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Dominique Lerinckx

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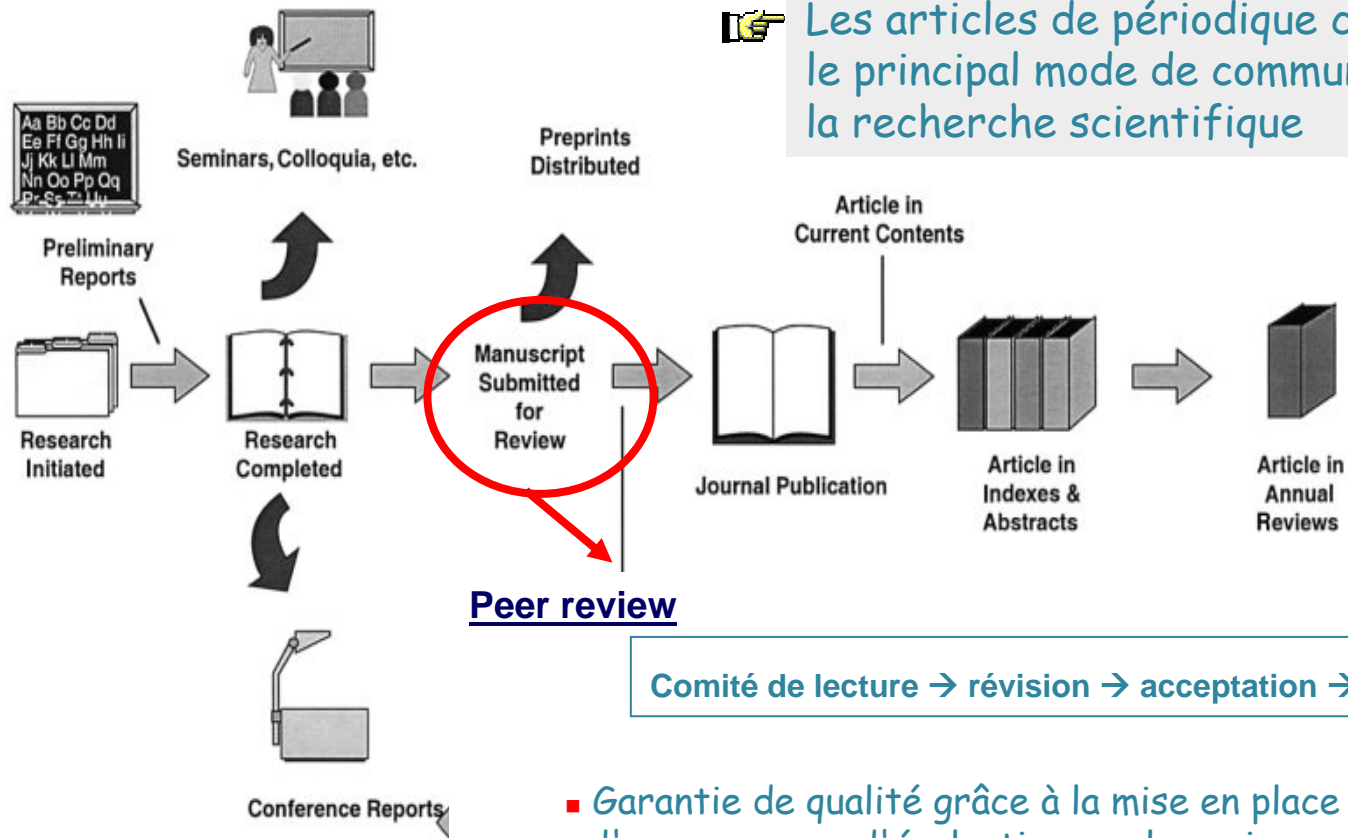
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→ **contrôle à priori**
- Permet le maintien de la politique éditoriale



Agricultural intensification, soil biodiversity and ecosystem function in the tropics: the role of nitrogen-fixing bacteria

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Abstract

Among the nitrogen (N_2)-fixing bacteria, the rhizobia in symbiosis with legumes are generally the most important in agriculture, although *Frankia*, cyanobacteria and heterotrophic free-living N_2 -fixers may fix significant amounts of nitrogen under specific conditions. The taxonomy of N_2 -fixing bacteria is undergoing substantial revisions due to the advent of molecular methods for phylogenetic analysis, and in certain cases this has proved useful in unravelling ecological relationships among confusing groups. Molecular methods are also proving useful in studies of biodiversity within populations of rhizobial species.

