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Referenze e Abstract 1975-2012

D Salmaso

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ABSTRACT

Year of Publication 1976

Authors	Title	Abstract
Salmaso, D.; Denes, G.; De Stavola, G.	Interhemispheric differences in attention to novelty.	Scopo del presente lavoro era quello di determinare il ruolo giocato da ciascun emisfero in un compito di attenzione alla novità, quando lettere e linee sono presentate tachistoscopicamente al campo visivo destro e a quello sinistro. Ventiquattro soggetti destrimani hanno partecipato all'esperimento. La prestazione del soggetto era misurata sulla base dei due tipi di errori passibili: errori falsi negativi e falsi positivi. Indipendentemente dal materiale usato il totale degli errori falsi negativi era maggiore per l'emisfero destro (RH). Per poter separare la componente sensitiva e la componente decisionale della prestazione finale di ciascun soggetto, i dati sono stati anche analizzati sulla base della Signal Detection Theory (SDT). Il parametro d' è maggiore per I'emisfero sinistro nella presentazione verbale e per il destro nella presentazione di linee. Per il parametro beta esiste una differenza tra i due emisferi, in favore dell'emisfero destro, solo per il materiale verbale. I risultati sono discussi sulla base delle conoscenze sulla specializzazione eniisferica. The goal of this study was do determine the part played by each hemisphere in a task of attention to novelty, when verbal and directlonal stimuli are presented tachistoscopically. Twenty-four normal right-handed students took part in the experiment. Performance was scored according to type of errors: false positive and false negative errors. The total of false negative errors was greater for right hemisphere presentations, regardless of the materia1 used. In order to separate sensitivity (d') and decisional components (beta) of the final performance, an analysis of the data according to the Signal Detection Theory was made. d' measure is greater far the left hemisphere in the verbal task and for right in the directional material. For beta there is a significant interhemispheric difference, in the favour of the right hemisphere, only in the verbal material. These results are discussed in terms of reciprocal specializations of functions in the cerebral hemispheres.

Year of Publication 1977

Authors	Title	Abstract
Salmaso, D.; Umiltà, C.	Presentazione al libro di A.R. Luria "Come lavora il cervello. Introduzione alla neuropsicologia"	Questo libro, che nell'edizione italiana appare dopo la scomparsa dell'autore, rappresenta la migliore sintesi delle idee di A. R. Luria sul rapporto esistente tra cervello e processi cognitivi. Luria è certamente il piU conosciuto tra gli psicologi sovietici contemporanei, non solo per la grande quantità di materiale pubblicato, ma anche. per il sempre vivo tentativo di dare alle ricerche o ai casi presentati una sistematizzazione organica. La sua importazione metodologica risente da una parte dell'ambiente clinico in cui ha lavorato dal 1930 in poi, dall'altra delle elaborazioni teoriche della scuola psicologica sovietica (Pavlov, Bechterev, BernStejn), ma è soprattutto dalla collaborazione con Vygotskij e dallo sviluppo di suoi concetti che Luria ricava alcuni principi fondamentali, quali l'origine sociale dei processi psicologici e l'importanza del linguaggio per la loro regolazione, che hanno, soprattutto in questo libro, una risonanza particolare. Lo studio dell'attività mentale umana richiedeva il superamento di uno schema semplificato quale quello della sua riduzione a sistemi di riflessi elementari e il passaggio a un metodo che, pur salvaguardandone gli aspetti essenziali, ne permettesse un'analisi scientifica, Fu Vygotskij che per primo affermò l'importanza delle esperienze sociali nello sviluppo delle attività mentali superiori, ma è soprattutto Luria che l'ha sviluppata e sisrematizzata. L'attività mentale cosciente è u n prodotto sociale perché mediata, nel suo sviluppo, dai rapporti che il bambino ha con l'adulto e si basa su aiuti esterni (linguaggio, numerazione, ...) senza i quali non può realizzarsi, e che diventano allora elementi importanti per la stabiiizzazione delle connessioni funzionali tra singole parti del cervello. E solo grazie a tale interazione sociale che il linguaggio passa da una fase di regolazione esterna, in cui è l'intervento di un adulto a dirigere l'attenzione ed il processo cognitivo, a uno stadio di interiorizzazione deli'attività linguistica, che diventa poi una vera e propria fase di programmazione e autoregolazione.

Year of Publication 1978

Authors	Title	Abstract
Salmaso, D.; Sava, D., Umilta', C.;	Differenze funzionali tra gli emisferi cerebrali nel riconoscimento di vocali e consonanti.	Precedenti ricerche hanno dimostrato che i tempi di reazione (TR) per coppie di lettere uguali sono significativamente inferiori di quelli per coppie di lettere diverse. Analogamente è stata dimostrata la maggiore rapiditià nei TR per coppie di lettere fisicamente uguali (ad es. BB) rispetto a quelle nominalmente uguali (ad es. Bb). Nel presente lavoro si studiano le possibili differenze funzionali tra gli emisferi cerebrali, per entrambi questi paradigmi, in un compito di discriminazione di coppie di vocali e di coppie di consonanti. I risuItati confermano i precedenti risultati sia per quanto riguarda I) la maggior rapidità delle risposte uguali che 2) la minore latenza per le coppie fisicamente identiche; indicano 3) un vantaggio dell'emisfero sinistro per le risposte diverso, 4) una maggiore rapidità nelle risposte uguale a coppie di vocali e 5) differenti modi di elaborazione per le coppie di lettere uguali in rapporto al campo visivo di stimolazione e alla condizione sperimentale. I dati sono discussi nell'amhito di quanto è oggi noto nel campo dell'elaborazione dell'informazione.

Year of Publication 1979

Authors	Title	Abstract
Umilta, C.; Salmaso, D.; Bagnara, S.; Simion, F.	Evidence for a right hemisphere superiority and for a serial search strategy in a dot detection task	In Experiment I the subjects manually signaled whether a solid dot was present or not in an array of empty dots presented either in the right or in the left visual field. The dots were either three or six and the target could appear in any of the possible locations. The results showed (a) a left visual field superiority; (b) a left hand superiority; (c) faster responses to three-dot than to six-dot displays, and (d) an effect of the location of the target in the display. Experiment II exactly replicated the previous experiment with the exception that the stimuli were centrally projected. The results showed: (a) a left hand superiority; (b) an effect of the number of dots in the display. These results can be interpreted to indicate: (a) a right hemisphere specialization in a simple feature detection task without any spatial component; (b) the compatibility of a right-hemisphere advantage with a serial search strategy.

Year of Publication 1980

Authors	Title	Abstract
Bisiacchi, P., Salmaso, D.	Levels of processing in conduction aphasia.	The present work analyzes the hypothesis that repetition deficit in conduction aphasia is caused by an auditory immediate memory defect. Two conduction aphasics were tested on eleven memory trials. The resuits seem to suggest that conduction aphasia is a consequence of a limitation of information processing rather than a storing capacity limitation. This idea is discussed in the light of Craik and Lockhart's model.
Salmaso, D.	Hemispheric differences on a novel task requiring attention.	16 students, 8 men and 8 women, ranged in age from 18 to 25 yr., served as subjects in an experiment, where 320 pairs of consonants and 320 pairs of lines were presented tachistoscopically to the left and to the right visual field. One pair, both for letters and for lines, constituted the nonsignal event and the remainder the signals. A high event rate and a low signal density were used. Subjects were instructed to press a key when a signal had been presented. Performance was scored according to nonparametric estimates of sensitivity and criterion. The main results were a clear-cut dissociation between the two measures, a greater sensitivity for the presentation in the right visual field, irrespective of the type of material, and different effects on detection and response bias for men and for women. The importance of these findings with respect to lateralization and information processing is discussed.
Salmaso, D.	Vygotskij, Lurija e la neuropsicologia.	Una delle tesi fondamentali della psicologia sovietica è che la natura dei processi mentali superiori non può essere compresa che attraverso un'analisi scientifica, attraverso cioè uno studio delle basi materiali che rendono possibile lo svolgimento di tali processi. Se inizialmente queste basi sembravano essere trovate in una riduzione dei processi mentali a sistemi di riflessi elementari, si venne tuttavia progressivamente a sviluppare l'idea che tale riduzione non rendeva conto delle piU complesse attività mentali umane. Gran parte dell'attività umana è influenzata dail'esperienza passata e controllata da piani e programmi che autonomamente l'uomo si crea. Se si voleva evitare che i processi mentali superiori rimanessero aperti a delle speculazioni soggettive, occorreva un modo radicalmente diverso di affrontarne l'analisi. E' a Vygotskij e alla sua scuola che va il merito di aver indicato un punto di partenza radicalmente differente. Al totale rifiuto di considerare una base materiale per i processi mentali superiori e al tentativo di considerare anche questi processi come naturali innate proprietà del cervelio ognuno direttamente legato ad una singola zona della corteccia cerebrale, Vygotskij oppose una concezione storica. L'origine dei processi mentali piU elevati

Authors	Title	Abstract
		doveva essere cercata al di fuori dell'organismo umano, nella storia sociale, nello sviluppo e nell'uso degli strumenti, ma soprattutto nella formazione del linguaggio.
Umilta', C.; Sava, D., Salmaso, D.	Hemispheric asymmetries in a letter classification task with different typefaces.	Two experiments used M.I. Posner's paradigm to investigate hemispheric asymmetries in coding. In Experiment I the stimuli were print-like letters and produced name matches faster in the left than in the right hemisphere, while for physical matches there was no lateral asymmetry. In Experiment II the stimuli were script-like letters and showed the expected opposite lateral asymmetries for name matches (faster in the left hemisphere) and physical matches (faster in the right hemisphere), although in the latter case the effect was clear. In both experiments, different responses showed no hemispheric role of linguistic and visuospatial processing in determining hemispheric asymmetries for name and physical matches.

