their communication[11]. The software outputs a resonance index for each couple of article and patent, standardized for the lengths of compared texts and ranging in the [0; 1] interval.

Unrelated texts, as those for instance resulting from homonyms inventor-author typically have a null resonance value, or a very low one, in case they are on the same scientific field. This is particularly important, since our methodology allows us to cope with potential fake matches, due to homonyms,

[11] See Crawdad Software description at http://www.crawdadtech.com/html/01_software.html.

otherwise very frequent in ISI database search. In Table 1 we report summary statistics for the resonance index and for the number of publications which have been examined for every patent included in our sample. The correlation between the computed resonance index and the number of publications is rather low (0.20) confirming that the algorithm for the evaluation of the resonance is not affected by the number of publications.

Table 1 – Summary statistics for computed reference index and publications screened for each patent

Variable	Mean	Std.	Min	Max
Resonance Index	0.104	0.080	0.001	0.821
Number of Publications	130.674	233.971	2.000	2540

At this stage we had to make sense of the resonance index output. We firstly dropped from the sample all those patents that gave a null resonance level. We are left with 567 patents, each paired with the article ranked first in the computed values of non-null resonance. The distribution of resonance index in our sample is shown in A manual check of matched patents and articles obtained in such way confirms the reliability of the selected threshold. We also fixed a higher threshold level at 0.1767, equal to the 85th percentile (85 observations) of the distribution of resonance among the sample, to check for the sensitivity of results to the selected threshold of resonance. As shown in deeper detail below, results do not significantly change when the second and more selective threshold is used. For this reason, we herein present descriptive sample statistics related to the 0.1 threshold.

Figure 1. The distribution is truncated in zero, skewed to the left and shows a long right tail. If you consider that the algorithm would give a value of one when the title and abstracts of patents and papers are identical not only in the choice of words, but also in the description syntax, you can appreciate that the right tail is made by those pairs of article and patent made on a cut-and-paste across documents. Because a patent and a scientific publication are aimed at different ends (industrial use vs. communication to a scientific community) and patents are generally subjected to the screening and refinement of a number of people besides the authors, such as liaison office associates, patent attorneys and examiners, you can appreciate that those matches should very rarely occur and possibly come from inexperienced people[12].

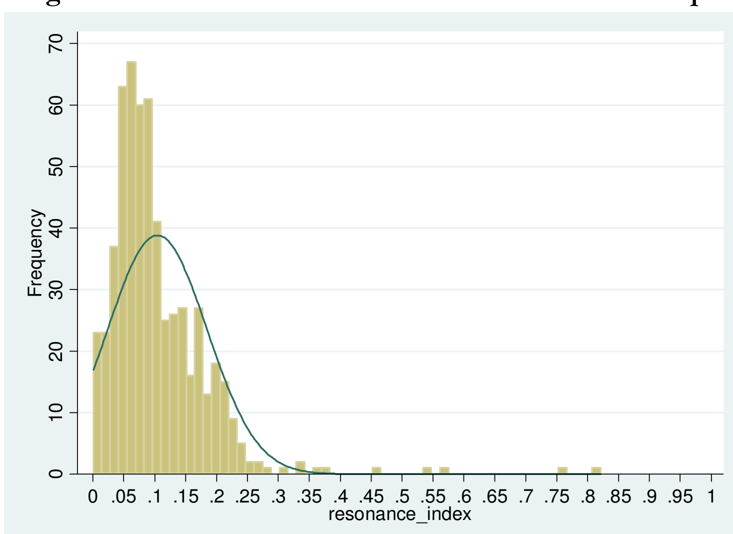
To provide the reader with some insights on the output and reliability of matches, in the Annex 1 we report some examples of matched patent and papers and the related resonance index. In order to

[12] When observing cases with resonance level above 0.5 we found a perfect coincidence of patent and paper abstracts. However, patents' abstract might included just a subset of the contents of the publication and vice-versa. Moreover, the contents of the patent might reasonably derive from a number of different publications, among which we will select the most similar. In this perspective, our matching is more flexible than a strict matched-pair procedure.

identify a threshold of significant resonance, we took the following approach. We assumed that, if the European examination procedure works well, we should observe no highly resonant article published before the priority date. We use this observation as a natural experiment, allowing us to fix a threshold level of minimum resonance equal to 0.1, as the one that gives a negligible incidence of matched articles in the prior art. This resonance level equals the 60th percentile of the distribution of resonance, leading to a sample of 230 patent-paper pares above threshold, out of a sample of 567 potential patent-publication pairs (having a non null resonance).

A manual check of matched patents and articles obtained in such way confirms the reliability of the selected threshold. We also fixed a higher threshold level at 0.1767, equal to the 85th percentile (85 observations) of the distribution of resonance among the sample, to check for the sensitivity of results to the selected threshold of resonance. As shown in deeper detail below, results do not significantly change when the second and more selective threshold is used. For this reason, we herein present descriptive sample statistics related to the 0.1 threshold.

Figure 1 - Distribution of Resonance Index in the Sample



The final dataset comprises 230 relevant patent-paper pairs. Summary statistics showing the incidence of resonant publications per 1-digit International Patent Class (IPC) code, publication and priority country and type of assignee are shown in Table 2.

Patents in the IPC classes are distributed in the usual way, with the majority of academic patents concentrated in the two classes of human necessities (comprising biotechnologies and drugs), and chemistry & metallurgy, which overall account for nearly 60% of the sample. Physics accounts for nearly 20% and the rest is comprised into performing operations and electricity.

The sample was constructed in such a way to be evenly split among USPTO and EPO-granted patents. Even so, nearly the 70% of all patents resulted to have had an original US-priority, i.e. a priority in a country that allows for a general grace period. Approximately the 30% of patents (62) resulted to be originally a US patent extended to the EPO, for which we expect that no general grace period should have been used.

Table 2 Summary statistics of matched patent (above resonance threshold 0.1)

	Variable	observations	% on total
Ipc	human necessities	67	29.13
	performing operations	15	6.52
	chemistry and metallurgy	69	30.00
	textile and papers	3	1.30
	fixed construction	0	
	mechanical engineering	1	0.43
	Physics	43	18.70
	Electricity	32	13.91
patent type	US patent	114	49.57
	EPO patent	116	50.43
	US-priority	159	69.13
	US-extended to EPO	62	26.96
Assignees	University	221	96.09
	firm assignee	28	12.17
	PRO	31	13.48
	single assignee	184	80.00
	university-only assignee	173	75.22

4. Results: Patent-Publication Lags and the Effect of the Grace Period

As explained in the previous section, our analysis is based on patent-paper pairs, i.e. on a one-to-one document match of a patent and an article published on a scientific journal, as identified by similarity of content. Similarity is computed by the resonance index which gives a continuous metrics in the interval [0; 1]. Our threshold value is 0.1 and threshold for the sensitivity check if 0.1767. For sake of clarity, in the following tables we will report our results only for the lower threshold (0.1) while in Annex 2 we show the results for the more restrictive threshold.