Rhizobia are surprisingly competent free-living bacteria, although few fix nitrogen in the free-living state, and the major factors that determine their population sizes in the absence of legume hosts are environmental stresses (such as soil acidity factors), protozoal grazing and some factors associated with agricultural intensification such as increases in salinity or heavy metal pollution of the soil. Rhizobial populations generally increase in response to the presence of the host legume. Due to the high degree of host-specificity between legume hosts and rhizobial species, loss of a single rhizobial species can result in loss of N_2 -fixation by that legume, although many legumes can be nodulated by several species of rhizobia. However, as only a single, compatible rhizobial genotype or strain is necessary for establishment of effective N_2 -fixation (i.e. the basis of the rhizobial inoculant industry), it is questionable whether biodiversity within species is necessary to ensure function, although this may confer resilience in the face of further environmental stresses. © 1997 Elsevier Science B.V.

Keywords: Azorhizobium; Bradyrhizobium; Cyanobacteria; Free-living nitrogen-fixing bacteria; Rhizobium; Legumes; Nitrogen fixation

1. Introduction

1.1. N_2 -fixation as an ecosystem function

The importance of nitrogen (N_2)-fixation in nature can best be seen in non-climax ecosystems. At

* Corresponding author.

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Titre de la revue suivi du
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Le document a été
accepté en 1996 et
publié en 1997

Titre de l'article

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Résumé

made. Since the 1984 edition of *Bergey's Manual of Systematic Bacteriology* in which four species were described (Jordan, 1984), nine additional species have been named (Table 3). Most of these new species were isolated from legumes belonging to the subfamily Papilionoideae. Whether this can be taken to indicate the Papilionoideae as a particular source of rhizobial diversity, or whether this is simply due to the lack of research on rhizobia from nodules of legumes which belong to the other two subfamilies, the Mimosoideae and the Caesalpinioideae, remains to be established. Jordan (1984) pointed out that rhizobia classification would require gradual modification as the large reservoir of tropical leguminous species are examined. Recent surveys of the nodulation ability of tropical legume species from the Amazon and Atlantic Brazilian forests have resulted in the isolation of many new strains from nodules of legumes belonging to divergent groups of all three subfamilies of the Leguminosae (Faria et al., 1984, 1987; Moreira et al., 1992). Preliminary results based on sodium dodecyl sulphate polyacrylamide electrophoresis of the total cell protein of 171 strains (Moreira, 1991; Moreira et al., 1993) demonstrated high diversity among these isolates, which may thus represent a source of new species and genera of rhizobia. Among 23 protein electrophoretic clusters obtained from these 171 strains (of which 120 were slow or very slow growers), only nine clusters comprised rhizobial species already described. Diversity among isolates from legume tree species from the Sahelian region of Africa has also been reported (Zhang et al., 1991).