Year of Publication 1981

Authors	Title	Abstract
Salmaso, D.	Vigilanza e specializzazione emisferica.	L'articolo passa in rassegna la letteratura sulla vigilanza con lo scopo particolare di determinare la consistenza dell'ipotesi che l'attenzione sostenuta e l'attenzione selettiva siano distintamente lateralizzate. L'ipotesi proposta è infatti che l'emisfero destro sia specializzato per l'attenzione sostenuta mentre il sinistro per quella selettiva. Vengono considerate le caratteristiche rilevanti per la possibile distinzione tra questi due tipi di meccanismi. Vengono analizzati in modo particolare due fattori: la complessità del segnale e la sua densità. L'emisfero destro benché apparentemente predominante in situazioni semplici, sembra incapace di estendere la sua superiori& a segnali più complessi o quando sono implicate delle incertezze temporali. Le asimmetrie emisferiche sono anche valutate alla luce dello specifico runlo giocato da ciascun emisfero nell'analisi dell'informazione. Un altro fattore analizzato è la lunghezza del compito. I dati sin qui disponibili non permettono di formulare precise conclusioni né su quanto debba essere lungo un compito per provocare un declino della capacità, né se i due emisferi si comportano distintamente. In conclusione non sembrano esserci allo stato suffcienti elmenti per definire in modi preciso il contributo di ciascun emisfero nella vigiianza. The paper reviews the iiterature on vigilance. A partcular goal of the review was to deternine whether the hypothesis of a differential hemispheric specialization for sustained versus selective attention could be supported.

Authors	Title	Abstract
		The hypothesis of diflerentiai hemispheric specialization for attention mechanisms considered, rnaintains that the right hemisphere is specialized for sustained attention while the left hemisphere is specialized for selective attention. Features relevant to a possible distinction between the two attention mechanisms were considered in terms of hemispheric differences. The two major factors in vigilant experiments taken in consideration were signal complexity and signal density. While the proposed hypothesis could easily accomodate much of the reviewed material, there remains a not insignilicant part of the literature which cannot easily he explained in terms of the hypothesis. The right cerebral hemisphere, though apparently predominant in simple situations, is unable to extend this superiority when more complex signal or temporal uncertainty are involved. Hemispheric asymmetries are also evaiuated in light of the specific role played by each hemisphere in information processing. Another factor analyzed is task length. The data now availahle do not allow firm conciusions neither on how long a task must be to promote a decline in performance nor on whether the two hemispheres behave diflerently as a function of task length. A reanalysis of the resuits on all three factors considered in terms of signal detection theory (S.D.T.) promises to reconcile some apparentiy conficting results. In conclusion, a review of vigilance experiment that have studied the cerebral basis for this mental action suggest that even an optimistic interpretation of the resuits does not allow a clear account of the contribute of each hemisphere to Vigilance.

Year of Publication 1982

Authors	Title	Abstract
Salmaso, D.	Il computer nella ricerca psicofisiologica.	La rivoluzione tecnologica in atto nel mondo per effetto delio sviluppo deli'elettronica, in particolare grazie alla realizzazione dei circuiti integrati, su vasta scala prima (LSI) e su vastissima oggi (VLSI), è d i tale importanza e d i tale portata che è impensabile ritenere che la psicologia non ne sia interessata. Lo sviluppo di tali circuiti integrati (IC) su materiale base costruito da silicio permette oggi di concentrare in un unico CHIP di piccolissime dimensioni migliaia e migliaia di funzioni che con l'elettronica tradizionale dovrebbero essere svolte da milioni di transistors con l'occupazione fisica di centinaia di metri cubi. La tecnologia che sta alla base della microelettronica è tuttavia altamente costosa, ammortizzabile soltanto con grossissimi livelli di produzione. Come conseguenza di ciò i principali costruttorl hanno da una parte favorito l'utilizzazione di questi componenti in

Authors	Title	Abstract
		campi estremamente diversi, dall'altra hanno cercato di costruire degli IC il più generali possibili. Gli effettl più evidenti di tale rivoluzione si possono trovare in molti campi della nostra vita quotidiana, dalle piccole calcolatrici ai timer, dai videogiochi alle lavatrici . Ma l'elemento più interessante di tale rivoluzione è sicuramente l'introduzione sul mercato del "microprocessore". Sviluppato solo negli ultimi dieci anni, lo si può definire come un circuito integrato capace di ricevere informazioni, analizzarle, memorizzarne il risultato e spedire tali informazioni e/o i l risultato dell' analisi ad un qualsiasi altro output. Il microprocessore può essere programmato e quindi le sue funzioni possono essere svolte in qualsiasi sequenza. E ' tale caratteristica che sta alla base della sua flessibilità rendendone possibile l'uso in campi molto diversi e di differente complessità. Grazie a ciò gli alti costi di realizzazione possono sempre più essere suddivisi su livelli di produzione sempre più alti riducendone cosi il costo ormai a poche migliaia di lire. Il microprocessore è la parte centrale di un computer ed insieme ad almeno altri 2 elementi, un chip di memoria e un altro chip dedicato al controllo input-output, forma un computer operativo. Alla sua accensione, il computer può fare due cose distinte: 1) se si t r a t t a di una "macchina dedicata", eseguire tutta una serie di istruzioni residenti in un chip di memoria atte a compiere delle funzioni prestabilite; 2) mettersi i n attesa di ricevere delle istruzioni da un operatore umano o più in generale da una qualsiasi unità che comuniche con esso.
Salmaso, D.	Vigilanza e Specializzazione Emisferica.	L'articolo passa in rassegna la letteratura sulla vigilanza con lo scopo particolare di determinare la consistenza dell'ipotesi che l'attenzione sostenuta e l'attenzione selettiva siano distintamente lateralizzate. L'ipotesi proposta è infatti che l'emisfero destro sia specializzato per l'attenzione sostenuta mentre il sinistro per quella selettiva. Vengono considerate le caratteristiche rilevanti per la possibile distinzione tra questi due tipi di meccanismi. Vengono analizzati in modo particolare due fattori: la complessità del segnale e la sua densità. L'emisfero destro benché apparentemente predominante in situazioni semplici, sembra incapace di estendere la sua superiori& a segnali più complessi o quando sono implicate delle incertezze temporali. Le asimmetrie emisferiche sono anche valutate alla luce dello specifico runlo giocato da ciascun emisfero nell'analisi dell'informazione. Un altro fattore analizzato è la lunghezza del compito. I dati sin qui disponibili non permettono di formulare precise conclusioni né su quanto debba essere lungo un compito per provocare un declino della capacità, né se i due emisferi si comportano distintamente. In conclusione non sembrano esserci allo stato suffcienti elmenti

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Salmaso, D.; Denes, G.;	Role of the frontal lobes on an attention task: a signal detection analysis.	Sensitivity and criterion were studied on an attention task requiring detection of new stimuli for a group of 20 patients with unilateral hemispheric damage restricted to the anterior or posterior areas. Patients performed a simple attention task, in which the presence of a novel stimulus had to be detected against the repetition of the same stimulus repeated. Only the site of the lesion (anterior vs posterior damage) influenced the performance of the task. In fact, frontal patients had both lower capacity to discriminate between signals and nonsignals and lower confidence in their responses.

Authors	Title	Abstract
Salmaso, D.; Umilta` , C.	Vowel processing in the left and right visual fields.	Two laterality experiments were conducted to assess the performance of the left and right hemispheres in a letter classification task using only vowel pairs. In Experiment I stimuli were presented in a print-like form and neither physical nor name matches yielded hemispheric asymmetries. Experiment II, by using script-like vowels, showed an overall advantage of the right hemisphere for both kinds of match. These findings suggest that physical matches and name matches for print-like vowels are performed by both hemispheres. The right-hemisphere advantage for script-like letters is attributable to the higher-order level of spatial processing required by this material.

Year of Publication 1983

Authors	Title	Abstract
Antinucci, F., Salmaso, D.	Modelli di confronto tra frase e figura.	Molti studi di psicolinguistica hanno usato la tecnica della verifica di una frase con una sua rappresentazione visiva come modo di studiare sperimentalmente fattori linguistici che interessano la comprensione di una frase. Si assume generalmente che questo tipo di compiti richiedano: a) una codificazione della frase e dell'immagine seconda una rappresentazione interna comune e b) un confronto delle due rappresentazioni omagenee così ottenute. Per quanto riguarda a) cioè la forma della rappresentazione interna, sono stati proposti vari modelli. Ad esempio Clark (Clark and Chase, 1972; Clark, 1976) favoriscono un modello in c u i la codificazione prende la forma di una rappresentazione astratta in predicati simile a una rappresentazione semantica profonda. Glucksberg. Trabasso e Wald (1973) sono favorevoli a un formato simile a quello della grammatica dei casi. Wannemacher (1974.1976) propone un tipo di rappresentazione basato sulla struttura superficiale. D'altra parte, un più largo consenso sembra esistere sulla natura di (b), cioe' sul processo di confronto. Per quanto riguarda cio', tutti i modelli citati precedentemente condividono alcune assunzioni fondamentali. che possono essere cosi' riassunte: il processo di confronto e' seriale, passo dopo passo. autoterminante, cioe', qualunque sia il formato della rappresentazione interna. il confronto procede un elemento dopo l'altro e termina non appena vi e' informazione sufficiente per dare la risposte di "vero" o "falso". Come vedremo i risultati del nostro esperimento mettono in dubbio proprio queste assunzionì.
Bagnara, S, Diani, M, Salmaso, D.	Lavoro mentale e automazione d'ufficio.	La progettazione e l'introduzione dell'automazione d'ufficio fanno solitamente riferimento ad analisi del lavoro che si basano sulla identificazione e misurazione delle attività visibi/i

