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Cognitive Science in France

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The history of cognitive science—briefly defined as the study of mind and of its material underpinnings by the methods of scientific psychology, neuroscience, linguistics, logic, computer science, and philosophy—in France is in some respects a sorry tale. The American psychologist David Premack goes so far as to claim that the very idea was actually conceived in France, thanks in large part to the vision of Jacques Monod, a Nobel laureate and a founding father of French molecular biology; but that national academic institutions stood in the way of the field's growth, with the result that it developed instead in the United States and Great Britain, and was imported years into France later as yet another Anglo-American manufacture. There is some truth in this view: certainly cognitive science has always met with resistance in France. It has, moreover, constantly been beset by internal quarrels. The preeminence of English as the international language of research and communication, as well as France's place on the periphery of the field, have posed additional difficulties for the French community.

Seen from another perspective, however, the development of cognitive science in France is something of a success story, one in which a few talented and far-sighted scientists were able to overcome the opposition of the French academic system and to exploit the few assets available to them. Foremost among these was a small number of outstanding young scholars who, with the support of an even smaller number of equally remarkable senior figures, traveled widely, made themselves known abroad, and came back home to create an international forum for study and research. The result, although not uniformly brilliant, turned out to be far better than might have been expected, and arguably superior to what occurred during the same period in countries of comparable size and intellectual tradition.

Cognitive science has served as a banner and a vector for modes of thought that once were—and to a large extent still are—vastly underrepresented in French academic life, while at the same time encouraging genuinely interdisciplinary approaches in the humanities and the sciences alike. Traditional French strengths in fields such as mathematics, philosophy, history of science, neuropsychology, and psychophysics have given the most prominent French participants in this essentially international enterprise both the confidence to think for themselves (and so to resist buying indiscriminately into every new trend originating in the United States) and sufficient authority to defend them (particularly in debate with their colleagues elsewhere in Europe). Nonetheless, circumstances were long unfavorable to the emergence of cognitive science in France. The obstacles to interdisciplinary education presented by the rigid separation of disciplines in the French academic system and the often unproductive division of labor between the universities and the *grandes écoles* are well known. Nor are the separate disciplines equally prestigious in the eyes of students and their teachers: biology ranks below physics (a situation that may at last be changing), though not by quite the distance that separates psychology from linguistics, which in turn is outranked by

philosophy; applied mathematics and computer science come behind pure mathematics, and so on. What is more, within cognitive science itself the constituent fields are unequal, being weighed by the product, as it were, of the relative standing of the parent discipline with respect to the other main disciplines and of the relative standing of the field within the parent discipline.

A divide of a different sort works to isolate the universities from the *grands organismes* (of which the Centre National de la Recherche Scientifique [CNRS] is the best known), the *grands établissements* (such as the Collège de France and the École des Hautes Études en Sciences Sociales), and, of course, the top *grandes écoles* (École normale supérieure, École Polytechnique, Mines, Télécom, Centrale, and so on). Thus progress achieved in a new field of study or by means of a novel approach within the CNRS, say, or the Collège de France does not automatically penetrate the world of the universities; only at the graduate level, and then only on a very small scale, does meaningful communication actually take place. And then, of course, there is the abiding division between the natural sciences and the humanities in France, which persists in part owing to the dominance within the humanities of extreme versions of historicist and relativist doctrines that run precisely counter to the naturalistic and universalist assumptions of the “cognitive turn”, that is, the attempt to seriously integrate the consideration that agents are systems endowed with a *materially constituted* mind. As a consequence, cognitive scientists, in laying claim to the study of specifically human mental faculties—as opposed to the low-level perceptual and motor abilities that humans appear to share with some, if not most, animals—find themselves cast in the role of a detestable minority.

The force of all these structural and perceptual obstacles was to place the pioneers of cognitive science in France in a weak and defensive position for more than twenty years, from the late 1950s until the early 1980s. This present situation is rather different. Any program (or grant proposal) in the humanities that calls itself “cognitive” now enjoys the sort of official favor experienced by programs in biology in the 1960s that called themselves “molecular”—a circumstance many cognitive scientists consider a mixed blessing. Nonetheless there is general satisfaction that cognitive science has finally carved out a place for itself on the map of French science and philosophy—not as a sect or a craze, but as a genuine intellectual enterprise able to engage in critical interaction with other currents and fields; and that French cognitive science is now firmly established internationally as well, helping to offset the parochial character of postwar French intellectual life (though, predictably perhaps, this has encouraged opinion leaders in cultural circles and the humanities to regard cognitive science as one more dark deed of American imperialism, or *mondialisation* as it is now called).