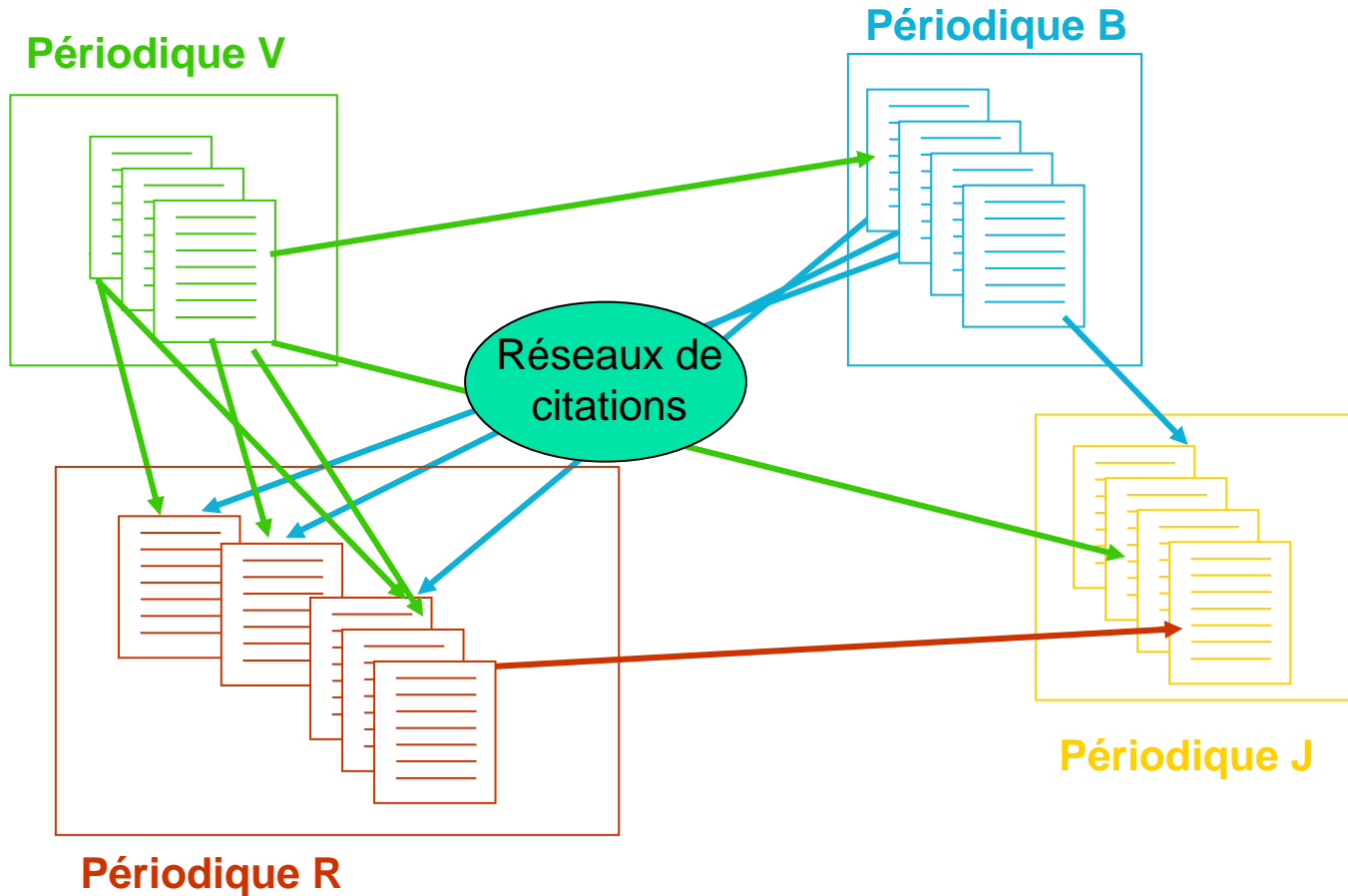
internal cycling of nutrients and low loss rates, the input of nitrogen from free-living diazotrophs may in fact be sufficient to meet the requirements for maintenance of productivity. Whether agricultural intensification is always directly linked to reductions in biodiversity of rhizobial species, and strains within those species, remains to be established, but future benefits of the legume–rhizobium symbiosis, whether for food, fodder, soil fertility or forestry, will depend on the exploitation of natural biodiversity of both the legume hosts and the bacterial strains present in the soils of the tropics. Only when we better understand the factors regulating this biodiversity will we be able to conserve it for the future and exploit it fully in tropical agriculture.