Authors	Title	Abstract
		necessarie per l'esecuzione dei compiti. Viene trascurato che queste attività prevedono delle operazioni mentali specifiche, degli automatismi particolari che si sviluppano con l'esperienza lavorativa, delle strategie cognitive adeguate per la soluzione dei problemi e differenti livelli di impegno mentale. Non viene inoltre considerato che nell'esecuzione di una qualsiasi attività mentale un operatore deve tener conto non solo dell'informazione relativa al compito ma anche delle informazioni riguardanti la strurrura organizzativa dentro le quali il compito si colloca. L'irnpegno mentale e l'elaborazione dell'informazione (il carico mentale organizzarivo) da parte dell'operatore varia anche in funzione del tipo di struttura organizzativa e del modo in cui le informazioni relative sono presentate e debbono essere trattate. La mancata considerazione di queste variabili conduce ad una scarsa compatibilità dell'ufficio automarizzato con le abilità umane e a una caduta dell'affidabilità e dell'efficienza previste. Di qui una delle radici degli atteegiamenti di opposizione e delle difficoltà nell'introduzione dell'automazione d'ufficio.
Delle Cave, V., Panunzi, P., Perusini, G., Salmaso, D.; Salsano, A.	An applied psychology laboratory: the visual and acoustical perception stations	The problern of an applied psychology laboratory is faced: the solution proposed consists in several independent intelligent perception stations, usable as stand-alone terminal or connected viith a small persona1 computer. Possible irnplementations of the visual and acoustical perception stations are presented: visual and acoustical stirnula of different features can be produced in a programmed way and reaction times can be easily rnonitored with microprocessors-based systems which are one order cheaper than the currently used rnachines.
Salmaso, D.; Longoni, A.M.	Hand preference in an Italian sample.	A hand-preference questionnaire was administered to 1694 Italian adults. Analysis indicates no relationship of sex and handedness and a percentage of 6.4 left-handers. The difference in percentage of left-handers across different populations is discussed in terms of cultural differences.
Salmaso, D.; Umilta', C.	Hemispheric differences for consonant and vowel processing in the visual modality.	In this paper we will discuss some data about the specific role of the two cerebral hemispheres in the processing af alphabetical material. The basic experinental paradigm employed is a same-different letter clasiification task. As shown by Posner (1969), a pair of visually presented letters as "B B" may be classified as "Same'' faster than a pair of letters like "B b". In the first case the letters are physically identical (and, of course, have the same name). while the second ones share only the same name. The longer RT of the latter pair can be attributed to the linguistic processing of the tuo letters, that is of their names. while same responses ta tuo identica1 Ietters can be based on

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		their physical characteristics. Thus, this paradigm seems to be useful to study the specialized mechanisms of the tuo hemispheres involved in processing alphabetical material. It is known that left and right hemispheres hold anatomical and functional differences. Since the Broca's (1861, 1855) observations of quite different effects of the damage of the left hemlsphere as compared with that of the right, many studies have shown that the left hemlsphere is better to analyse verbal stimuli and the ripht to analyse nonverbal and spatial configurations. However, it is quite clear today that the verbal-nonverbal dichotomy is purely descriptive and does not capture the basic mechanisms that underlie functional hemispheric asymmetries (Moscovitrh, 1979). The studies with split-brain patients have shown that. although relatively incapable of producing either written or spoken language, the rigth hemisphere (RH) can understand simple and complex syntactical construction (Seariiorn. 1977; Zaidel. 1978). Here we want to discuss only of the first and oldest dichotomy. that is the verbal-nonverbal one. The general idea which is generally accepted in recent researches is that it is not the type of stimulus to determine which hemisphere is dominant. but rather the type of information processing required to perform the experimental task. In other words. if only visual recognition is called for, even when the stimulus material is verbal. the right hemlsphere prevails. On the contrary, if a verbal transformation is demanded. even when the material is nonverbal, the task is performed by the left hemisphere.

Year of Publication 1984

Authors	Title	Abstract
Burani, C., Salmaso, D.; Caramazza, A.	Morphological structure and lexical access.	The three experiments reported in this paper addressed the question of whether the frequency of the root-morpheme of a word (e.g., "sent" from "sentire", to hear) or che frequency of the surface form of a word (e.g., "sentito", heard) determines decision latencies in a lexical decision task. The results indicate that both root-morpheme and word surface frequency contribute to variation in lexical decision times supporting previously reported experiments by Taft (1979). We argue that these results support a model of lexical organisation that represents words in morphologically decomposed form. We also propose, however, that the address procedure for these representations does not require that the stimulus input be parsed into roots and affixes but that they can be addressed through a whole word address system.

Authors	Title	Abstract
Longoni, A.M., Salmaso, D.	Preferenza laterale e disturbi dell'apprendimento.	La diversa connotazione semantica attribuita alle parole destro e sinistro che si ripete anche in altre lingue riflette uno stato di pregiudizio verso i mancini che probabilmente ha origini remote nel tempo e sulle cui cause si possono fare solo illazioni. L'uso preferenziale di una mano è una caratteristica della specie umana relativamente stabile nel tempo. Soltanto fra gli uomini infatti si trova che la stragrande maggioranza usa in molte attività quasi esclusivamente la mano destra e che soltanto una piccola percentuale usa invece la mano sinistra.
Mecacci, L.; Salmaso, D.	Evoked potentials by letters in printed and script forms	Visual evoked potentials were recorded for 6 adult male subjects in response to single vowels and consonants in printed and script forms. Analysis showed the vowels in the printed form to have evoked responses with shorter latency (component P1 at about 133 msec.) and larger amplitude (component P1-N1) than the other letter-typeface combinations. No hemispheric asymmetries were found. The results partially agree with the behavioral data on the visual information-processing of letters.

Year of Publication 1985

Authors	Title	Abstract
Bagnara, S, Rizzo, A, Visciola, M, Salmaso, D.	Differential automatization processes as a function of the type of stimuli.	Previous work on visual search (Schneider & Fisk, 1982) has shown that subjects' performances vary as a function of whether stimuli and responses are consistently or variably mapped. For a consistently mapped (CM) condition is meant that across "trials the subject makes the same overt or covert response each time the stimulus occurs"; whereas a condition is classified as variably mapped (VM) when "responses changes across trials" (Schneidera, 1984). While CM conditions yield large practice effects, VM conditions do not show any improvement in subjects' performance "even after thousands of trials" (Schneider & Fisk, 1982). These differential practice effects are attributed to the fact that stimuli and responses should be processed automatically in CM conditions, and under control in VM conditions. Automatic processing is thought as "fast, parallel, fairly effortless, and not under subjects'control". To the contrary controlled processing should be "slow,generally serial, effortful, capacity-limited, and subject-regulated" (Schneider et al. 1984). Finally, Fisk & Schneider (1981) suggested that vigilance decrements are expected when controlled rather than automatic processing takes place.
Gerbino, W, Salmaso, D.	Un'analisi processuale del completamento amodale.	Il completamento amodale comporta effetti funzionali simili a quelli riscontrabili con le figure modalmente complete. L'osservazione fenomenologica non fornisce sufficienti

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		informazioni sui processi sottostanti il realizzarsi di tali forme di organizzazione percettiva. Pertanto, qui cerchiamo di analizzare i processi di completamento mediante un compito di confronto simultaneo tra una figura completa ed una composizione di regioni adiacenti, che appaiono come una superficie completa parzialmente nascosta da una superficie interposta. Le inferenze sui tipi di elaborazione sono basate sulla velocità con cui viene identificata una figura completata rispetto ad una equivalente figura troncata (Esperimentl 1-3) o rispetto ad una figura aperta (Esperimento 4). In tutti i casi si evidenzia una chiara facilitazione per la situazione di completamento. Negli Esperimenti 5-7 abbiamo anche controllato se il completamento è una soluzione privilegiata o se la disambiguazione è influenzata dal compito. I risultati indicano che le caratteristiche della figura isolata, completa o manipolata, orientano la generazione delle soluzioni percettive.
Rossi, B., Salmaso, D.	Mancino se e' possibile.	Una descrizione del mancinismo nella scherma che consente un confronto con i dati rilevati sulla popolazione normale. Risultati: un ridimensionamento delle percentuali di mancini riportate nella letteratura sportiva che non possono essere considerate realmente descrittive del fenomeno, la dimostrazione che vi è un quadro di preferenze sinistre consistentemente maggiore nel campione di schermidori, la quasi totale assenza di soggetti che, per ragioni strategiche, usano una mano per combattere diversa da quella preferita abitualmente.
Salmaso, D.	Deficit o supercapacita'.	Alcuni recenti lavori, di cui la stampa si e' particolarmente interessata, hanno contribuito in modo significativo a rafforzare l'ipotesi di un'origine biologica e non culturale o sociale del mancinismo. I lavori a cui mi riferisco riguardano la dimostrazione da parte di Geschwind e Behan che i mancini hanno maggiori probabilità' di presentare alcuni disturbi cognitivi, alcune particolari forme di emicrania, di allergie e altri disturbi di tipo immunitario. All'origine di questi deficit ci sarebbe, secondo questi ricercatori, un'anomala produzione di testosterone durante la vita fetale. Il secondo e recentissimo lavoro e' quello della neuropsicologa S. Witelson, la quale analizzando, post mortem, 42 cervelli umani ha rilevato che i soggetti mancini hanno il corpo calloso, la più larga struttura di connessione tra gli emisferi cerebrali, più esteso dei soggetti destrimani. Altri dati neuroanatomici erano gia' conosciuti sulle differenze di organizzazione cerebrale tra destrimani e mancini, cosi' come e' noto che vi e' una componente ereditaria e che la maggior preferenza nell'uso della mano destra e' un tratto indipendente dalla cultura, dalla posizione geografica e dall'epoca storica. L'uso