4.1. Use of the grace period in the USPTO

Table 3 shows the estimated incidence of patents that have been applied for during the grace-period and have thus been granted thanks to the non-prejudicial disclosure exception. According to our estimation, out of the 159 patents that were applied for in the USPTO, only 37 (23.3%) resulted to have used the grace period, while the great majority of patents (122, equal to 76.7%) were not disclosed before filing, under the 102 b).

The content of patents that used the grace period was published on a scientific article on average 7 months before filing the application[13], while applications that did not use the grace period were disclosed in a scientific article on average 16 months after filing. It is quite notable that, not only the average lag difference is quite striking (23.5 months), but also the average publication delay of non-grace patents is quite big in absolute values. Our results seem to suggest that when the grace period was not used, the content was published into a scientific article nearly 24 months after being discovered. In addition, although in principle on the day after having filed a patent, disclosures in whatever form, including publications on scientific journals, would not add to the prior art, inventors waited more than 16 months before disclosing to open science, i.e. 2 months on average before the patent itself would go into public domain. This would in turn suggests that the inventor is holding (or being asked to hold) her invention secret to preserve the commercial value of her patent.

In Table 3 we also report the breakdown of patents and their related publication lags per 1-digit IPC classes. Although the number are quite small, inventions in the electricity and textile & paper classes result to experience the bigger lag (18 months), while chemistry and human necessities have a mean lag of nearly 16 months.

Table 3 Incidence of the use of grace period and mean patent publication lags

	Freq.	did not use grace	used grace	% that did not use grace	% that did not use grace	did not use grace: mean lag	used grace: mean lag	ttest Ha: mean_diff≠ 0
USPTO priorities patents	159	122	37	76.7%	23.3%	16.488	-7.004	***
IPC human necessities	45	38	7	84.4%	15.6%	15.905	-12.090	***
IPC performing operations	10	7	3	70.0%	30.0%	12.476	-3.111	**
IPC chemistry & metallurgy	55	47	8	85.5%	14.5%	15.690	-3.892	***
IPC mechanical engineering	2	2	0	100.0%	0.0%			
IPC physics	0	0	0					
IPC electricity	23	14	9	60.9%	39.1%	18.379	-4.948	***
IPC textiles & paper	24	14	10	58.3%	41.7%	18.107	-8.950	***
firm	20	14	6	70.0%	30.0%	23.667	-4.211	***
university	150	113	37	75.3%	24.7%	16.264	-7.004	***
PRO	24	21	3	87.5%	12.5%	20.067	-6.011	***
single assignee	126	95	31	75.4%	24.6%	15.401	-7.142	***
university-only assigned	117	88	29	75.2%	24.8%	14.705	-7.721	***

* p≤0.10, ** p≤0.06, *** p≤0.01

Results are also very interesting when comparing the average publication lag of patents according to the typology of assignees, also reported in Table 3[14]. Patents that were co-assigned to at least one

[13] Tolerance error is of 2 months.

[14] Note that all patents need to be assigned at least to one university or PRO among the assignees, because of the sampling procedure. The variable "firm" is a dummy having value 1 if the patent has at least one firm among the assignees. The variable "PROs" is a dummy having value 1 if the patent has at least one Public Research Organization (PRO) among the assignees. The variable "university" is a dummy having value 1 if the patent has at least one university among the assignees.

firm show an average time to publication of 23.6 months. A similar result (20.1 months) was found for patents co-assigned to at least one Public Research Organization (PRO).

4.2 Comparing the patent-publication lag across different international patent systems

We start by comparing time lags of patents with different priority countries. For each matched couple of patent and scientific article we have computed the time span expressed in months between the patent priority date and the publication date of the scientific article. We then proceeded by comparing the average time lag for sub samples of matched couples with a set of one tailed t-tests. In Table 4 we show the comparison between the average time lag of grace-priority patents (USPTO) and non grace-priority patents[15]. In model I the analysis involves all the 230 patents with a resonance above the threshold value of 0.1. In this case we obtain a positive and significant difference pointing to a longer time lag before the publication of the scientific article for the non-grace priority sub sample of patents. Clearly such result might be driven by the fact that USPTO patents are allowed a grace period, leading in some cases to negative lags which contribute to lower the average. For this reason, in model II of we restrict the analysis to those patents with a positive time lag (hence excluding cases involving the grace period). Even in this case we find a significantly longer delay in the case of non-grace priority patents.

Table 4 Comparing time lags of patent with an original USPTO priority vs. European priorities.

	variable	obs.	mean	st. err.	difference	p-value (Ha : diff>0)
I	Non grace priority country	71	15.422	1.420	6.400	0.000
	Grace priority country	159	9.022	1.069		
II	Non grace priority country	64	17.940	1.164	3.452	0.010
	Grace priority country	122	14.488	0.864		

The fact that even when dealing with patents with a positive time lag (model II) we obtain a shorter delay for the sub sample including patents with a US priority might suggest that the presence a grace period actually affects the behaviour of patentees also in the post-application period. As we explained in section 2.2, during the post application period the contents of a patent are subject to potential refinement. Hence, the inventors might have an incentive to postpone the publication of a related scientific article even after being assigned a patent priority. In presence of a grace period system such incentives are likely to be lower, because any scientific article would not fall in the prior art of any refined patent application.

While the above reported results seem to indicate an advantage of the US system in terms of shorter average delays between patent application and scientific publication, in the introduction of this paper

[15] Non grace-priority patents include EPO priorities, EPO-member state priorities and priorities of other countries that do not allow for a general grace period. In our sample, grace priority patents include only US-priority patents.

we stressed how the overall actual impact of the grace period is reasonably affected by the non harmonised international patent rules. In principle, patents originally applied in the US but subsequently extended to EPO cannot benefit from the grace period exception. In order to provide evidence on this point we performed an additional test, reported in Table 5, in which we compare the average time lag for patents with an original USPTO priority date and later extended to the EPO, and the average time lag for patents with an original USPTO priority date and not extended. The group of extended patents shows a significantly higher average time lag. To enlighten this result it is worth considering that the US authors-inventors are reasonably subjected to some degree of uncertainty concerning the probability that a specific publication might be judged as prior art barring the extension abroad of their patent. In this sense the absence of a grace period in Europe might have some impact also on publishing behaviour of US academics. We can expect this effect to be stronger for those people working in technological and scientific fields whose industrial application have a potential international or global market. Beside this issue, the punctual evidence of average delay of approximately 12 months for US extended patents (see Table 5) supports the reliability of our methodology as a way to identify pairs of patents and publications. In common practice, extensions from the US to the EPO are commonly performed at the verge of the 12th month after the original application, as allowed by international treaties, so to exploit the patent right as long as possible. This suggests that US inventors opt for publishing the innovation on scientific journals as early as possible, i.e. right after the extension to the EPO.