Liste de références sur lesquels l'auteur a basé ses recherches

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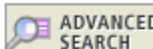
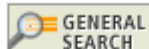
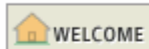
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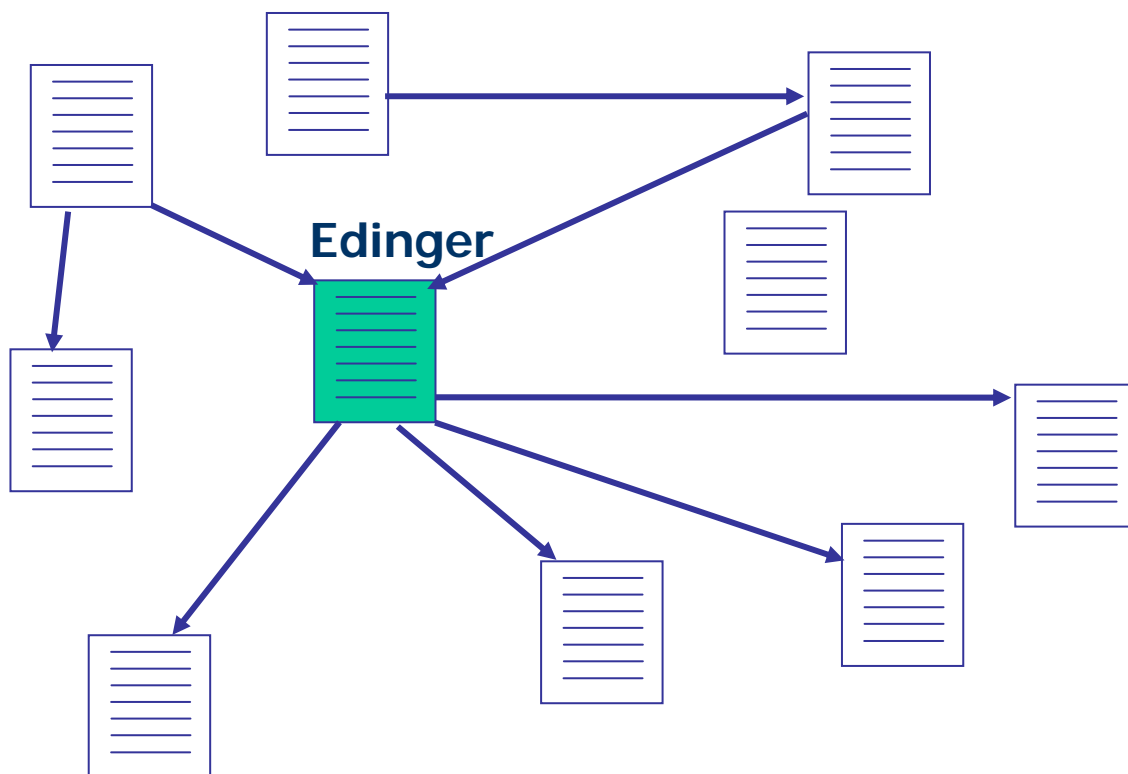