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		prevalente della mano destra e' pertanto un'evidente asimmetria di comportamento che si correla strettamente con l'evoluzione dell'uomo e del suo cervello in particolare.
Salmaso, D.	Preferenza manuale ed aspetti ergonomici.	Il ruolo esercitato dalla normale preferenza manuale, per la maggior parte destra, nell'utilizzo di strumenti di lavoro o di oggetti di uso comune e' in larga parte tutta da indagare. In assenza di dati di questo tipo e' necessario poter disporre prima di tutto di dati normativi sulla distribuzione delle preferenze che si ottengono su attivita' normali. Ma quello che sembra piu' importante e' lo sviluppo di una metodologia di studio che permetta di arrivare ad una piu' corretta definizione e valutazione dei problemi riguardanti la preferenza manuale e la sua origine biologica e neurologica.
Salmaso, D., Longoni, A.M.	Problems in the assessment of hand preference.	Hand preference for the original items proposed by Oldfield (1971) and information concerning age, sex, familial sinistrality were obtained from a population of 1694 subjects. An item analysis was performed which resulted in the elimination of some of the items. Handedness distribution derived on the basis of the selected items was compared with the distribution obtained on the basis of the Oldfield's selection. Results show that handedness distributions depend on item selection, familial sinistrality and age, while no effect of sex is found.
Salmaso, D.; Mecacci, L.	Frequenze spaziali e loro effetti sulla latenza di risposte e sul campo visivo di presentazione.	Per studiare l'effetto che stimoli periodici hanno sulla latenia di risposta e sul campo visivo di presentazione, sona stati condotti due esperimenti. Nel primo esperimento gli stimoli sono presentati in visione centrale, mentre nel seconda sono inviati casualmente al campo visivo sinistro e destro (CVS e CYD). In entrambi gli esperimenti la latenza di risposta è modificata dalla frequenza spaziale dello stimolo. In presentazione periferica rimane questa relazione globale, che interagisce tuttavia con il campo visivo; infatti stimoli periodici con più elevata frequenza sono elaborati più velocemente dal CVS. I risultati sono interpretati sulla base deli'attività di due sistemi visivi distinti, suggerendo I'ipotesi che la specializzazione emirferica possa anche essere trovata a livelli elementari dell'analisi dell'informazione.

Year of Publication 1986

Authors	Title	Abstract
Salmaso, D., Viola, G., Lucioli, R.	Differenze quantitative e qualitative tra giovani ed anziani nella	Il titolo del convegno "L'invechiamento tra paura e desiderio", riassume bene la problematica psicologica insita nell'invecchiamento. Vi è da una parte infatti il desiderio di poter vivere I'invecchiamento e dall'altra la paura che questo stato si

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	velocita' di risposta.	accompagni a delle modificazioni sostanziali fisiologiche e psicologiche capaci di mettere in crisi la propria individualità. Lo studio dell'uomo è per sua natura uno studio che richiede un approccio multidisciplinare e lo studio di che cos'è l'invecchiamento richiede maggiormente una convergenza di competenza. Inoltre lo studio delle caratteristiche proprie dell'invecchiamento richiede un continuo confronto con le caratteristiche proprie del soggetto adulto non anziano. A parte l'ovvia difficoltà di definire i confini dell'invechiamento, vi è nelì'ambito della psicologia, una maggiore difficoltà nel definire le caratteristiche dei processi psicologici del soggetto adulto non anziano. In realtà tra gli psicologi non vi è affatto concordanza su ciò che deve essere considerato "normale", e ciò che non lo è, con l'ovvia conseguenza che manifestazioni psicologiche patologiche possono essere considerate in modo diverso a seconda dei criteri utilizzati per l'analisi.

Year of Publication 1987

Authors	Title	Abstract
Gerbino, W., Salmaso, D.	The effect of amodal completion on visual matching.	In a series of five experiments, we investigated how amodal completion affects pattern recognition, and tested possible models of processes underlying completion of simple shapes. Inferences about processing models were based mainly upon the comparison of [`]same' latencies in a simultaneous matching task. The major result of experiments 1-4 regards two conditions where a complete target had to be matched with a given stimulus region, belonging to a composite comparison pattern. Matching is faster when this stimulus region is amodally completed than when it looks like an incomplete shape. In experiment 5 we compared complete vs incomplete targets, that were either phenomenally or topographically identical to a given region of the comparison pattern. The failure to show any effect of target completeness suggests that phenomenal identity may be as effective as topographical identity.

Year of Publication 1988

Authors	Title	Abstract
Salmaso, D.	Specializzazione degli emisferi cerebrali nell'elaborazione dell'informazione linguistica.	La maggior parte del lavoro condotto per lo studio delle caratteristiche funzionali di ciascun emisfero portarono inizialmente i ricercatori a ritenere che i due emisferi cerebrali potessero differire sostanzialmente per il TIPO d i stimoli che erano capaci o più abili nell'elaborare. Per ragioni di spazio mi riferirò solo agli studi condotti nella modalità visiva. Una situazione sperimentale tipica è quella che vede la

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		presentazione di stimoli visivi all'uno e all'altro emisfero cerebrale attraverso la tecnica di presentazione tachistoscopica. Attraverso il confronto sull'accuratezza e/o sulla velocità di risposta tra gli stimoli presentati all'emisfero destro e quelli presentati all'emisfero sinistro è possibile stabilire la superiorità dell'uno e dell'altro emisfero per quel tipo di materiale. I risultati condotti inizialmente su soggetti normali, insieme a quelli ottenuti su pazienti con lesioni cerebrali unilaterali, sembravano complessivamente far supporre che ciascun emisfero fosse specializzato unicamente nel trattare un tipo di materiale: l'emisfero sinistro il materiale verbale e il destro quello nonverbale. I primi dati riportavano infatti differenze significative a vantaggio dell'emisfero sinistro quando venivano presentate singole parole o anche singole lettere che dovevano essere identificate. Ma con il procedere della sperimentazione, sia sul soggetto normale, sia sui soggetti patologici e, in particolare con un tipo di pazienti che per necessità terapeutica avevano dovuto subire una divisione delle fibre di connessione tra i due emisferi, la possibilità di continuare ad integrare i risultati che si andavano ad ottenere secondo questa dimensione verbale-nonverbale diventava sempre più difficile. In particolare con l'accurato controllo di altre variabili che potevano entrare in gioco nella più generale dimensione linguistica si cominciò a dimostrare anzitutto che era improbabile una rigida divisione di compiti tra i due emisferi, che il materiale presentato non era l'elemento principale per evidenziare una superiorità di un emisfero, ma che il tipo di processo stimolato dalle istruzioni date al soggetto o il tipo di operazione mentale normalmente svolta dal nostro cervello nell'elaborazione dell'informazione, incidevano maggiormente di quanto fosse fatto dal materiale usato. A dimostrazione di quanto sostenuto nelle righe precedenti vorrei citare alcuni esempi di lavori che mettono in crisi questa interpretazione verbale-nonverbale nel modo di elaborare di ciascun emisfero cerebrale.
Salmaso, D.; Lucioli, R.; Viola, G.; Vittori, M.L.	Subjective and objective evaluation of cognitive processes in the elderly.	The relative increase of elderly people has aroused growing scientific interest in the medical and social problems related to the third age.This interest has increasingly taken the form not only of action addressed to pathological forms typical of this age but also that of the capacity to maintain and recover biological functions that are altered during the normal aging process. Recent research has stressed with increasing clarity the importance of psychological factors, particularly cognitive ones, in the aging process. However,the clarification of the role played by these factors has not been accompanied by a corresponding methodological clarity in the treatment of the related problems. Current research on the psychological factors has to take into

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		account 3 main objectives: 1)an increasingly accurate description of the psychological patterns involved in normal aging; 2)the construction of psychological tests that allow early diagnosis to be made; 3)the development of suitable rehabilitation plans.The present paper addresses the first 2 objectives. The capacity to make early diagnoses of any abnormality in a psychological process depends on the amount of information available concerning normal patterns related to that process and on the availability of adequate measuring instruments. Neither of these conditions has so far been satisfied in the field of cognitive processes and the obvious result is incorrect diagnosis and failure to act until the deficit has become manifestly pathological and probably irreversible. The construction and use of suitable evaluation tools therefore represents a particularly important stage in research and clinical practice. Attempts to satisfy the need for early diagnosis have recently been made using self-evaluation questionnaires, which are believed to allow the clinical situation of numerous subjects to be ascertained rapidly.The aim of the present research is to examine the quality of the information conveyed by these tools by studying the correlations obtained from objective tests. A brief study is also made of the effects of some variables, such as age and education, on the results obtained using these tools.
Salmaso, D.; Rossi, B.; Guadagni, S.	Mancinismo e Sport	La maggioranza delle persone ha una sostanziale preferenza laterale destra, cioe' per le loro attivita' piu' comuni usano preferenzialmente la loro mano destra. In un lavoro recente (Salmaso e Longoni, 1985) si e' stimata intorno al 93.4% la percentuale di soggetti che manifesta tale preferenza. Tale preferenza e' sostanzialmente di ordine biologico, essendo scarsamente influenzata dalla cultura e dalla pratica: infatti, anche quando tali fattori esercitano un certo peso su certe attivita' comuni eseguite da un individuo, raramente vi e' una loro estensione alle altre attivita' "naturalmente" eseguite con l'una o l'altra mano. Un esempio eclattante di quanto appena detto e' rappresentato dai mancini "corretti": essi, costretti a scrivere con la mano destra, seguitano tuttavia ad avere una sostanziale preferenza sinistra per le altre attivita'. Altri 2 elementi sono importanti nel sostenere la natura biologica della preferenza manuale. Il Io riguarda la prevalenza in ogni periodo storico, posizione geografica o sviluppo culturale, di soggetti destrimani, prevalenza che si puo' far risalire gia' a 2 milioni di anni fa (Toth, 1985). Il IIo elemento importante e' che la maggior parte dei neonati, anche di poche ore di vita, dimostra una prevalenza laterale destra precorritrice di una futura prevalenza manuale destra. E' presente sicuramente una base