Table 5 Comparing time lags of USPTO extended and not extend patents

variable	obs.	mean	st. err.	difference	p-value (Ha : diff>0)
US extended	62	12.217	1.457	5.237	0.008
US non extended	97	6.979	1.452		

Finally, Table 6 shows USPTO patents extended to the EPO showed on average a shorter time to publication than the EPO and EPO-members countries patents.

Table 6 Comparing time lags of USPTO extended vs. EPO-priority patents

variable	obs.	mean	st. err.	difference	p-value (Ha : diff>0)
US priority extended to EPO	62	12.217	1.457	-3.205	0.059
EPO priority	71	15.422	1.420		

4.3 In search of the determinants of patent-publication lags

In the previous analyses we have investigated those determinants of patent publication lags which are essentially related to differences in patent systems. We now turn to considering the potential impact on extending the time lags determining by other factors, relating to the management of the intellectual property rights.

Our database includes 184 (80%) patents with above-threshold resonance which show multiple assignees. Of those 28 (12.2%) patents listed at least one firm among the assignees. Co-assignations to a firm can typically arise from several circumstances: they might derive from firm-sponsored research, they can be patents developed by an academic professor, for which the University Technology Office has found a buyer or partner very early (before filing a patent), or can be patents co-assigned to an academic spin-off.

The test reported in

Table **7** suggest that there is a potential longer delay whenever an academic patent is co-assigned to a private company (90% confidence level). This might be interpreted as depending on the lower incentives to disclose of firms vs. academe alone. This results are confirmed by the data reported in Table 8, where we test the effect of having only universities as assignee vs. firm and/or public research institutions.

Table 7 Comparing time lags of patent with and without at least one firm among assignees.

variable	obs.	mean	st. err.	difference	p-value (Ha : diff>0)
firm	28	14.765	2.788	4.290	0.0554
no firm	202	10.475	0.920		

Table 8 Comparing time lags of patents with only on university as assignee and others.

variable	obs.	mean	st. err.	difference	p-value (Ha : diff>0)
others	57	14.461	1.814	4.605	0.0117
university only	173	9.856	0.992		

The data in the two tables above clearly stress how the process of protection of IP rights is likely to be affected by significant transaction costs and what we observe is actually the outcome of a complex bargaining involving agents (inventors, financers of R&D, patent attorneys and managers of Technology transfer offices) with sometimes contrasting objectives. This is reflected in the higher time lag identified for those patent with multiple assignees, independently of their identity, as shown in the results of Table 9.

Table 9 Comparing time lags of patents with single and multiple assignees

variable	obs.	mean	st. err.	difference	p-value (Ha : diff>0)
multiple assegnees	46	15.128	1.869	5.163	0.0093
single assignee	184	9.965	0.983		

In section 3 we have provided descriptive statistics concerning the technological classification of the patents included in our sample according to the IPC. In the following we introduce a set of simple multivariate analyses in which we specifically control for IPC classification through dummy variables. Multivariate analysis allows us to control that the differentials estimated in the t-tests are not driven by the technological composition of the sub groups, by field-specific timing of publications, co-assignment of the patent to a firm and so on. We apply a standard OLS model using time lags expressed in months as the dependent variable. For the sake of comparability, the models reported in Table 10 and Table 11 are applied only to the sub sample of patents (with either EPO priority or USPTO priority) with a positive time lag, hence ruling out US patents granted under the grace period exception. We regress the time lag against a set of dummy variables. *PRO assignees* is a dummy variable equal to one if among the patent assignees there is at least one Public Research Organization (PRO), *firm assignee* is a dummy variable equal to one if among the patent assignees there is at least one company, *university assignee* is a dummy variable equal to one if among the patent assignees there is at least one University, *extended from grace* is a dummy variable equal to one if a patent with an original USPTO priority has been subsequently extend to the EPO. The IPC dummy variables measures the sectoral effects with respect to the IPC textiles & papers. Given the high correlation between the dummy variable *single assignee* and *university assignee*, in the models reported in Table 11, we avoid to use the two variables jointly.

Table 10 Testing the effects of US priority on patent-publication lags.

	Lag>= 0		Lag >= 0		Lag>= 0	
lag (publication-patent date)	mean	st.err.	mean	st.err.	mean	st.err.
us patent	-3.538	1.409 **	-2.926	1.435 **	-2.693	1.415 *
single assignee			-3.310	1.732 *		
university assignee					2.824	3.818
PRO assignee					4.037	2.335 *
firm assignee					6.781	2.244 ***
IPC human necessities	-17.528	5.499 ***	-18.506	5.482 ***	-18.616	5.447 ***
IPC performing operations	-17.713	6.007 ***	-17.866	5.963 ***	-17.520	5.962 ***
IPC chemistry & metallurgy	-18.294	5.494 ***	-18.917	5.464 ***	-18.803	5.438 ***
IPC mechanical engineering	-21.468	10.738 **	-21.264	10.659 **	-20.782	10.544 **
IPC physics	-15.291	5.638 ***	-16.006	5.609 ***	-16.194	5.614 ***
IPC electricity	-15.609	5.769 ***	-16.961	5.770 ***	-17.910	5.777 ***
IPC textiles & paper						
constant	34.302	5.384 ***	37.408	5.586 ***	30.792	6.065 ***
Obs	186		186		186	
Adj R-squared	0.059**		0.072***		0.102***	

* $p \leq 0.10$, ** $p \leq 0.06$, *** $p \leq 0.01$

Table 11 Testing the effect of extension from the US on patent publication lags.