Cognitive science rests on three core disciplines—psychology, linguistics and neuroscience—and straddles four academic cultures—the humanities and social sciences, the life sciences, engineering, and the exact sciences (physics and mathematics).

The course of French psychology in the twentieth century has to a large extent been determined by three mutually reinforcing choices. It has thought of itself, first, as part of the humanities rather than the life sciences; still today psychology is taught in *facultés de lettres et sciences humaines* rather than *facultés des sciences* (by contrast with the CNRS classification). Second, psychology has all but given itself over to psychoanalysis, or rather to a literary and philosophical form of Freudianism. Despite the tradition inaugurated in the late nineteenth century by Théodule Ribot (1839–1916) at the Collège de France and carried on until the Second World War by Pierre Janet (1859–1947), Henri Wallon (1879–1962), and Henri Piéron (1881–1964), a rigorous experimental approach to psychology had limited space in which to flourish and thereafter owed its subsistence mostly to its links with neurobiology, on the one hand, and pedagogy on the other. Thirdly, in part due to the exceptional personality of Paul

Guillaume (1878–1962), the reigning paradigm in experimental psychology was for a long time *Gestalttheorie* (or *psychologie de la forme*).

Linguistics, on the other hand, had turned away from psychologism and other forms of naturalism in the early 1900s and devoted itself chiefly to historical and comparative investigations. To this day the typical French linguist is first and foremost someone who has mastered a large number of languages. Yet there also was a glorious structuralist tradition, born in the wake of Ferdinand de Saussure's teaching in Paris and developed by Émile Benveniste (1902–1976) and André Martinet (1908–1999) (who, incidentally, taught at Columbia in the United States in the early 1960s, when Roman Jakobson was there, before moving to MIT). There was no fundamental reason why the younger structuralists should have felt the need to oppose Noam Chomsky, and indeed their relations were friendly at first. Yet for reasons that are not entirely clear, but which owe much more to sociopsychological factors than to conceptual differences, most theoretically minded French linguists gradually turned away from Chomsky's research program and tended to side either with American structuralists, themselves anti-Chomskyan, or with homegrown mixtures of empiricism and German expressivism.

Neuroscience (a term coined in the 1970s to encompass neurology, neuropsychology, neuroanatomy, and neurophysiology) got off to a brilliant start in France in the nineteenth century with a line of distinguished physicians and psychiatrists following in the steps of Paul Broca (1824–1880) and Jean-Martin Charcot (1825–1893), as well as a number of eminent figures who held chairs at the Collège de France—François Magendie (1783–1855), Marie-Jean-Pierre Flourens (1794–1867), Claude Bernard (1838–1878), and Étienne-Jules Marey (1830–1904)—where the tradition was carried on after World War II by André Fessard (1900–1982) and Yves Laporte (1920–). Subsequently, however, it faced competition in fundamental life science from molecular biology, on the one hand, and in the clinical sciences from psychoanalytic and existentialist psychiatry on the other. Still, an impressive tradition in neurobiology was upheld by a small number of remarkable figures throughout the twentieth century.

A broader perspective on the development of cognitive science is provided by the various academic cultures in which it grew up. On the one hand, the humanities and social sciences in the 1960s were under the spell of structuralism, which served as an all-purpose and highly ambiguous rallying cry for a variety of scholars seeking an alternative to the prevailing historicist, subjectivist mood, and went some ways toward preparing a new generation of scholars for the cognitive turn. It is not by chance that several of the leading figures on this side of the field today started out as students of the great structuralist masters—Lévi-Strauss, Barthes, Foucault, Althusser, and even Lacan, in retrospect the most removed from their present concern. Structuralism's affinity with logic also had the effect of turning young people in the direction of formal methods and the exploration of what would soon become artificial intelligence.