Authors	Title	Abstract
		genetica dimostrata, anche se non in modo definitivo, da un certo grado di concordanza tra preferenze dei genitori biologici e quelle dei figli, ma non con i genitori adottivi (Carter-Saltzman, 1980). Il meccanismo genetico sembra comunque operare in modo diverso per destrimani e mancini. Le recenti scoperte sull'organizzazione cerebrale ripropongono in modo diverso l'interesse verso i mancini: e' necessario non solo analizzare le correlazioni tra mancinismo e deficit, ma anche capire la natura della opposta correlazione con abilita' particolari o anche supercapacita' (Geschwind, 1984). Le cronache sportive richiamano ogni tanto la nostra attenzione sulla predominanza di atleti mancini in alcuni settori particolari, come ad es la scherma o il tennis. Ad es. nei campionati del mondo di scherma del 1982, sulla base delle schede delle federazioni, risultano il 43.8% di schermidori mancini nelle prove individuali e il 35.9% nelle prove a squadre. Il principale problema con questi dati e' l'impossibilita' a confrontarli con i dati sulla popolazione normale e di conseguenza la difficolta' di capire la natura di questa iperrappresentazione.

Year of Publication 1989

Authors	Title	Abstract
Salmaso, D.; Mecacci, L.; Lucioli, R.	Autovalutazione della memoria in soggetti giovani ed anziani.	Recentemente nello studio dei processi cognitivi sono stati introdotti dei questionari di autovalutazione allo scopo di determinare quale sia la rappresentazione soggettiva delle proprie funzioni mentali, indipendentemente dalle prestazioni date in prove di laboratorio. Queste strumenti possono essere di particolare interesse in psicologia geriatrica per studiare come l'anziano valuta le sue capacità psicologiche e come su tali processi possono intervenire fattori esterni quali l'istituzionalizzazione. Due questionari di autovalutazione dei disturbi della memoria (Perlmuiter, 1968; Sunderland, Harry e baddely, 1983) sono stati somministrati a soggetti dai 20 agli 80 anni. Ai soggetti viene richiesto di esprimere. su di una scala. il grado di disturbo per vari tipi di ricordi (eventi, parole, facce, ecc.). Complessivamente sono stati esaminati 525 soggetti di cui 139 erano anziani istituzionalizzati. In entrambi i questionari è risultato un effetto significativo dell'età sull'autovalutazione. In particolare nel questionario di Sunderland et al il disturbo di memoria viene valutato come più grave nei soggetti piu anziani e questo fenomeno è accentuato negli anziani istituzionalizzati.
Salmaso, D.; Viola, G	Il declino della memoria nel normale invecchiamento.	Benché il declino della memoria con l'invecchiamento sia ormai un dato generalniente accertato, non sono tuttavia note le sue cause. I deficit sembrano particolarmente collegati alla

Authors	Title	Abstract
		memorizzazione di materiale nuovo e non strutturato. Recentemente si è osservata l'importanza del fattore educativo-culturale. Due gruppi di anziani, di differente scolarità e QI, e un gruppo di giovani sono stati studiati con una batteria di test comprendente prove di apprendimento e di ripetizione di diversa complessità e con diverse strategie. I risultati mostrano, in tutti i test, differenze significative tra giovani ed anziani e anche tra gli stessi due gruppi di anziani. Per quanto riguarda le strategie, nessun gruppo sembra avvantaggiarsi di un aiuto semantico, mentre l'aiuto visivo ha effetti positivi negli anziani, ma solo con le liste pii lunghe. Un chiaro miglioramento delle prestazioni si ottiene invece con l'allungamento del ritmo di somministrazione degli item. I risultati sono discussi alla luce delle ipotesi avanzate, in particolare circa la possibilità di un generale rallentamento nel ritmo di elaborazione dell'informazione da parte dei soggetti anziani.
Salmaso, D.; Viola, G	L'efficacia di strategie mnestiche sulla performance dell'anziano.	La frequente cornpromissione della memoria, determinata sia da patologia cerebrale sia dal normale processo di invecchiamento, rende necessaria l'individuaziune di opportuni interventi riabilitativi. Si può ipotizzare che l'introduzione di adeguati aiuti e strategie possa favorire il recupero delle informazioni. L'efiicacia di questi inierventi può dipendere tanto dal tipo di compito e di deficit, quanto dalle caratteristiche del soggetto (livello educativo, QI, età). In ogni caso, è irnportantc conoscere come agiscono nelle persone normali per avere utili dati di riferimento. Sulla base di questi presupposti, il presente lavoro esamina due gruppi di anziani sani (differenti per livello educativo) mediante prove di ripetizione immediata con e senza aiuti specifici (semantici, visivi o temporali). I risultati mostrano che il suggerimento semantico fa peggiorare la performance dei due gruppi, mentre l'aiuto visivo e quello temporale si rivelano più efficaci.
Salmaso, D.; Viola, G	Valutazione e autovalutazione nell'invecchiamento cognitivo.	L'esigenza di disporre, nella pratica clinica, di strumenti psicodiagnostici agili e tuttavia capaci di fornire utili informazioni, ha portato di recente all'impiego di questionari di autovalutarione. Allo scopo di verificare la loro attendibilità, nella presente ricerca vengono confrontati due di tali questionari (uno cognitivo e uno di memoria) con due corrispondenti test oggettivi. Essi sono stati somministrati a gruppi di anziani di differente età e livello intellettivo-culturale. I risultati mostrano che mentre i test oggettivi riescono a discriminare i diversi gruppi, con i questionari di autovalutazione non si ottengono differenze significative, né

Authors	Title	Abstract
		emergono correlazioni tra il punteggio ottenuto all'autovalutazione e quello ottenuto nelle prove oggettive.

Year of Publication 1990

Authors	Title	Abstract
Caffarra, P., Salmaso, D., Viola, G., Scaglioni, A., Malvezzi, L.	Reaction time in mormal aging and Alzheimer's disease.	There are two models that can explain the slowing of reaction time (RT) during aging. The first one depicts age as having addictive effect, the second states that age has a multiplicative effect on RT. General cognitive abilities, simple and choice RT were compared in young adults, norma1 elderly and Alzheimer's disease patients (DAT). Statistical anaìysis showed significant group effect (F = 4.7, DF = 2.63, p<.OO1) and a cignificant group x task interaction (F = 9.5, DF = 2.63, p.<OO1). Further analysis of two groups of elderly subjects with different IQ also showed group x task interaction (p<.005). Our results SUggeSt that simple and choice RT may help to differentiate groups with different cognitive levels and normals from demented subjects.
Salmaso, D.	Attenzione e memoria.	I processi mentali, analogamente a quelli fisici, si svolgono all'interno delle dimensioni spaziali e temporali e richiedono, per il loro svolgimento, energia. Una conoscenza comune per ciascuno di noi è quella che riguarda il tempo che si impiega ad es. per percorrere un tratto di strada di 100 mt o un tratto di I km: qualsiasi sia il mezzo che impiegheremo, anche «a piedi», per il secondo tratto impiegheremo più tempo. Un'altra conoscenza comune è il tempo che abbiamo impiegato, prima che comparissero calcolatrici e calcolatori, per eseguire una moltiplicazione di 2 cifre o di 4 cifre. Analogamente ai processi fisici, anche le funzioni mentali hanno la caratteristica principale di svolgersi nel tempo. Di molte di queste funzioni, pur avendo molta esperienza, abbiamo tuttavia poca coscienza, non ci accorgiamo cioè che il fattore temporale impone dei limiti molto precisi su ciò che riusciamo a fare. Per studiare come il fattore temporale influisce sulla nostra attività mentale si parte da un principio molto semplice: il nostro cervello impiegherà più tempo a svolgere un compito che richiede, rispetto ad un altro, un'operazione mentale aggiuntiva e che la differenza tra i due compiti, cosi costituita, rappresenta una stima della durata di tale operazione (cfr. Umiltà, 1982). Uno degli esempi più noti di applicazione di questo principio è quello conosciuto come paradigma di Posner. Due lettere dell'alfaheto sono presentate insieme per un giudizio di uguaglianza o diversiti, dove l'uguaglianza può essere stabilita a vari livelli di complessità, attraverso l'impiego di strategie visive