	Lag >= 0			Lag >= 0		
lag (publication date - patent date)	mean	st.err.		mean	st.err.	
extended from grace	-3.620	1.478	**	-3.923	1.445	***
university assignee				1.365	3.795	
PRO assignee				4.093	2.311	*
firm assignee				7.879	2.165	***
IPC human necessities	-17.750	5.503	***	-18.581	5.390	***
IPC performing operations	-18.899	6.003	***	-18.015	5.892	***
IPC chemistry & metallurgy	-18.073	5.501	***	-18.168	5.388	***
IPC mechanical engineering	-22.702	10.781	**	-21.995	10.454	**
IPC physics	-16.958	5.638	***	-17.307	5.545	***
IPC electricity	-16.608	5.757	***	-18.462	5.694	***
IPC textiles & paper						
constant	35.536	5.458	***	33.464	6.114	***
Obs	186			186		
Adj R-squared	0.057**			0.120**		

* $p \leq 0.10$, ** $p \leq 0.06$, *** $p \leq 0.01$

The results reported in Table 10 and Table 11 essentially confirm the findings of the t-tests. In particular, even after accounting for the technological classification of patents, the fact that a patent has an original priority in a patent system that allows for a grace period exception is negatively correlated to the time lag between the patent priority and publication of the matched scientific article. This holds also when restricting the analysis to the sub sample of patent-publication pairs with a positive lag.

Applications to the EPO that come as an extension from a patent system allowing for the grace period (USPTO) are likely to experience a reduced lag to publication of 3.6 months, after controlling for both the technological classification and the typology of assignees. The overall evidence reported above can be summarised along the following points.

The empirical methodology developed to identify couples of patent and publications on the basis of text and content analysis seem to be a reliable tool for investigating the relationship between patenting and publishing behaviours of academic inventors. In fact, the preliminary results shown here turn to be in line with theoretical predictions. First, there is evidence of an actual impact of the grace period on the timing of disclosure of knowledge through the publication of scientific articles.

Second, the typology of the patent assignees has a significant impact on the delay of the publication of scientific results after the patent application, both for EPO and USPTO patents. However, even controlling for the identity of the owner of the patent the fact that a patent system allows for a grace period still has a negative correlation with the time lag.

Third, we find evidence of a longer time lag for those patents that after being originally filed to the USPTO are subsequently extended to a system, the EPO, which does not guarantee a grace period.

In general the magnitude of the difference in time lag (possibly generated by the presence of the grace period) ranges on average around 6-7 months. It is hard to assess which is the actual cost perceived for such delay by authors-inventors, and how which kind of effect it might exert at systemic level.

5. Conclusions

All in all, the contributions of the paper are twofold. First, the methodology we developed allowed us to come to a first estimate of the actual patent-publication lags. So far, empirical data were limited to survey data (Walsh et al., 2005), over which our methodology has the advantage of being replicable and unaffected by social response bias. Second, preliminary evidence provided in this paper gives support to a number of hypothesis raised within the literature on IPR management and academic patenting.

Our results suggested that, in the USPTO, approximately the 23% of academic patents was filed during the grace period. The majority of USPTO academic patents, for which the grace-period was not invoked, was disclosed into scientific journals on average 16 months after filing a patent, while in the EPO it was disclosed nearly 18 months after filing.

In the US, although the general grace period exception is in place, patents filed during the grace period cannot be extended to countries that do not recognize the same right, such as the EPO. This non-harmonization of the international patent systems is likely to nullify the effect of the grace period for all patents that have (or are expected to have) a global market, because compliance to international regulations is compulsory. Even so, USPTO patents extended to the EPO showed on average a (3 months) shorter time to publication than the EPO or EPO-members countries patents.

We also found that when patents are co-assigned to at least one firm, the publication lags is likely to be longer than non-firm co-assigned patents and similar results apply for PROs.

Finally, the publication lag is longer when a patent is co-assigned to many assignees of whatever kind, vis-a-vis single-assegnee patents.

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Annex 1
Resonance Index and related title and abstract match

	resonance index	patent	publication
title	0.8212	Bisbubstrate inhibitors of kinases	Mechanism-based design of a protein kinase inhibitor
abstract		Protein kinase inhibitors have applications as anti-cancer therapeutic agents and biological tools in cell signalling. Potent and selective bisbustrate inhibitors for the insulin receptor tyrosine kinase are based on a phosphoryl transfer mechanism involving a dissociative transition state. One such inhibitor is synthesized by linking ATPγS to a peptide substrate analog via a two-carbon spacer. The compound is a high-affinity competitive inhibitor against both nucleotide and peptide substrate and shows a slow off-rate. A crystal structure of this inhibitor bound to the tyrosine kinase domain of the insulin receptor confirms the key design features inspired by a dissociative transition state, and reveal that the linker takes part in the octahedral coordination of an active site Mg²⁺ ion.	Protein kinase inhibitors have applications as anticancer therapeutic agents and biological tools in cell signaling. Based on a phosphoryl transfer mechanism involving a dissociative transition state, a potent and selective bisbustrate inhibitor for the insulin receptor tyrosine kinase was synthesized by linking ATP gammaS to a peptide substrate analog via a two-carbon spacer. The compound was a high affinity competitive inhibitor against both nucleotide and peptide substrates and showed a slow off-rate. A crystal structure of this inhibitor bound to the tyrosine kinase domain of the insulin receptor confirmed the key design features inspired by a dissociative transition state, and revealed that the linker takes part in the octahedral coordination of an active site Mg2+. These studies suggest a general strategy for the development of selective protein kinase inhibitors.
title	0.7344	Pharmaceutical Compositions Comprising Beta-Turn Peptidomimetic Cyclic Compounds	A designed peptidomimetic agonistic ligand of TrkA nerve growth factor receptors
abstract		Proteolytically stable small molecule beta -turn peptidomimetic compounds have been identified as agonists or antagonists of neurotrophin receptors, such as TrkA. A compound of particular interest binds the immunoglobulin-like C2 region of the extracellular domain of TrkA, competes the binding of another TrkA ligand, affords selective trophic protection to TrkA-expressing cell lines and neuronal primary cultures, and induces the differentiation of primary neuronal cultures. The small beta -turn peptidomimetic compounds of the invention can activate a tyrosine kinase neurotrophin receptor that normally binds a relatively large protein ligand. Such compounds that bind the extracellular domain of Trk receptors are useful pharmacological agents to address disorders where Trk receptors play a role, by targeting populations selectively.	A proteolytically stable small molecule beta-turn peptidomimetic, termed D3, was identified as an agonist of the TrkA neurotrophin receptor. D3 binds the Ig-like C2 region of the extracellular domain of TrkA, competes the binding of another TrkA agonist, affords selective trophic protection to TrkA-expressing cell lines and neuronal primary cultures, and induces the differentiation of primary neuronal cultures. These results indicate that a small beta-turn peptidomimetic can activate a tyrosine kinase neurotrophin receptor that normally binds a relatively large protein ligand. Agents such as D3 that bind the extracellular domain of Trk receptors will be useful pharmacological agents to address disorders where Trk receptors play a role, by targeting populations selectively.
title	0.5624	System and method for 3-D digital reconstruction of an oral cavity from a sequence of 2-D images	A 3-D reconstruction system for the human jaw using a sequence of optical images
abstract		Systems and methods are provided through which a model-based vision system for dentistry which assists in diagnosis, treatment planning and surgical simulation. The present invention includes an integrated computer vision system that constructs a three-dimensional (3-D) model of the patient's dental occlusion using an intra-oral video camera. A modified shape from shading technique, using perspective projection and camera calibration, extracts the 3-D information from a sequence of two-dimensional images of the jaw. Data fusion of range data and 3-D registration techniques develop a complete 3-D digital jaw model. Triangulation of the 3-D digital model is then performed, and optionally, a solid 3-D model is reconstructed.	This paper presents a model-based vision system for dentistry that will assist in diagnosis, treatment planning, and surgical simulation. Dentistry requires an accurate three-dimensional (3-D) representation of the teeth and jaws for diagnostic and treatment purposes. The proposed integrated computer vision system constructs a 3-D model of the patient's dental occlusion using an intraoral video camera. A modified shape from shading (SFS) technique, using perspective projection and camera calibration, extracts the 3-D information from a sequence of two-dimensional (2-D) images of the jaw. Data fusion of range data and 3-D registration techniques develop the complete jaw model. Triangulation is then performed, and a solid 3-D model is reconstructed. The system performance is investigated using ground truth data, and the results show acceptable reconstruction accuracy.