In the life sciences, a distinctive feature of the French approach is its traditional posture of defiance with respect to evolutionary theory. Alone among the leading countries of science, France has shown an unwavering suspicion of Darwinism. And even though many contemporary cognitive scientists doubt whether Darwin offers any real guidance with regard to their most basic conceptual quandaries, the fact remains that being a staunch evolutionist unquestionably makes it easier to be a committed naturalist, which in turn is an advantage in becoming a productive cognitive scientist.

Progress in engineering in France after the Second World War was handicapped by the indifference shown by mathematicians and physicists to applied science. As a result, the field remained largely unprepared for the conceptual shifts required by the new information-processing paradigm. Even so, for rather the same reasons as in the United States and Britain, military research and development projects gave engineers the opportunity to make important contributions to the design of computers, cybernetic devices, and automatic translation programs. The notorious hostility of French mathematicians, not only to applied mathematics but also to formal logic, had the further consequence that probability theory, signal theory, optimal control, operations

research, and logic—all important for cognitive science—were slow to develop. But because the overall quality of French mathematics remained at very high (even if it has fallen from the top of the international ranking at the beginning of the century to the third or fourth place today), the small number of French mathematicians who did enter those fields rapidly attained a level of excellence. One domain in which French mathematics led, rather than trailed behind, was dynamical systems: the towering figure of René Thom (1923–2002)—a Fields medalist as well as a visionary natural philosopher who attempted to develop mathematically well-founded, “deep” approaches to theoretical biology, linguistics, and psychology—stands out in retrospect as a source of some of the most influential ideas in contemporary cognitive science.

Physicists, for their part, suffered from a superiority complex that prevented most of them from stooping to do work in the empirical sciences. When they did consent to condescend, they showed an interest in models of the brain rather than abstract information-processing systems. Consequently the functionalist program (roughly speaking, the postulation of a level of description at which the relevant processes operate on “information” independently of any physical “realization”), which did so much towards providing cognitive science in the United States and Britain with a unified paradigm, did not make much headway among the most influential French scientists: again, antilogicism got in the way.

The 1960s and 1970s were a decisive period, marked by the convergence of research in artificial intelligence, generative linguistics, psycholinguistics, and functionalist philosophy of mind. The major figures in the field in France today were then graduate or post-doctoral students at universities in the United States and Britain. There the philosophers and social scientists among them received their first exposure to analytic philosophy—particularly the work of Putnam, Quine, Davidson, and Searle, as well as that of Chomsky in linguistics—and to a completely novel way of practicing their trades; meanwhile the mathematicians, biologists and physicists—most of them graduates from the best *grandes écoles scientifiques*—were simply acquiring the tools of their trades, usually without any sense of discontinuity since their teachers in France were fully acquainted with work being done overseas and had sent their students abroad for further study.

By comparison with the American situation, cooperation among the groups that were later to join forces and together form the cognitive science community in France was very limited, each developing initially in isolation from the others. Sometimes they ignored each other; sometimes they viewed each other with suspicion; in some cases they were simply unaware of one another’s existence. As a result, France missed out on the founding phase of cognitive science, which is often said to have been born at MIT in 1956. At the outset in France there were five main groups of researchers. The first was made up of specialists in computer science—what in France is known as *informatique*, originally a branch of applied mathematics. Undeterred by repeated failures to develop an internationally competitive computer industry, a number of mathematicians—notably René de Possel (1905–1974) and Jean Kuntzmann (1912–1992)—joined with physicists and engineers in the early 1960s to create the first institutes, in Grenoble and Paris, devoted to both the theory of computer design and computation, on the one hand, and practical applications on the other. In 1967 the government-supported Institut de Recherche en Informatique et Automatique (IRIA, soon to be renamed INRIA) was established, and computer science departments (or programs within mathematics departments) multiplied both within universities and the CNRS. France’s strong mathematical tradition favored the development of an original school of theoretical computer science intimately linked to logic and general algebra. In the years since, the work of Marco Schutzenberger (1920–1996), Alain Colmerauer (1941–), Jean-Louis Krivine (1940–), Jean-Yves Girard (1945–) and others has had a considerable impact worldwide. The structuralist fashion in social science encouraged an early interest in

computer science as well, particularly among linguists, who inaugurated an active tradition in natural language processing. The group led by Maurice Gross (1934–2001) at Jussieu in Paris, along with teams in Nancy and Grenoble, went on to achieve international renown.