Authors	Title	Abstract
		(identità fisica) o semantiche (identità di classe).
Salmaso, D.; Caffarra, P.	Normalita' e patologia delle funzioni cognitive nell'invecchiamento.	Le ricerche sull'invecchiamento cerebrale si sono occupate finora quasi esclusivamente dei deficit associati all'età, in particolare di quelli conseguenti alle patologie degenerative. In mancanza di altre valide spiegazioni, questi deficits sono stati attribuiti ad un qualche fattore genetico che ridurrebbe progressivamente le capacità del sistema nervoso centrale e le fnnzioni cognitive ad esso associate. Secondo le previsioni attuali, la popolazione mondiale generale dovrebbe aumentare del 38% nel 2000, mentre quella degli ultrasessantenni dovrebbe salire del 61%. Tra quest'ultimi l'aumento percentualmente maggiore dovrebbe essere tra le persone con più di 80 anni. Le modifiche nella struttura demografica, associata ad un calo della natalità, impongono alla società, e di conseguenza alla ricerca, un'ottica diversa verso l'invecchiamento in generale e quello psicologico in particolare. Lo studio dei deficit deve cominciare ad essere inquadrato in un contesto più generale che studia l'evoluzione dei processi cognitivi lungo l'arco di vita e la loro dipendenza da altre variabili oltre la mera età cronologica. Ragioni teoriche e pratiche giustificano questo diverso approccio all'invecchiamento. Lo studioso che voglia capire come la mente umana si evolve con l'età e quale sia il rapporto tra evoluzione e strutture cerebrali, non può non tener conto di quelle gravi forme di alterazione strutturale che sono le demenze. D'altro canto il clinico che con queste forme di patologia interagisce, se non vuole limitarsi ad una esclusiva registrazione del fatto degenerativo, non può non studiare quali siano i sintomi che precedono il globale deterioramento e quale la soglia della irreversibilità. Ma in questo studio l'incontro con la normale evoluzione diventa inevitabile, anzi indispensabile. Il titolo di questo libro sintetizza la necessità che tra i due settori di ricerca vi sia una reciproca interazione.
Salmaso, D.; Viola, G	Quale rapporto tra eta', livello cognitivo e processi di elaborazione?.	Analogamente ai processi fisici, anche le funzioni mentali e cognitive in particolare, hanno la caratteristica principale di svolgersi nel tempo. Se da un lato è molto semplice osservare che si impiega in genere più tempo ad es. per fare 200 mt di strada rispetto a quando se ne devono fare 100, molto meno comune è accorgersi che anche per le nostre operazioni mentali avviene qualcosa di analogo. La scoperta che tali operazioni potevano essere misurate, così come avviene per i processi fisici, ha consentito alla psicologia di fare un notevole balzo in avanti verso la conoscenza delle nostre funzioni mentali. Il principio su cui si basa tale conoscenza deriva dall'assunzione che il nostro cervello impiegherà, in genere, più tempo a svolgere

Authors	Title	Abstract
		un compito che richiede, rispetto ad un altro, un'operazione mentale aggiuntiva e che la differenza tra i due compiti, così costituiti, rappresenta una stima della durata di tale operazione (cfr. Umiltà, 1982). Qualcuno potrà obiettare che le situazioni di vita reale sono ben lontane dal poter essere ricondotte alle situazioni controllate del laboratorio. Tuttavia il fatto che queste situazioni siano più complesse non implica necessariamente che non possano essere scomposte in singole operazioni, le cui caratteristiche diventino studiabili in laboratorio. Inoltre molte situazioni complesse possono essere ricondotte ad una successione di operazioni, la cui analisi può consentire di sviluppare progressivamente modelli e teorie che si adattano ad esse. Una delle situazioni più semplici attraverso cui le operazioni mentali sono state studiate è quella dei tempi di reazione semplice (TRs); in questo caso al soggetto viene chiesto di rispondere, il più rapidamente possibile, ad uno stimolo prefissato. Un'altra situazione più informativa è quella dei TR di scelta: in questo caso ci sono almeno 2 stimoli e 1 o 2 risposte a seconda del tipo di TR di scelta studiato. Diversi lavori di psicologia geriatrica hanno affrontato il problema del declino delle funzioni mentali con l'età attraverso lo studio dei tempi di reazione. Tale misura sembra infatti particolarmente sensibile al grado di efficienza del sistema nervoso centrale ed è stata messa in relazione sia ai processi evolutivi che a quelli patologici. Viene spesso riportato che il TR dei soggetti anziani è più lungo di quello dei giovani. Tale rallentamento non sembra attribuibile a fattori sensoriali, ma a componenti centrali del sistema nervoso (Botwinick, 1971; 1972; Moscovitch, 1982; Schaie & Gribbin, 1975). Non è tuttavia chiaro se esso dipenda da un globale peggioramento nell'elaborazione o nell'organizzazione di una risposta oppure se si manifesti solo con l'aumentare della complessità del compito. Due modelli (Cerella, 1985) possono sostanzialmente spiegare il rapporto tra TR ed invecchiamento: il primo prevede che il rallentamento sia costante in tutti i compiti, mentre il secondo assume che l'età abbia un effetto moltiplicativo sulle latenze, che si dovrebbe evidenziare con compiti via via più complessi. Benché vi sia una maggiore tendenza a considerare come più esplicativo il secondo modello rispetto al primo, le cause del rallentamento in funzione dell'età non sono ancora sufficientemente chiare.

Year of Publication 1991

Authors	Title	Abstract
Salmaso, D.; Marsella, D., Torti, P., Viola, G.	A self-report questionnaire for the psychological state (QSP).	Early detection of disease arising in the elderly is going to be the primary goal for psychological research. However, this goal can only be reached by using methods less expensive and quicker than a complete examination of the subject. A way to achieve this aim has been the development of self-evaluation questionnaires which allow the clinical situation of numerous subjects to be ascertained rapidly. In order to collect information about the psychological state of aging population we have developed a self-report questionnaire (QSP). The QSP includes 38 items exploring cognition, depression, anxiety, emotion and so on. Additional information about marital status, living arrangements and physical health are also required. Subjects provide information by answering each item on a three-point scale (2=often, 1=sometimes, 0=never). A total score (obtained by adding the score for each item and dividing by 2) represents the frequency with which psychological symptoms are supposed to be present in the subject considered. The QSP was administered to 201 subjects (78 M, 123 F; mean age 60.4) living in Rome and attending recreational activities for elderly. For our subjects the mean score was 0.63 (sd 0.29). There were neither sex differences, nor among 4 differently-aged groups, nor among 4 differently-educated groups. On the other hand QSP scores were affected by physical and social distress, according to the suggestions provided by WHO Expert Group (1977). Altogether QSP seems to be useful for the screening of the elderly population and for the early identification of subjects (or groups), who could develop some forms of dementia.
Salmaso, D.; Scaglioni, A., Chiusa, M., Malvezzi, L., Caffarra, P.	Normal and pathological performance in a serial learning test.	The ability to learn a list of words implies an organization of the material presented. One organizational phenomenon appearing in a learning task is known as seriation, i.e. items that are presented together are also recalled together. The aim of this work was to investigate seriation in normal aging and dementia. Normal elderly subjects (n= 32), DAT patients (n=17, MMS=18.9) and AAMI subjects (n= 12) participated to the study. All subjects were instructed to recall seven unrelated words in the order in which they were read. The list was repeated up to a maximum of 12. Learning was measured according to 4 different scores: 1) total number of words recalled (A); 2) total number of serial positions recalled (B); total number of relative serial positions recalled (C); total distance among items recalled (D). All scores showed statistical difference among groups ($p < .001$), but differences changed according to the score. These findings help to understand how serial learning is organized and if one or more component are basically impaired in a pathological condition.

Year of Publication 1992

Authors	Title	Abstract
Caffarra, P., Scaglioni A, Malvezzi L, Salmaso, D.; Spreafico L	Age at onset and Spect imaging in Alzheimer's disease.	It is generally accepted that presenile Alrheimer's disease (AD) has faster pro-gression and severer clinical manifestation than senile onset AD. Recently arelative left frontal hypoperfusion was only found in patients with presenileAD by using SPECT imaging. The aim of the present report was to ascertainwhether the same conclusion could be drawn matching the population withrespect to the severity of the cognitive profile and disease duration. Twentysubjects for each group were studied with SPECT and no differences emergedbetween groups. It is postulated that presenile and senile onset AD representaspects of the same biologica1 process.
Salmaso, D.	Componenti della prestazione mnestica.	L'osservazione che la memoria declina con l'età rappresenta ormai una banalità. Non lo sono tuttavia le ragioni di questo declino. Per identificare quali specifici processi si modificano con l'età viene proposto di applicare l'approccio "information-processing", la cui assunzione principale è che la risposta di un soggetto possa essere divisa in singole componenti. Differenze individuali potrebbero esistere nella durata e nella qualità di ognuna delle componenti in cui un processo complesso, come la memoria, può essere suddivisi. Per illustrare questa tesi sono presentati alcuni esempi. Di seguito vengono poi analizzati i risultati ottenuti su un compito di apprendimento verbale, che nel complesso rafforzano l'uso della metodologia information-processing per lo studio dell'invecchiamento normale e patologico. The observation that memory declines with advancing age is a well-accepted banality. However, the reasons for this decline are not yet clear. To identify which specific memory processes do decline, the information-processing approach may be applied. The basic assumption of this approach is that a response can be partitioned into single components. Individual differences could exist in the duration or in the quality of any one components in which complex behaviour, like memory, could be separated. To illustrate this view few examples are presented. After then, a detailed analysis of a verbal learning task is shown. Results obtained by normal elderly subjects and by subjects with different diseases reinforce the application of the information-processing approach to the study of the normal and pathological aging.
Salmaso, D.	Un progetto per l'invecchiamento.	In un progetto finalizzato del CNR (Consiglio Nazionale delle Ricerche) interamente dedicato allo studio dell'invecchiamento non vi sono gruppi di ricerca che si interessono di depressione. Eppure la depressione nell'anziano viene valutata intorno al 10-15%.