title	0.3799	Adaptive sigma-delta modulation with improved dynamic range	Stability and performance analysis of an adaptive sigma-delta modulator
abstract		An adaptive sigma-delta modulation and demodulation technique, wherein a quantizer step-size is adapted based on estimates of an input signal to the quantizer, rather than on estimates of an input signal to the modulator.	This work develops an adaptive sigma-delta modulator that is based on adapting the quantizer step-size using estimates of the quantizer input rather than the modulator input. The adaptive modulator with a first-order noise shaping filter is shown to be bounded-input bounded-output stable, Moreover, an analytical expression for the signal-to-noise ratio is derived, and it is shown to be independent of the input signal strength. Simulation results confirm the signal-to-noise ratio performance and indicate considerable improvement in the dynamic range of the modulator compared to earlier structures.
title	0.226	Method for manufacturing an array of indented diamond cylinders	Periodic submicrocylinder diamond surfaces using two-dimensional fine particle arrays
abstract		A cylinder array of diamond having a dent in its cylinder top face is manufactured by subjecting a cylinder array of diamond to a plasma etching.	Periodic submicroscale diamond-cylinder arrays were fabricated on diamond surfaces using two-dimensionally ordered arrays of SiO2 particles. For the preparation, the diamond surface was etched by means of reactive ion etching with oxygen plasma through two-dimensionally ordered arrays as masks. The etching time has an important influence on the diameter and depth of the diamond cylinders. The Raman spectra of these films indicate that they consist mostly of diamond, with small amounts of sp(2) carbon.
title	0.1969	Composite materials having substrates with self-assembled colloidal crystalline patterns thereon	Bragg diffraction from indium phosphide infilled fcc silica colloidal crystals
abstract		Composite materials having colloidal photonic crystals patterned in substrates for use in different technologies including lab-on-chip and photonic chip technologies. The colloidal crystals are patterned either on or within surface relief patterns in the substrates of the composite materials and each colloidal crystal exhibits Bragg diffraction.	Here we present results on Bragg diffraction in the optical range from indium phosphide infilled solid face-centered-cubic silica colloidal crystals. Scanning electron microscopy and optical properties indicate that the semiconductor is homogeneously grown within the three-dimensional lattice of voids in the colloidal crystal. The photonic-crystal behavior of the periodic dielectric is enhanced as a result of the high contrast of dielectric constants when InP is introduced.
title	0.1801	Methods For Preserving Cut Flowers Using Thidiazuron	Thidiazuron - a potent inhibitor of leaf senescence in Alstroemeria
abstract		This invention relates to compositions and methods for preserving plants and plant parts. In particular, it relates to compositions comprising compounds of Formula I to inhibit senescence in plants.	The time to flower senescence and leaf yellowing in 20 cut flower cultivars of Alstroemeria was studied. In deionized water (DI), the time to abscission of the first petal ranged from 9 to 16 days. Time to leaf yellowing ranged from 5 to 18 days. These two processes proceeded independently so that in some cultivars leaf yellowing occurred long before flower senescence, and in others, much later. Thidiazuron (TDZ, N-phenyl-N'-1,2,3-thiadiazol-5-ylurea), a substituted phenylurea with cytokinin-like activity, markedly extended leaf longevity. TDZ was much more effective than two other substituted phenyl-urea compounds tested, in delaying leaf yellowing. A single 24-h pulse treatment with 10 muM TDZ prevented yellowing of isolated leaves for more than 2 months.
title	0.1783	Diagnosis Of Pre-Eclampsia	A longitudinal study of biochemical variables in women at risk of preeclampsia