A second, considerably smaller group was made up of conceptually minded cyberneticians, philosophers, biologists, engineers, and physicists who took their lead, in large part, from the original cybernetics of Wiener and von Neumann. In 1957 they established a society now known by the name it acquired eleven years later—the Association Française pour la Cybernétique, Économique et Technique (AFCET)—which exerted a certain measure of influence on intellectual life at large, through books and a few university chairs, despite its modest scientific contribution. At the head of this small vanguard was the Groupe des Dix, an informal association of politicians, biologists, industry leaders, engineers and public intellectuals (among the best known were Edgar Morin, Henri Laborit and Henri Atlan) who gathered periodically between 1969 and 1976 and who sought, very much in the spirit of the Macy Conferences (held between 1946 and 1953 in New York and Princeton) and the Hixon Symposium (held in 1948 at Caltech), to devise radically new solutions to political and social problems through the study of complex, self-organized biological systems—brain, mind, and society being regarded as instances of a general type that also included artificial systems such as computers and formal neural networks.

The third group was made up of generative linguists who gathered mostly in the linguistics department of the new university (Paris–VIII) that had been created at Vincennes in the wake of the 1968 uprising. A remarkable number of outstanding young teachers—among them Nicolas Ruwet (1932–2001), Gilles Fauconnier (1944–), and the American Richard Kayne—and students—mostly foreign, such as the Italian Luigi Rizzi—made Vincennes a leading center for the study of Chomskyan syntax, which attracted the attention of a wide circle of linguists, philosophers, logicians, and psychologists, not all of whom were primarily interested in generative grammar.

Experimental psychologists and neurobiologists formed a fourth group, comparable in size and variety to the first. The physiologists, many of them trained as doctors of medicine, belonged to an illustrious tradition and wielded power and prestige, holding high positions in the Collège de France, Académie des Sciences, and the Sorbonne. Having gained the trust of officials at the CNRS, which grew to considerable proportions during these years, they were able to build up important laboratories while at the same time traveling abroad and interacting with the international scientific elite. A typical figure is Jacques Paillard (1920–), a student of Fessard and a pioneer of electroencephalograms, Vincent Bloch (1925–), Jean Bancaud (1921–1993). Paillard became head of the Institut Neurophysiologique et Psychophysiologique (INP) in Marseilles—the first institute of cognitive neuroscience in France—in 1970 and later, together with the American psychologist Lawrence Weiskrantz, founded the European Neuroscience Association. Another leader was Pierre Karli (1926–), who after a year at Johns Hopkins in the mid-1950s became a leading figure in Strasbourg while gaining international fame for his work on motivation and aggression. In the next generation, Michel Imbert (1935–), Marc Jeannerod (1935–), and Alain Berthoz (1939–) came to prominence in the 1980s as leaders of the now predominant neuroscience wing of cognitive science.

The psychologists were in a much weaker social position. Often philosophers by training, they led difficult and rather marginal academic lives in impoverished *facultés des lettres*. Outside France, French-speaking havens for work in non-psychanalytic branches of psychology were found in Belgium (with such figures as Albert Michotte, Marc Richelle and later Paul Bertelson) and Switzerland (with Jean Piaget—whose Centre International d'Épistémologie Génétique owed its existence to the Rockefeller Foundation—and Bärbel Inhelder, his closest collaborator and successor in Geneva). In France itself, the École Pratique des Hautes Études (EPHE), and later its sixth section, which became the École des Hautes Études en Sciences Sociales (EHESS)—archetypal

“patches” on the chronically ailing university system—supplied a niche in which research in cognitive psychology could blossom. One man (himself an *agrégé de philosophie*) played a key role: François Bresson (1921–1996), whose Centre d’Étude des Processus Cognitifs et du Langage (CEPCL), founded in 1962, was the heart of cognitive psychology in the country for a generation. There are few cognitive psychologists active in France today who have not spent time in his laboratory, which in 1970 moved into the newly created Maison des Sciences de l’Homme on Boulevard Raspail. One particularly promising recruit was the Argentinian-born Jacques Mehler (1936–), who had abandoned chemistry for psychology and, after a year spent with Piaget following the completion of his doctorate at Harvard, almost accidentally moved to Paris, eventually settling there for good. A specialist in psycholinguistics and the pioneer of a new approach to the study of infants, he cofounded the influential journal *Cognition* in 1972, thus putting CEPCL at the center of international cognitive science. In 1986 Mehler succeeded Bresson as head of the lab, changing its name to Laboratoire de Science Cognitive et Psycholinguistique, and went on in his turn to train a great many of the next generation of French cognitive psychologists.