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		Ma la depressione è una dimensione tipica dell'invecchiamento o no? Se cio' fosse vero, dovremmo aspettarci una correlazione (statistica) con l'eta'. Per rispondere a questa domanda mi sono ancora rivolto alla letteratura scientifica recente e la risposta e' stata abbastanza dubbia: cioe' non e' cosi' ovvio che all'aumentare dell'eta' aumenti anche la depressione (in termini di frequenza). La mia attenzione si e' in particolare soffermata su 2 studi condotti su un grande numero di soggetti. Nel primo sono state studiate piu' di 6.000 persone e non e' stata trovato un aumento con l'avanzare dell'eta'. Nel secondo sono stati studiati oltre 2.000 individui in uno studio longitudinale, cioe' in una ricerca in cui gli stessi soggetti sono stati visti piu' volte a distanza d'anni. L'intervallo in cui sono stati visti varia da 2 a 25 anni (media=16.6). In questo lavoro sono stati studiati sia i sintomi fisici che quelli psicologici. Dall'analisi di questa massa di dati emerge un aumento dei sintomi psicologici di 1 ogni 28 anni, mentre per i sintomi fisici l'aumento e' di 1 ogni 3 anni. In particolare per l'ansia e la depressione l'aumento dei sintomi e' ancora piu' lento. Anche questo risultato getta pertanto qualche dubbio su un significativo aumento della depressione con l'eta'. Le dimensioni del problema sono pertanto tutte da discutere e, positivamente per gli anziani, sembrano dire che probabilmente il numero di soggetti anziani depressi non e' maggiore di quello che si riscontra tra i giovani. Senza una chiara definizione dell'andamento del problema non possiamo disegnare adeguati piani di prevenzione. In questo senso la ricerca deve svolgere un ruolo fondamentale: una migliore definizione qualitativa e quantitativa del problema al fine di fornire al mondo politico corrette informazioni su cui basare gli interventi.

Year of Publication 1993

Authors	Title	Abstract
Bianchi, A., Zolo, P., Salmaso, D.	Effects of frontal lesions on a selective attention task.	We set out to test the hypothesis that patients with frontal damage are specifically disabled in carrying out tasks requiring a high level of controlled attention. A group of patients with frontal lesions and another group of patients with retrorolandic lesions were tested for selective attention on a computerized task designed to produce a conflict situation between automatic and controlled processes. Frontal patients proved to be significantly more prone to errors of commission (false alarms) than retrorolandic patients.
Caffarra, P.;	Age at onset and	It is generally accepted that presenile Alzheimer's disease

Authors	Title	Abstract
Scaglioni, A.; Malvezzi, L.; Previdi, P.; Spreafico, L.; Salmaso, D.	SPECT imaging in Alzheimer's disease	(AD) has faster progression and severer clinical manifestation than senile onset AD. Recently a relative left frontal hypoperfusion was only found in patients with presenile AD by using SPECT imaging. The aim of the present report was to ascertain whether the same conclusion could be drawn matching the population with respect to the severity of the cognitive profile and disease duration. Twenty subjects for each group were studied with SPECT and no differences emerged between groups. It is postulated that presenile and senile onset AD represent aspects of the same biological process.
Salmaso, D.	Memory and aging: components and processes.	This article provides a critical review of memory and aging. The focus is on the more accepted ternary scheme of memory, i.e. procedural, semantic and episodic, and on processing resources. A review of the literature in these areas, considering the more relevant studies or those with a greater number of subjects, reveals a gradual decrease of performance with age. No single hypothesis, either psychological or physiological, seems to be capable of explaining this decline. However, the hypothesis of a cognitive slowing during aging has an appealing simplicity and offers the chance to integrate the myriad of task-specific explanations that have proliferated in the literature.
Salmaso, D.	Mental slowing and age.	Growing evidence is today available on the age-related slowing of information-processing and on its role on mental decline. Besides age, some other subject-variables may considerably change the profile of that decline. The weight of age, schooling, intelligence and emotional state have been studied on reaction time tasks. Results indicate as main predictors of mental slowing age and intelligence. The importance of separating the effect of single variables for understanding age-effect will be discussed.

Year of Publication 1994

Authors	Title	Abstract
Caffarra, P., Durante, D., Salmaso, D.; Scaglioni, A., Umilta, C., Riggio, L.	Shifting of attention in Parkinson's disease	Objectives. The ability te focus attention in Parkinson's disease (PD) is controversial. In the present report we studied the importance of the internal scurces of attention using a modified version of Posner's paradigm. Design/methods. Nine patients with PD belonging to stage I of the H-Y scale and nine to stage 3 participated in the study. Nine elderly subjects and nine ycung subjects served as controls. All participants were screened by means of Mini Mental State Examination, Rayen's coloured Progressive Matrices PM47, Wisconsin Card sorting test and a simple visual test (Albert test}

Authors	Title	Abstract
		in order to exclude any sign of cognitive decline. Subjects sat in front of a CRT screen driven by IBM compatible computer. The head was positioned in an adjustable head-and-chin rest at a distance of 57 cm from the screen. The stimulus locations were marked by boxes(one in the left and one in the right hemifield) and three kinds of cue were used flash, arrows and digits). The cues differed in the degree of internal control required. Results and Conclusion. A comparison between PD and elderly aged-matched subjects showed patients to be slower than normal ones. The validity effect was significant with the less demanding cues (flash and arrows); the affect was much slower and not significant with the more demanding cue (digit) . The same pattern of results was present in patients and controls. A comparison between elderly and young subjects showed a validity effect with digit cue much stronger in young than in elderly subjects. PD patients seem as much affected as normal age-matched in using internal attentional control and aging may play a crucial role in this regard.
Salmaso, D.; Caffarra, P.	Organizzazione soggettiva nell'apprendimento verbale: normalita' e patologia.	L'apprendimento è una funzione complessa che dipende dal lavoro combinato di diverse aree cerebrali; la sua misurazione attraverso un singolo indice fornisce, generalmente, scarse informazioni su come quella funzione si è attuata. Ciò è particolarmente rilevante quando la memoria è studiata in pazienti con lesioni focali, dove alcune componenti potrebbero essere preservate ed altre no, od anche nello studio dell'invecchiamento normale e patologico, dove alcune componenti potrebbero deteriorarsi prima di altre (Salmaso, 1993). La capacità di apprendere una serie di elementi è normalmente descritta in base al numero di ripetizioni necessarie al soggetto per apprendere o al numero totale di elementi riportati (cfr. Lezak, 1983; Spreen & Strauss, 1991); quasi nulla rimane così evidenziato dei processi di organizzazione che hanno condotto al successo o all'insuccesso. Nell'apprendimento seriale, cioè in ordine degli elementi dati, la misurazione della performance deve riguardare le informazioni da apprendere e il loro ordine: l'ordine, anche quando non esplicitamente richiesto, è un elemento fondamentale per l'organizzazione delle informazioni da ricordare. Le conoscenze recenti sulla memoria portano a sostenere che le strutture temporo-mediali siano più coinvolte nella ritenzione delle informazioni, mentre le aree frontali lo sarebbero nella loro organizzazione. Una lista di 7 parole di alta frequenza e tra di loro non correlate è stata proposta per l'apprendimento. La lista è stata ripetuta (nello stesso ordine) fino all'apprendimento o fino ad un massimo di 12 volte. Dopo ogni ripetizione erano registrati

Authors	Title	Abstract
		gli elementi forniti dai soggetti e il loro ordine. La performance è stata analizzata attraverso diverse misure; esse prendono origine principalmente dagli studi sulla subjective-organization (Tulving, 1962) e sono rivolte sia allo studio del rapporto tra lista originale e output fornito, sia al rapporto tra gli output di ripetizioni successive. Alcune misure sono state direttamente elaborate dagli autori, mentre altre, come l'ITR (Intertrial repetition) o il PF (pair frequency) sono riprese dalla letteratura (Sternberg & Tulving, 1977). Sono stati studiati 5 gruppi di soggetti (giovani, anziani, parkinson, dismnesici, e alzheimer) per un totale di 121 soggetti. I risultati dimostrano che, laddove c'è apprendimento, esiste organizzazione del materiale riprodotto, mentre, quando l'apprendimento non si raggiunge o è molto più faticoso, il materiale viene ricordato ma non la relazione tra gli elementi della lista. Le differenze tra i gruppi risultano pertanto molto più marcate negli indici di organizzazione che in quelli di ritenzione; questo effetto è particolarmente evidente nel confronto tra i parkinson e gli altri gruppi, rivelando pertanto ciò che per questi soggetti è ipotizzato (Shimamura, Janowslcy, Squire, 1990) e cioé uno specifico deficit nell'ordinamento del materiale da ricordare. Questo approccio allo studio della memoria sembra particolarmente utile nel confronto delle prestazioni ottenute da gruppi diversi di soggetti o per comprendere come alcune caratteristiche individuali facilitano la performance, fornendo un utile strumento per l'esame dettagliato dei processi di memoria.