abstract		The present invention relates to a method of predicting pre-eclampsia (PE). The present invention also relates to a diagnostic kit for performing a method of predicting PE. In particular, the method determining the level of two or more markers selected from placenta growth factor (PIGF), plasminogen activator inhibitor-1 (PAI-1) plasminogen activator inhibitor-2 (PAI-2) and leptin.	OBJECTIVE: The purpose of this study was to characterize gestational profiles of biochemical markers that are associated with preeclampsia in the blood of pregnant women in whom preeclampsia developed later and to compare these markers with the markers of women who were delivered of small-for-gestational-age infants without preeclampsia and with women who were at low risk for the development of preeclampsia. STUDY DESIGN: This was a prospective case control study. The subjects were women at risk of preeclampsia who were enrolled in the placebo arm of a clinical trial. Indices of antioxidant status, oxidative stress, placental and endothelial function, and serum lipid concentrations were evaluated from 20 weeks of gestation until delivery in 21 women in whom preeclampsia developed later, in 17 women without preeclampsia who were delivered of small-for-gestational-age infants, and in 27 women who were at low risk for the development of preeclampsia. RESULTS: Ascorbic acid was reduced early in preeclampsia and small-for-gestational-age pregnancies. Leptin, placenta growth factor, the plasminogen activator inhibitor (PAI-1)/PAI-2 ratio, and uric acid were predictive of the development of preeclampsia. CONCLUSION: Gestational profiles of several markers were abnormal in the group with preeclampsia, and some of the markers that may prove useful in the selective prediction of preeclampsia were identified.
title	0.1652	Membrane scaffold proteins	Self-assembly of discoidal phospholipid bilayer nanoparticles with membrane scaffold proteins
abstract		Membrane proteins are difficult to express in recombinant form, purify, and characterize, at least in part due to their hydrophobic or partially hydrophobic properties. The membrane scaffold proteins (MSP) of the present invention assemble with target membrane or other hydrophobic or partially hydrophobic proteins or membrane fragments to form soluble nanoscale particles which preserve their native structure and function; they are improved over liposomes and detergent micelles. In the presence of phospholipid, MSPs form nanoscopic phospholipid bilayer disks, with the MSP stabilizing the particle at the perimeter of the bilayer domain. The particle bilayer structure allows manipulation of incorporated proteins in solution or on solid supports, including for use with such surface-sensitive techniques as scanning probe microscopy or surface plasmon resonance. The nanoscale particles, which are robust in terms of integrity and maintenance of biological activity of incorporated proteins, facilitate pharmaceutical and biological research, structure/function correlation, structure determination, bioseparation, and drug discovery.	Nanoparticulate phospholipid bilayer disks were assembled from phospholipid and a class of amphipathic helical proteins termed membrane scaffold proteins (MSP). Several different MSPs were produced in high yield using a synthetic gene and a heterologous expression system and purified to homogeneity by a one-step purification. The self-assembly process begins with a mixture of the phospholipid and MSP in the presence of a detergent. Upon removal of detergent, 10-nm diameter particles form containing either saturated or unsaturated phospholipid. The ratio of components in the initial mixture was found to be crucial for formation of a monodisperse population of nanoparticles. Exploration of the phase diagram of the lamellar to phospholipid-detergent mixed micelle transition reveals that self-assembly proceeds from the mixed micellar phase. In this case a homogeneous and monodisperse population is formed. In contrast, particle formation from the detergent-phospholipid lamellar phase results in altered size, yield, composition, and heterogeneity of the resultant particles. The nanodisks contain approximately 160 saturated or 125 unsaturated lipids and can be formed from designed amphipathic alpha-helical scaffold proteins. The 10-nm particles can thus contain two molecules of MSP1 or a single molecule of an MSP1 fusion (MSP2). The phospholipid bilayer main phase transition temperature is preserved in the nanodisks as determined by fluorescence spectroscopy. Scanning probe microscopy shows a monolayer of nanodisks on a mica surface with a diameter of 10 nm and the thickness of a single phospholipid bilayer (5.7 nm), confirming the presence of a bilayer domain. The gentle method of self-assembly and robustness of the resulting nanodisks provides a means for generating soluble lipid bilayer membranes on the nanometer scale and opens the possibility of using these nanostructures to incorporate single membrane proteins into a native-like environment.
title	0.1453	Methods and compositions for stabilizing microtubules and intermediate filaments in striated muscle cells	Regulation of microtubule dynamics and myogenic differentiation by MURF, a striated muscle RING-finger protein

abstract		The present invention discloses new muscle ring finger (MURF) proteins designate MURF-1, MURF-2 and MURF-3. The genes encoding these MURFs also are provided. MURFs interact with microtubules and thus play a role in cytoskeletal function, mitosis and cell growth. Thus, the uses of MURFs in diagnosis, treatment and drug screening, in particular relation to cardiomyopathies, are described.	The RING-finger domain is a novel zinc-binding Cys-His protein motif found in a growing number of proteins involved in signal transduction, ubiquitination, gene transcription, differentiation, and morphogenesis. We describe a novel muscle-specific RING-finger protein (MURF) expressed specifically in cardiac and skeletal muscle cells throughout pre- and postnatal mouse development. MURF belongs to the RING-B-box-coiled-coil subclass of RING-finger proteins, characterized by an NH2-terminal RING-finger followed by a zinc-finger domain (B-box) and a leucine-rich coiled-coil domain. Expression of MURF is required for skeletal myoblast differentiation and myotube fusion. The leucine-rich coiled-coil domain of MURF mediates association with microtubules, whereas the RING-finger domain is required for microtubule stabilization and an additional region is required for homo-oligomerization. Expression of MURF establishes a cellular microtubule network that is resistant to microtubule depolymerization induced by alkaloids, cold and calcium. These results identify MURF as a myogenic regulator of the microtubule network of striated muscle cells and reveal a link between microtubule organization and myogenesis.
title	0.127	Selective nixtamalization process for the production of fresh whole corn masa, nixtamalized corn flour and derived products	Effect of the components of maize on the quality of masa and tortillas during the traditional nixtamalisation process
abstract		A process for the production of fresh masa, nixtamalized flour and derived produts is disclosed. Water-lime cooking of pericarp fractions of the corn, and appropriate hydration of the germ and endosperm fractions of the corn is achieved to prepare fresh masa, nixtamalized corn flour and derived products. The pericarp fractions are cooked with lime and water at a temperature between about 50° C. to about 300° C. The germ and endosperm fractions are hydrated with water. The pericarp fractions and the germ-endosperm fractions are milled separately, and the milled pericarp, germ and endosperm fractions are then mixed for producing fresh corn masa. The fresh corn masa can be dehydrated and milled for producing nixtamalizaed corn flour. Also, the pericarp, germ and endosperm fractions can be dried in order to produce nixtamalized corn flour.	In this work the importance of maize pericarp and germ in relation to the overall quality of masa and tortillas was studied. Alkaline-cooking originated alterations in the outer layers of the grain. Its components were hydrated and the pericarp fraction assumed a gummy and sticky texture. During the liming process, some components from the germ, pericarp and tip cap fractions released 'maize hull gums', increasing the contents of xylose, galactose and D-glucuronic acid. The presence of gums and insolubilised germ that remained after the traditional washing of the nixtamal improved the viscosity, cohesiveness and adhesiveness of the masa and tortillas as compared to the dry masa and tortillas from nixtamal with the germ removed and from exhaustively washed nixtamal, where most of the hull gums and germ were removed. Fresh tortillas or tortillas stored for 24h at room temperature prepared using the traditional process of nixtamalisation (washed twice) were more stretchable, elastic and resistant to tearing and cracking than tortillas prepared with exhaustively washed nixtamal or with nixtamal washed twice with the germ removed. Tortillas from nixtamal with the germ removed showed the worst texture, rollability and puffing.
title	0.1064	Method For Preparing Colloidal Particles In The Form Of Nanocapsules	Study of the emulsion-diffusion of solvent: Preparation and characterization of nanocapsules