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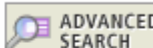
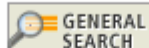
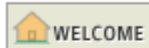
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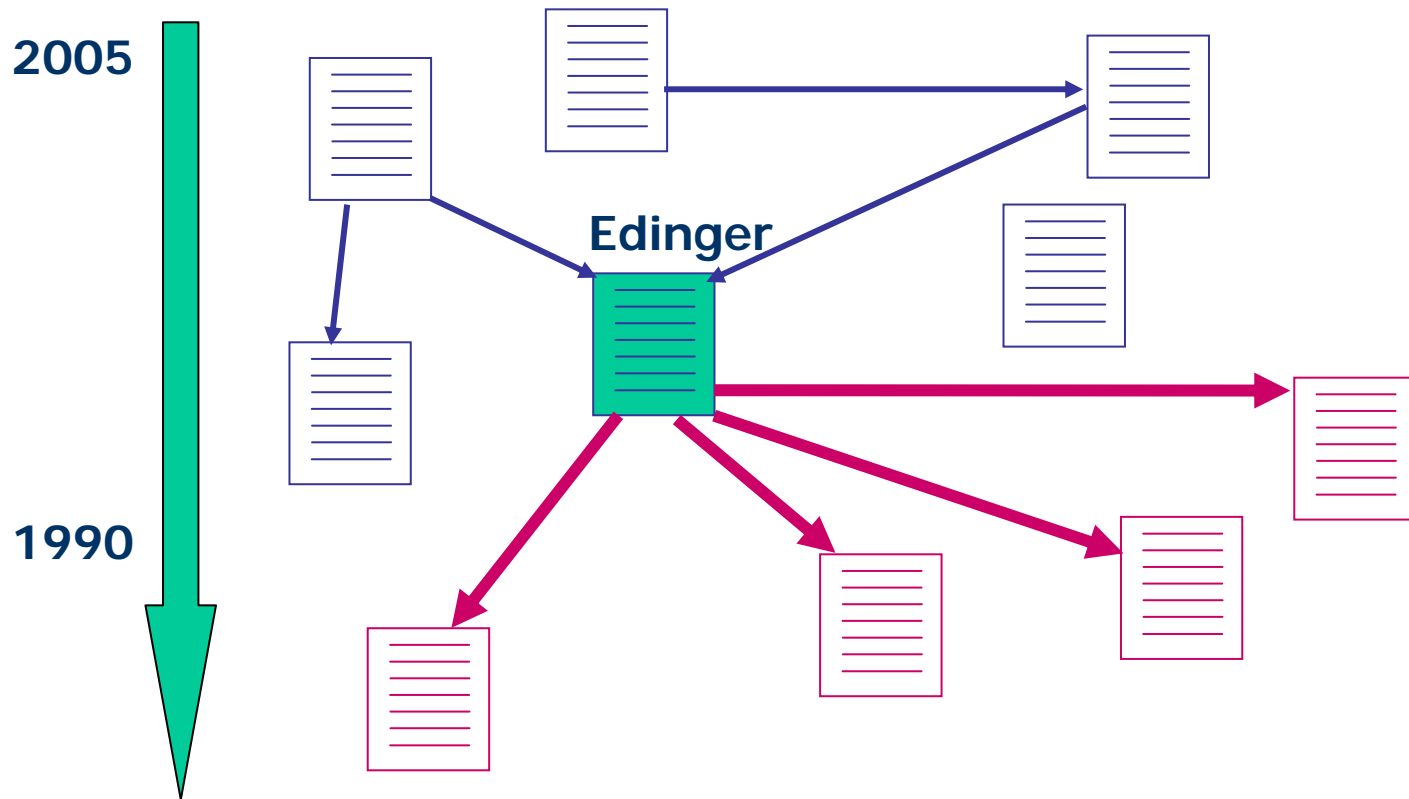