The fifth group relates to the third and fourth in somewhat the way the second relates to the first: it constituted a small, self-appointed vanguard, recruited from the same professional ranks, but with greater intellectual and social ambitions. The catalyst was Jacques Monod. In 1974, together with Edgar Morin and one of his own students at the Institut Pasteur, an Italian biologist (originally trained as a physicist) named Massimo Piatelli-Palmarini, he set up the Centre Royaumont pour une Science de l’Homme, a think tank-cum-conference center whose staff included an elite group of biologists, psychologists, anthropologists, sociologists, and historians. Royaumont hosted several important meetings, the best-known of them being the 1975 debate between Jean Piaget and Noam Chomsky. The American side included, in addition to Chomsky, Jerry Fodor, Seymour Papert (himself a Piaget student), Hilary Putnam, David Premack, and a young anthropologist, Scott Atran, who played a key role in the encounter and has continued to be a crucial transatlantic go-between ever since. On the French side were Mehler, the anthropologist Dan Sperber (1942–), a young molecular biologist named Jean-Pierre Changeux (1936–) who was already a professor at the Collège de France, and the mathematician René Thom and his student Jean Petitot (1944–). Geneva was represented by Piaget, Inhelder, and Guy Cellérier. The volume that grew out of the conference has become a classic of cognitive science, translated into twelve languages.

The early 1980s witnessed something close to what physicists call a transition phase: within a comparatively very short time, the situation underwent a qualitative change in many locations at once, with no intervention by a coordinating agency.

François Mitterrand was elected President in 1981. The Groupe des Dix included people close to the new President who were able to enlist official support for a number of new approaches to technology and applied research. The following year the Centre d’Études des Sciences et des Techniques Avancées (CESTA) was created to develop this agenda. CESTA subsequently became the home to two infant research groups: the Centre de Recherche en Épistémologie et Autonomie (CREA), and the Laboratoire de Dynamique des Réseaux (LDR). CREA grew out of a conference on self-organization that Jean-Pierre Dupuy (1941–), a top *polytechnicien* turned maverick economist, had organized in Cerisy in 1981. It involved a highly diverse group of people that included philosophers and political scientists in addition to biologists and computer scientists. LDR subsequently became a workshop for the more technically-oriented among them. Led by Henri Atlan, their aim was to develop ideas that soon were to become famous under the name of *connectionism* (or, more accurately, *neoconnectionism*, following on as they did from the original program of Warren McCulloch and Walter Pitts and, later, Frank Rosenblatt).

The timing was right: at exactly the moment when CREA and LDR were being created, a paper published by the Caltech physicist John Hopfield provided a key mathematical insight from solid-state physics that allowed connectionist models—popular once again through the efforts of a few American and British psychologists—to bypass the limitations of a two-layered network such as the “perceptron” devised by Rosenblatt. Whether the new models—known as neural networks—are viewed as models of cortical cell assemblies of the kind postulated in 1949 by the Canadian psychologist Donald Hebb or as more abstract information-processing devices, they represented an instance of partially self-organized systems (especially when studied, as Atlan urged, in a dynamical perspective) and so fit nicely with Dupuy’s approach as well as that of the Chilean-born neurophysiologist Francisco Varela, another founding member of CREA, who drew upon the theory of self-organization in biological systems developed by his teacher Umberto Maturana.

At just this moment yet another group was crystallizing around members of the old Royaumont crowd (Sperber and Atran), a couple of Vincennes linguists (Fauconnier and the Canadian Richard Carter) and psycholinguists (Mehler and the Argentinian Juan Segui), a neuroscientist (Imbert), two young philosophers (Pierre Jacob [1949–] and François Recanati [1952–]), and a logician (Daniel Andler [b. 1946–]). The Friday Group, as it came to be known, had no official status; its members met privately almost every week to discuss a wide variety of topics in the company of a constant flow of visitors from Britain and the United States. This arrangement lasted until 1987: following a conference organized that year in Cerisy by Andler, who in the meantime had joined CREA, the two groups merged. In its new incarnation, CREA—now standing for Centre de Recherche en Épistémologie Appliquée—rapidly became an internationally recognized center for research in philosophy of cognition, pragmatics, cognitive anthropology, economics, and the theory of complex systems. Thanks to a combination of novel ideas, imaginative and skillful leadership, the ample resources of the École Polytechnique (of which CREA was formally a part), and the rather sudden governmental decision to begin funding programs in cognitive science, a *de facto* joint venture emerged that brought together all of the groups of the earlier phase except one—the computer scientists.