abstract		Colloidal dispersible systems in the form of nanocapsules are prepared by mixing a solution of one monomer alpha with a solution of a second monomer beta and incorporating in the solution of alpha , a substance (B) along with suitable surfactants in the two phases. The solvent for monomer beta is a non-solvent for monomer alpha and for (B). Process for the preparation of colloidal dispersible systems in the form of nanocapsules in which the wall is composed of a polymer obtained by polycondensation of two monomers alpha and beta and in which the centre comprises substance (B) characterized in that the capsules are prepared as follows: (1) a first plastic phase is prepared which consists of a solution of monomer alpha containing at least one surface active agent as well as substance (B) in solution or suspension; (2) a second liquid phase is prepared consisting of non-solvent(s) (of monomer alpha and substance (B)), and containing monomer beta and at least one surface active agent. The first phase solvent(s) are miscible in all proportions with the non-solvent(s) of the second phase and the molar concentration of monomer beta is at least 5 times that of monomer alpha ; (3) the first phase is added to the second phase with stirring to obtain a colloidal suspension of nanocapsules, the stirring being maintained until the polymerisation of monomers alpha and beta is complete; and (4) if required, part or all of the (non)solvent(s) is/are removed to provide a colloidal suspension of nanocapsules at the required concentration.	The objective of this work was to obtained stable nanocapsules (NC), that is to say a core shell structure by a recently patented method, the emulsion diffusion of solvent. To study the capacity of encapsulation, the aim was first to control the nanocapsules size distribution before the characterization of the membrane. Nanocapsules (NC) were prepared by an emulsion-diffusion method. The emulsion was prepared using a high-speed stirrer (Ultraturrax T25), and the droplet size distributions were determined. The mechanism of particle formation is based on the diffusion of the solvent followed by the deposition of the polymer around the oil droplet. The solvent partially soluble in the water and included in oil droplets diffuses into the outer aqueous medium after the emulsion dilution with water. It is then removed under reduced pressure. In order to control the NC sizes, we studied the effect of various emulsion parameters such as the nature and the concentration of the polymer, the stabilizer, the organic/aqueous phases ratio on NC morphology and size. The mean size of NC was about 500 nm, but we could have NC with diameter size between 200 to 1,000 nm. Size distributions were found to be function of the polymer/oil ratio in the organic phase, and of the solvent volume in the droplet. The suspension of nanocapsules were characterized by Transmission Electron Microscopy (TEM), Nuclear Magnetic Resonance (NMR), density gradient centrifugation, and Differential Scanning Calorimetry (DSC). The formation of nanocapsules involves mass transfer of solvent, polymer, and oil between phases. The physicochemical properties of the system can be classified into transport parameters such as solvent diffusion into the non-solvent and interaction parameters such as solvent solubility in the water and the polymer. The mechanism of NC formation was investigated experimentally by monitoring the solvent concentration as a function of time in the continuous phase after different dilutions. The solvent elimination in the NC was complete after a dilution step followed by an evaporation under reduced pressure. This NC study gave some important information on their structure (core shell). The mechanism of formation based on the diffusion of solvent towards the aqueous phase was very rapid and depended on the volume of water at a kinetic level. We also showed that the state of the polymer changes and that the polymer forms the shell around the oil.
title	0.1032	Method And Apparatus For Transmitting And Receiving Multimedia Data	Enhancing TCP performance over wireless network with variable segment size
abstract		An apparatus for transmitting/receiving multimedia data including video data via a wireless packet in a radio transmitting/receiving system, and a method thereof are provided. The method comprises the step of performing uneven error- protection with respect to one source packet or a plurality of source packets. According to the present invention, error resilience of multimedia data (especially that of video data) can be increased by unevenly error-protecting with respect to the source packets without changing the stack of transmission/reception protocol in a conventional packet network such as H. 323	TCP, which was developed on the basis of wired links, supposes that packet losses are caused by network congestion. In a wireless network, however, packet losses due to data corruption occur frequently. Since TCP does not distinguish loss types, it applies its congestion control mechanism to non-congestion losses as well as congestion losses. As a result, the throughput of TCP is degraded. To solve this problem of TCP over wireless links, previous researches, such as split-connection and end-to-end schemes, tried to distinguish the loss types and applied the congestion control to only congestion losses; yet they do nothing for non-congestion losses. We propose a novel transport protocol for wireless networks. The protocol called VS-TCP (Variable Segment size Transmission Control Protocol) has a reaction mechanism for a non-congestion loss. VS-TCP varies a segment size according to a non-congestion loss rate, and therefore enhances the performance. If packet losses due to data corruption occur frequently, VS-TCP decreases a segment size in order to reduce both the retransmission overhead and packet corruption probability. If packets are rarely lost, it increases

			the size so as to lower the header overhead. Via simulations, we compared VS-TCP and other schemes. Our results show that the segment-size variation mechanism of VS-TCP achieves a substantial performance enhancement.
title	0.073	Wireless Atm Network	Determining the optimal configuration for the Relative Distance Microdiscovery Ad Hoc Routing protocol
abstract		A method of transmitting non-real-time data over a wireless link from a terminal (2) to an ATM switch (6) comprising the steps of generating in the terminal (2), a plurality of ATM cells derived from a protocol data unit, marking the last ATM cell of the protocol data unit, sequentially transmitting the ATM cells over the wireless link, determining in the ATM switch for each transmitted cell, whether that cell contains an error, and sending an error message back to the terminal if an ATM cell is determined to contain an error, the terminal (2) being arranged on receipt of the error message, to cease transmitting any remaining ATM cells of the protocol data unit from which the erroneous ATM cell was derived. Also, an ATM protocol stack for wireless ATM communications in which the physical layer below the ATM layer, has been adapted to include a radio access layer, the radio access layer including a medium access control protocol layer and a partial packet discard mechanism.	The Relative Distance Microdiscovery (RDM) Ad Hoc Routing (RDMAR) protocol is an on-demand protocol that reactively discovers and repairs routes within a local region of the network. This is accomplished by a simple distributed route searching algorithm, which we refer to as RDM, using a probability model for estimating the relative distance between two nodes as the basis for routing searching and, thus, for routing decisions. Relative distance (RD) between two nodes is the hop-wise distance that a message needs to travel from one node to the other. Knowledge of this RD is leveraged by the RDMAR protocol to improve the efficiency of a reactive route discovery/repair mechanism. Previous work has demonstrated that localization of routing control messaging serves to minimize communication overhead and overall network congestion. In this paper, we analyze the RDMAR protocol and its individual mechanisms, and determine their effectiveness and the manner in which they interact in order to contribute to the overall protocol performance. A framework for the modeling and analysis of the RDM algorithm is also presented and, based on this, a method for estimating a nearly optimal (RD) between two mobiles is then introduced. As demonstrated through simulations, the performance of RDM is very close to this of an optimal route searching policy while the query localization protocol is able to reduce the routing overhead significantly, often in the neighborhood of 48-50% of the flooding-based schemes.
title	0.0448	Method for manufacturing betulinic acid	The correct method of calculating energy savings to justify adjustable-frequency drives on pumps