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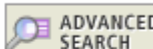
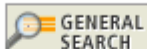
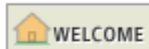
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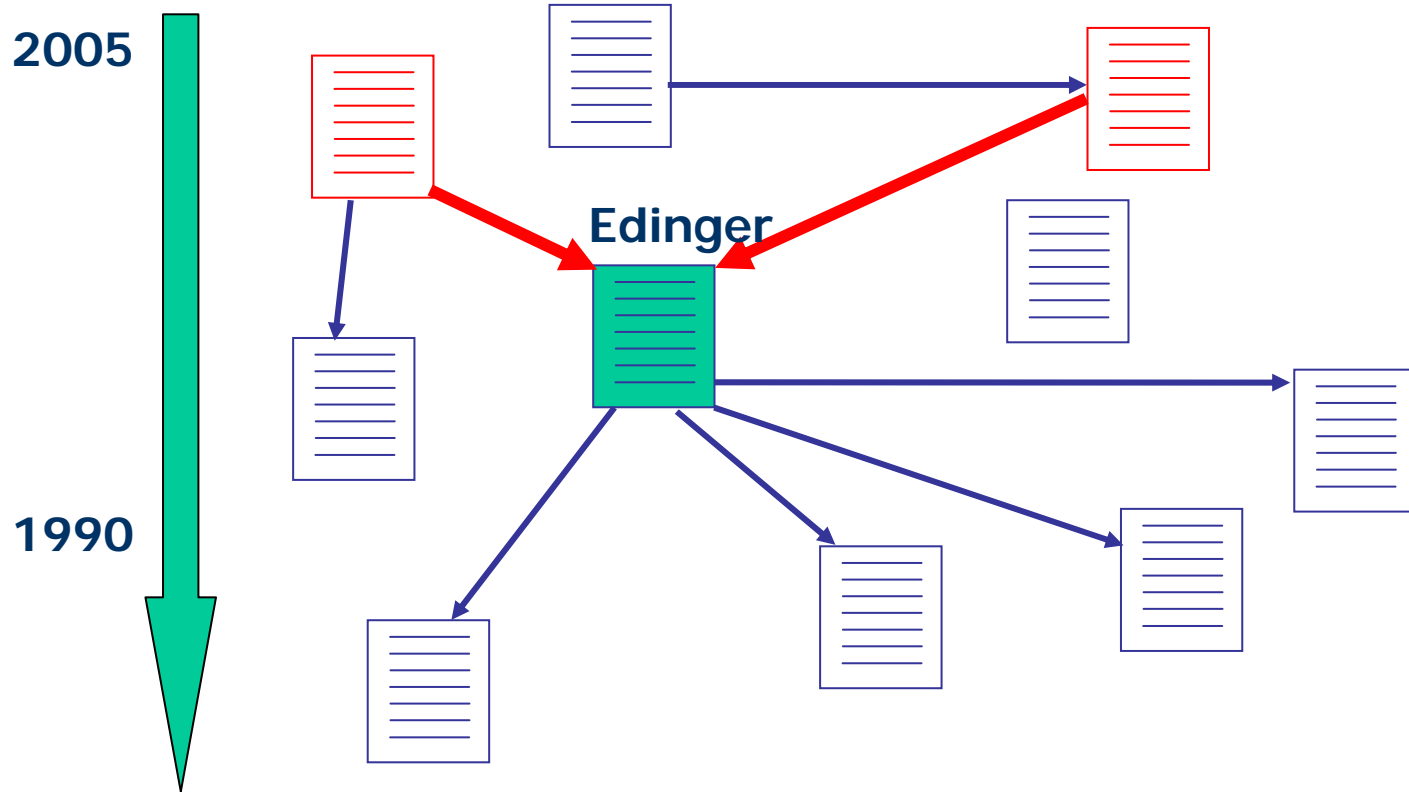
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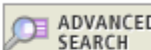