But they were not to be left behind. Led by Daniel Kayser (1946–), researchers in computer science and natural language processing had linked up with a group of psychologists of a mostly classical bent. Together, in 1981, they formed an interdisciplinary society called the Association pour la Recherche Cognitive (ARC) that wrote a report on the state of cognitive science in France, organized a major conference, and launched a new journal, *Intellectica*—all this at a time when a number of major computer science labs and institutes were broadening their interests as well. The neuroscientists then intervened, obtaining approval for the funding of facilities in Lyons, Caen, and Paris that could exploit the powerful and expensive new technologies of cerebral imaging. At the head of this effort was Jean-Pierre Changeux, whose best-selling *L’Homme neuronal* appeared in 1983. Rallying a small group of authoritative figures that included Imbert, Berthoz, and André Holley (1936–), Changeux devoted his considerable scientific prestige, willpower, and political skills to the task of persuading the national institutions to dramatically increase budgets for teaching and research. This was the crucial step. By the end of the 1980s, a unified cognitive science community had come into existence at last.

A flurry of activity followed: graduate programs were set up; reports were commissioned by the Ministry of Research and by the CNRS; workshops, prestigious conferences and summer schools brought the international elite to Paris; regional coordination of research laboratories was introduced; special issues of journals and magazines proliferated; additional funding was made available through special-purpose agencies headed by the leading neuroscientists; publishers brought out translations of the leading American authors while at the same time issuing the proceedings of conferences held in France and commissioning books by scholars working in France

(quite a few of them foreign-born); members of CREA joined with colleagues in Britain to form a European Society for Philosophy and Psychology; and, owing largely to the efforts of yet another prestigious neuroscientist, Marc Jeannerod, construction began outside Lyons on the Institut des Sciences Cognitives in the mid-1990s. Cognitive science had finally gained acceptance, becoming something like a normal component of academic life. As if officially to confirm its new status, the École Normale Supérieure founded a department of cognitive studies whose opening coincided with the beginning of the new millennium.

Cognitive science in France today looks rather the way it looks in many advanced countries, with a characteristically idiosyncratic distribution of strong and weak points. To be sure, there are still a great many difficulties to be overcome: universities remain wary of cognitive science; the community itself is still divided (the divisions, unsurprisingly, follow lines that are partly scientific, partly sociological); the present international redirection of cognitive science towards cognitive neuroscience (relatively underrepresented in France) is not to everybody's liking; and last, but not least, the field's welcome in the humanities remains half-hearted. Monod's dream of creating a "biological anthropology" is plainly far from being achieved.

Yet the intellectual landscape has indisputably changed. No longer is analytic philosophy seen as an alien force to be repelled by vigilant defenders of "true" philosophy. Indeed, even if various antinaturalist currents remain strong, they owe their vitality in part to the very challenge of philosophical naturalism arising from recent work in cognitive psychology, psychophysics, neuropsychology, neuropharmacology, and evolutionary theory. The same is true of moral and political philosophy, sociology, economics, and anthropology. Within cognitive science itself one finds the unifying forces of interdisciplinary inquiry everywhere at work: molecular neuroscience is no more able to go on ignoring integrative neuroscience than linguistics can hold itself aloof from psychology; mathematics cannot help noticing that vision research and robotics, no less than functional imaging, furnish some of the most exciting problems it has seen in a long while; computer science has gradually recognized that the virtual reality made possible by the World Wide Web holds out the hope that it may at last become a genuine science of information; even physics is now obliged to admit that the brain poses new and daunting challenges. All of which is grist for the mill of historians of science, who are witnessing with their own eyes an episode that already has prompted them to revise accepted accounts of everything from alchemy to molecular biology.

Further Reading

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