abstract		[From equivalent US20010007908A1] The present invention provides a method for preparing betulin-3-acetate including alcoholyzing betulin 3,28-dibenzoate; a process for preparing betulin-3-acetate including: (1) acylating betulin to provide betulin 3,28-dibenzoate and (2) alcoholyzing betulin 3,28-dibenzoate to provide betulin-3-acetate; and a process for preparing betulinic acid including: (1) acylating betulin to provide betulin 3,28-dibenzoate; (2) alcoholyzing betulin 3,28-dibenzoate to provide betulin-3-acetate; (3) oxidizing betulin-3-acetate to provide betulinic aldehyde-3-acetate; (4) oxidizing betulinic aldehyde-3-acetate to provide betulinic acid-3-acetate; and (5) deprotecting betulinic acid-3-acetate to provide betulinic acid.	It is easy to make a bad business decision when using electrical energy savings as a justification to install adjustable-frequency drives (AFDs) on pumps. The simple hydraulic formulas and "rules of thumb" are easily misapplied and the errors will almost always economically favor the AFD installation. To use energy savings as a justification for an AFD installation it is necessary to accurately determine these savings over the life of the equipment. These savings are not dependent upon the AFD or motor characteristics but depend upon the characteristics of the process system. This paper is a tutorial in nature and will, show why AFDs save electricity, give examples of the common errors that are made in performing the savings calculations, show how to do these calculations correctly, show how to mathematically model the process to assist in performing the analysis, and show how to perform the economic calculations to arrive at a rate of return and net present value on the AFD investment.
title	0.0051	Device And Method For Introducing And/Or Collecting Fluids From The Interior Of The Uterus Of An Animal	Further studies on RpoS in enterobacteria: identification of rpoS in Enterobacter cloacae and Kluyvera cryocrescens
abstract		It comprises a tube or catheter (1) that is introduced into the animal's vagina up to the cervix duct (19); characterized in that it additionally comprises a flexible probe (6) constituted of a first flexible tubular body (12), and the outside of which is covered by a layer of a flexible material; all to allow that the probe, after reaching the distal end of the tube (1), may progress through the cervix duct (19) and thereafter through the cervix horn (22). This structure allows to introduce a fluid with spermatozoids, embryos or therapeutic solutions to the anterior third of the uterus horn, or to obtain embryos from the anterior portions of the uterus horn, and all this without sedation or anesthesia and without disturbing the animal's well-being.$qTo facilitate obtaining embryos, the probe includes an elastic small external coating (28) that is inflated through a flexible tube (27) for adapting itself to the uterus horn (22) preventing refluxes when carrying out absorption.$qIt is essentially applied to porcine livestock, small ruminants and any other animal species.	RpoS, the alternative sigma factor sigma (s), is important for bacterial survival under extreme conditions. Many enterobacteria are opportunistic human pathogens and their ability to survive in a changing environment could be an essential step for their virulence. To determine the presence of this gene in enteric bacteria, an Escherichia coli rpoS probe was constructed and used to detect the presence of this gene in different species. A gene homologous to rpoS was found in Citrobacter amalonaticus, Enterobacter cloacae, Klebsiella planticola, Kluyvera cryocrescens, Serratia rubidaea, Shigella sonnei, and Yersinia ruckeri. Providencia stuartii and Proteus vulgaris were the only tested enterobacteria that did not show any signal with the E. coli rpoS probe or that did not lead to amplification of an rpoS fragment using specific primers. The rpoS gene from E. cloacae and from K. cryocrescens was cloned and sequenced and a mutant allele was constructed in E. cloacae. Survival rates under different harsh conditions were followed in order to determine the effect of rpoS inactivation in exponential- and stationary-phase cells of both strains. E. cloacae rpoS mutants were more sensitive to extreme pH, high osmolarity, and high temperature than the wild-type.

Annex 2
Sensitivity analysis: results of t-test carried out using a resonance threshold equal to 0.1767.

Table 3bis Sensitivity check

	Freq.	did not use grace	used grace	% that did not use grace	% that did not use grace	did not use grace: mean lag	used grace: mean lag	ttest Ha: mean_diff≠ 0
USPTO priorities patents	64	48	16	75.0%	25.0%	16.756	-8.750	***
IPC human necessities	20	16	4	80.0%	20.0%	15.463	-14.017	***
IPC performing operations	2	1	1	50.0%	50.0%	11.233	-3.667	
IPC chemistry & metallurgy	18	16	2	88.9%	11.1%	16.704	-11.183	***
IPC mechanical engineering	1	1	0	100.0%				
IPC physics	0	0	0					
IPC electricity	13	8	5	61.5%	38.5%	18.046	-2.753	***
IPC textiles & paper	10	6	4	60.0%	40.0%	16.583	-11.033	***
firm	9	7	2	77.8%	22.2%	26.738	-0.933	***
university	61	45	16	73.8%	26.2%	15.981	-8.750	***
PRO	10	9	1	90.0%	10.0%	24.337	-0.867	***
single assignee	51	37	14	72.5%	27.5%	14.762	-9.812	***
university-only assigned	46	33	13	71.7%	28.3%	13.128	-10.692	***

Table 4bis Sensitivity check

	variable	obs.	mean	st. err.	difference	p-value (Ha : diff>0)
I	Non grace priority country	21	16.873	3.290	8.494	0.012
	Grace priority country	64	8.379	1.830		
II	Non grace priority country	20	18.962	2.672	4.206	0.068
	Grace priority country	48	14.756	1.411		

Table 5bis Sensitivity check

variable	obs.	mean	st. err.	difference	p-value (Ha : diff>0)
US extended	26	12.978	2.426	7.746	0.018
US non extended	38	5.232	2.496		

Table 6bis Sensitivity check

variable	obs.	mean	st. err.	difference	p-value (Ha : diff>0)
US priority extended to EPO	26	12.978	2.426	-3.895	0.168
EPO priority	21	16.873	3.290		

Table 7bis Sensitivity check

variable	obs.	mean	st. err.	difference	p-value (Ha : diff>0)
firm	12	17.864	3.677	8.600	0.0337
no firm	73	9.263	1.780		

Table 8bis Sensitivity check

variable	obs.	mean	st. err.	difference	p-value (Ha : diff>0)
others	23	18.686	2.564	11.253	0.0009
university only	62	7.433	1.906		

Table 9bis Sensitivity check

variable	obs.	mean	st. err.	difference	p-value (Ha : diff>0)
multiple assegnees	17	16.986	2.939	8.136	0.0233
single assignee	68	8.850	1.871		