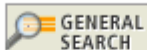
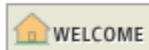
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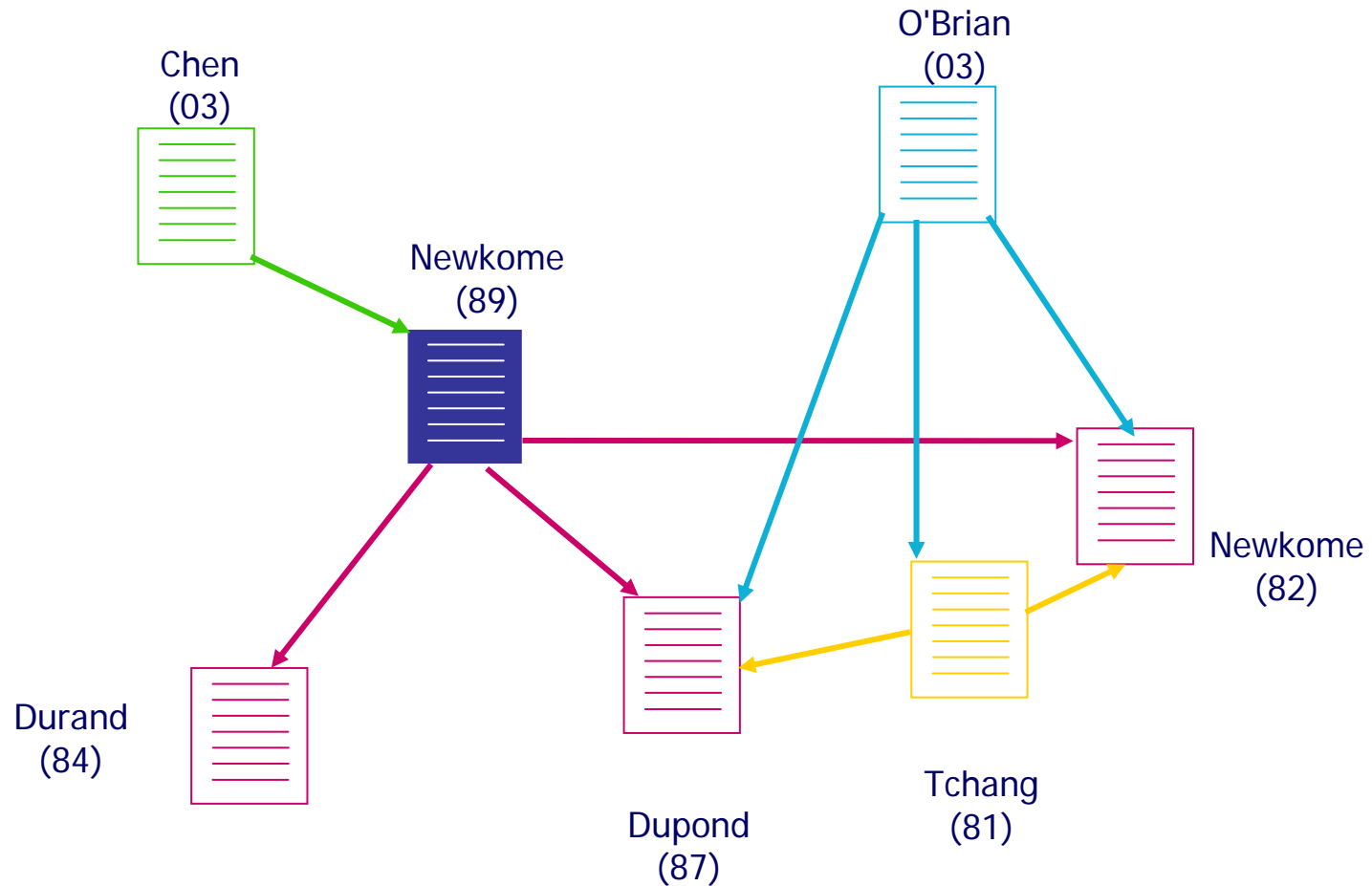
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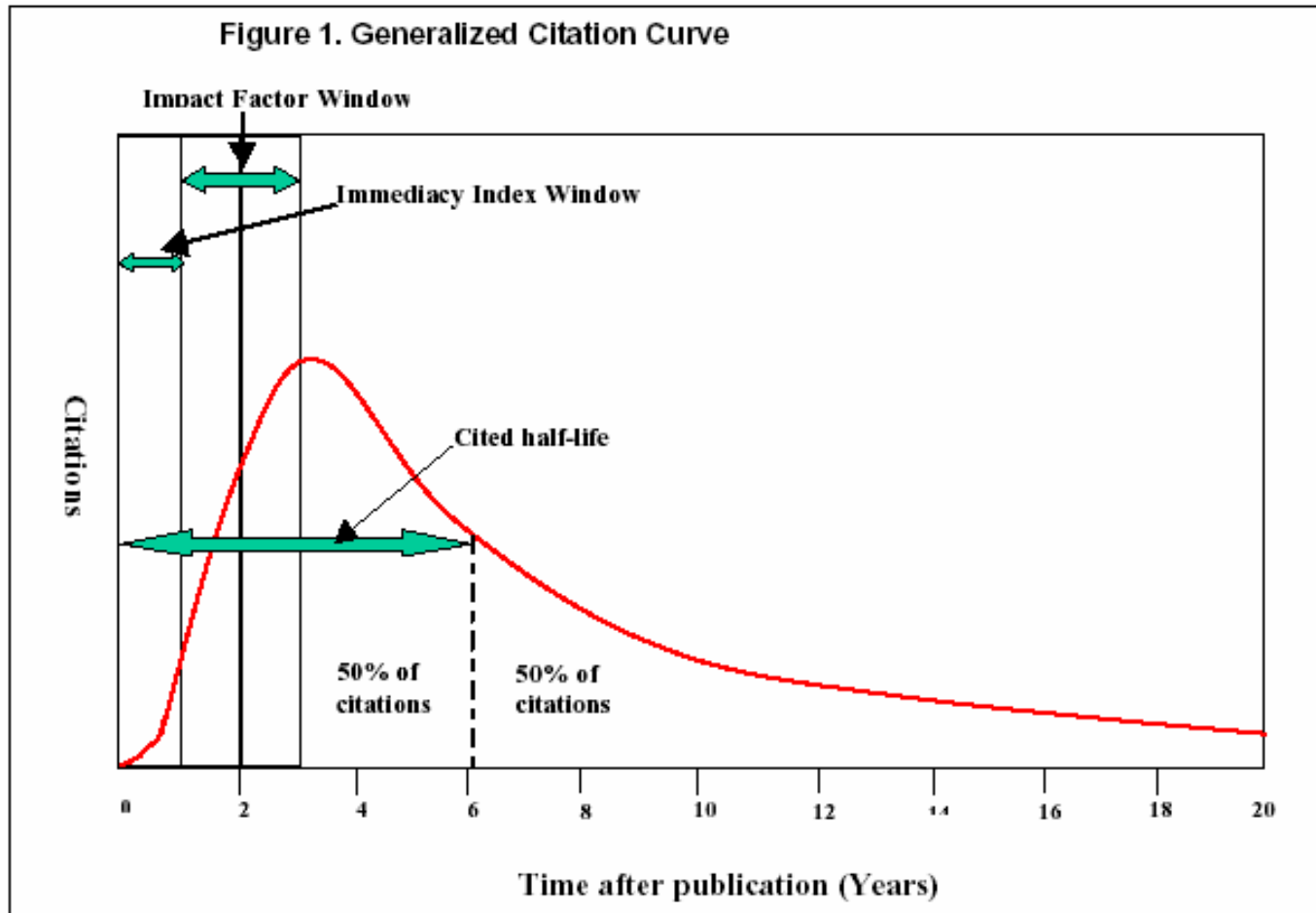
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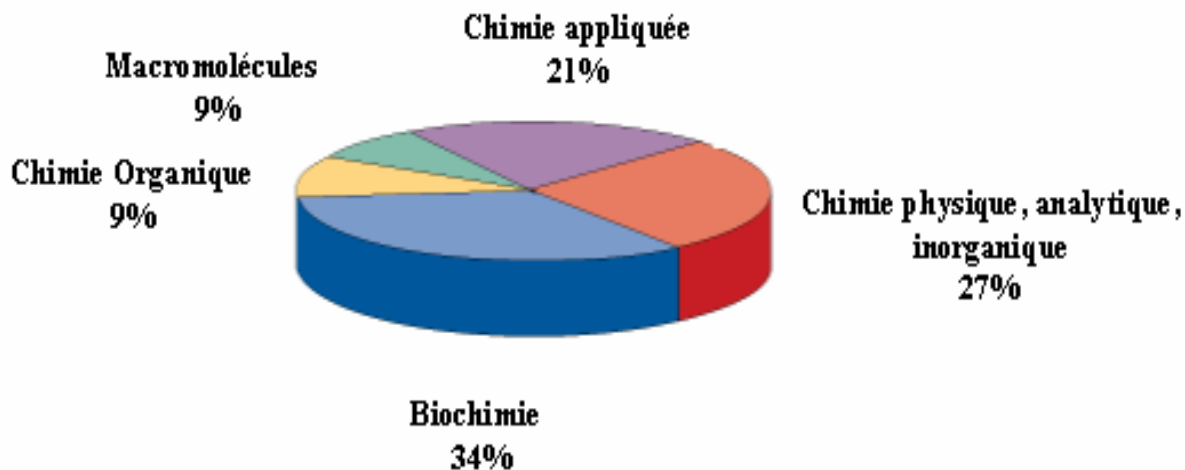
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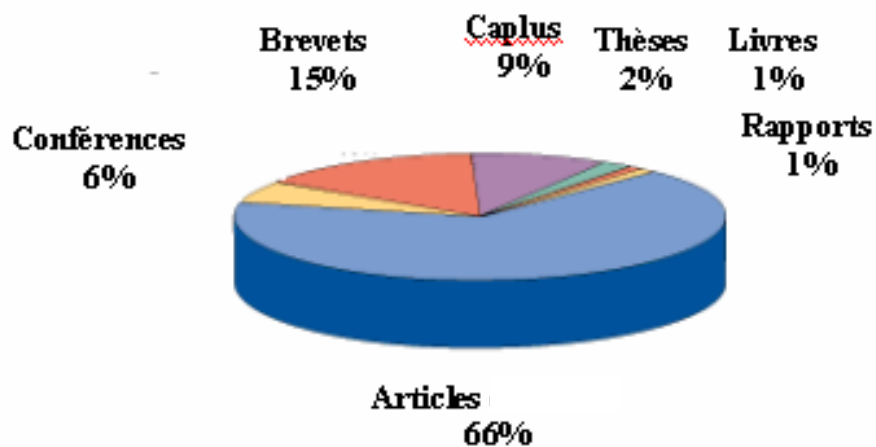
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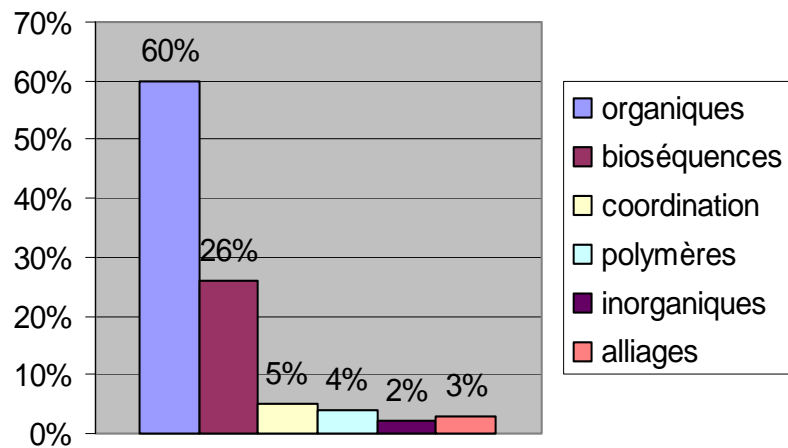


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