Year of Publication 1995

Authors	Title	Abstract
Caffarra, P., Copelli, S, Salmaso, D.; Parrino, L, Di Giovanni, G, Terzano, MG	Effetti cognitivi dell'uso cronico di benzodiazepine impiegate come ipnoinduttori.	La letteratura è generalmente concorde nel ritenere che le benzodiazepine (BDZ) assunte in maniera occasionale abbiano un effetto deprimente sulle funzioni cognitive ed in particolare sulle capacità di apprendimento e di memoria in genere, mentre non esiste concordanza sugli effetti neuropsicologici da uso cronico di BDZ. In modo particolare, tra i vari studi comparsi nella letteratura recente, ci è parso significativo il lavoro della Golombok e coll, eseguito in pazienti sottoposti a dosi elevate di BDZ per un lungo periodo di tempo. I risultati di questo lavoro indicano una compromissione selettiva per le prove di abilità visuo-spaziale e di attenzione sostenuta, suggerendo agli autori l'ipotesi di un interessamento delle aree corticali posteriori. …

Year of Publication 1996

Authors	Title	Abstract
Salmaso, D.	Il mancinismo in una prospettiva biologica.	The predominance of right-handed individuals is a biologica1 phenomenon, not a cultural one. This thesis is sustained by separate evidences: the right-handers have always been a majoriv, not only in historically very distant periods, but also in geographically different places. Moreover, newborns show mostly right preferences. The reasons for right-handedness are not known, but there are good arguments for believing that this phenomenon is linked up to the hemispheric specialization and, in particular, to the dominant role of the Ieft hemisphere in motor programing. In the subjects with a prevalent left preference, the role played by each hemisphere is in most cases the same as in the right-handers. Only a small percentage of subjects shows a lateralization different from that present in the right-handers. This difference could be the origin of both the advantages and disadvantages usually attributed to these subjects.

Year of Publication 1997

Authors	Title	Abstract
Jacopini, A.G.; Frontali, M, Perobelli, S, Salmaso, D	Organizzazione dei servizi genetici in Italia: il contributo delle discipline psicosociali.	Al momento attuale, le principali applicazioni delle tecnologie del DNA riguardano la diagnosi delle malattie genetiche o il rilevamento di un'aumentata suscettibilità ad esse perché le possibilità di cure efficaci sono scarse. Ciò nonostante i test genetici stanno già influenzando tutti gli aspetti della pratica medica. Questo, a nostro avviso, sottolinea la necessità di una consulenza genetica e psicologica di alto livello a causa dei problemi medici, psicosociali, etici e legali sollevati: - dalle difficoltà insite nell'offrire, fornire ed interpretare i test genetici presintomatici; - dalla natura predittiva della maggior parte dell'informazione genetica; - dall'impatto psicologico e sociale che la conoscenza del pro prio rischio genetico ha sull'individuo; - dalle implicazioni per gli altri familiari; - dalla complessità delle decisioni che le persone a rischio spesso devono prendere. In Italia esistono vari servizi di diagnosi e consulenza sebbene non uniformemente distribuiti in tutto il Paese. Noi ci siamo chiesti quanti di questi servizi siano effettivamente in grado di far fronte ai problemi complessi posti dalla consulenza genetica in generale e, in particolare, dalla gestione dei test genetici sia diagnostici che predittivi. Abbiamo perciò spedito dei questionari chiedendo informazioni a

Authors	Title	Abstract
		tutti i direttori dei servizi genetici elencati nella Guida ai Servizi di Diagnosi e Trattamento per le Malattie Genetiche, realizzata a cura del Ministero della Sanità e della Associazione A.I.R.H, e che costituisce l'elenco più completo e aggiornato attualmente disponibile in Italia. Una lettera che accompagnava il questionario spiegava che scopo della ricerca era appunto stabilire come sono organizzati i servizi e quali prestazioni vi sono effettuate (solo procedure diagnostiche di laboratorio, o solo consulenza genetica o entrambe).
Jacopini, A.G.; Frontali, M, Perobelli, S, Salmaso, D.	Organization of GC in Italy and input of psychosocial disciplines: a preliminary study.	In recent years, thanks to their new diagnostic potential, recombinant DNA technologies have revolutionized the approach to genetic diseases, opening up new possibilities for identifying and making a diagnosis of a growing number of hereditary disorders. In Italy as well this has brought about an increase in the number of genetic consulting services and of laboratories where specific diagnostic procedures can be carried out. In order to gain an understanding of the way in which these services are structured and organized we sent out a questionnaire specifically designed for this survey to 193 public and private centres listed in the Guide to the Diagnostic and Treatment Services for Genetic Disorders, which is the most updated list available in Italy at the moment. The questionnaire consists of two parts: Part A, to be filled in by the person in charge of the diagnostic service. Part B, to be filled in by the person in charge of the service which deals with the psychosocial aspects of genetic counseling. So far some 25% of all the centres to which they were sent have responded. However, the questionnaires duly filled in come from 13 out the 19 Italian Regions which means that most of the national territory has been covered. Some interesting remarks can be made on these preliminary data. Data from Questionnaire A, concerning the organization of the centres, show that 98% of the centres that have answered carry out both diagnostic and counseling activities. 54% of the respondents states that the psychosocial aspects of g.c. are dealt with by doctors or biologists whereas 46% assigns the task of managing the psychosocial problems to social workers or psychologists. 82% deems that the training of the medical staff is insufficient to deal with such issues as: anxiety and feelings of guilt, difficulties in making reproductive choices and complex family and couple dynamics which are also indicated as being the most frequently encountered problems. The psychosocial operators who answered to Questionnaire B are to be referred to 20 centres. Most of the respondents have begun to work in the area of g.c. only during the last 5 years. Hence this professional

Authors	Title	Abstract
		profile is a rather recent one in Italy. 42% of these operators have taken specific training courses on g.c. and all but one feel that it is indispensable. They complain the lack of coordination with the doctors, the directiveness of the medical team, the insufficient exploration of the psychosocial problems and the lack of boundaries in professional accountability. On the basis of these preliminary data, we can infer a fairly realistic picture of what is going on in Italy in this area, especially for the Northern and Central Regions of the Country. The picture is one of a severe delay with regard to the care for psychosocial aspects of g.c. and in providing specific training courses for ad hoc operators. The research is still on.
Pagani, M.; Ravagnan, G., Salmaso, D.	Effetti dell'acclimatizzazione sulla circolazione cerebrale e sull'apprendimento.	La limitata capacità del cervello di sopportare l'ipossia, ovvero la diminuita tensione di ossigeno nel sangue arterioso, ne fanno uno degli organi più sensibili alla carenza di ossigeno nell'atmosfera delle alte quote. Se tale carenza può anche accadere a livello del mare in seguito a varie patologie polmonari e del sistema cardiocircolatorio, a quote superiori ai 3.500 metri è la capacità individuale di reagire e di adattarsi alla quota a determinare la comparsa o meno di deficit del sistema nervoso centrale (SNC). Il mantenimento di una adeguata ossigenazione arteriosa è direttamente proporzionale alla capacità di incrementare, una volta in quota, la capacità ventilatoria e cardiocircolatoria e quindi di trasportare una maggiore quantità di ossigeno al cervello ed ai tessuti periferici. Soggetti allenati e ben adattati all'ipossia cronica alla quale sono esposti in altitudine mantengono livelli di ossigenazione arteriosa tali da limitare le alterazioni biochimiche a carico del SNC mentre soggetti incapaci di migliorare la propria performance cardio-polmonare si trovano nell'impossibilità di assicurare, apporto di ossigeno sufficiente all'appropriato funzionamento dell'encefalo.
Rosen, A., Rao, S.M., Caffarra, P., Scaglioni, A., Woodley, S.W., Cunningham, J., Bobholz, J., Hammeke, T.A., Umilta, C.A.; Salmaso, D.; Langer, C.	Functional MRI correlates of spatial attention and inhibition.	Spatial orienting can either be directed by endogenous (internal) or exogenous (external) cues. Endogenous attention is thought to involve anterior brain structures, whereas exogenous attention is purported to involve posterior and subcortical brain structures. While hoth endogenouis and exogenous cuing result in facilitation of attended and inhibition of unattended locations, inhibition of return (IOR) generally occurs only for exogenously cued stimuli. In IOR, reorientation to a previously attended region of space is slower ihan to a different location. Nine nonnal subjects performed the attentional tasks while undergoing whole-brain functional MRI (BvfRi). Reaction time data demonstrated inhibition ufinvalid cues in the endogenous condition and IOR in the exogenous wndition. The IMR images

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		supported the existence of separable brain systems mediating exogenous and endogenous orienting.
Salmaso, D.; Villaggio G, Copelli S, Caffarra, P.	Coloured progressive matrices: error type in dementia and memory dysfunction.	The importance of the cognitive assessment in determining early diagnosis of neurological diseases, is widely emphasized. Nevertheless, not much has been made for the development of adequate tools of investigation. These tools must be easy to administer and with a high sensitivity and specificity for different disorders. This work describes the results obtained with Raven's Coloured Progressive Matrices (CPM), a test designed to assess the intellectual processes of children, mentally defective individuals and eldery people. The test was administered to 92 subjects (mean age = 66.2, sd = 11.3) belonging to 3 different groups: 31 demented patients, 34 dismnesic patients and 27 normal subjects. All subjects underwent a comprehensive neuropsichological examination that included, among other tests, the Mini Mental State Examination (MMSE). CPM scores resulted to be different across groups: demented patients had (CPM = 12.3) lower scores than dismnesic (CPM = 22.3) and normal (CPM = 27.4) subjects. The same findings were obtained with MMSE scores. Considering CPM<20 and MMSE<26 as cut-off scores for demented patients, we obtained 90% of sensitivity. When dismnesic patients are considered, the MMSE categorizes as inferior 53% of the patients, while the CPM identifies as such only the 35%. When CPM errors are analysed, instead of the correct responses, the best diagnostic utility of this test results evident. A factorial analysis conducted on the different types of error reveals 2 factors: a factor choice and a factor orientation. On the first type of error, dismnesic patients perform like normal subjects, while on the second type of error demented and dismnesic present an equal number of errors. This result is very important to diagnostic goals, since the first type of error might be more closely related to a diffused degeneration, while the second type might be caused by alterations of specific cerebral structures.

Year of Publication 1998

Authors	Title	Abstract
Pagani, M.; Ravagnan G, Salmaso, D.	Effect of acclimatisation to altitude on learning.	Long-term exposure to high altitude has been reported to impair cognitive functions, possibly resulting in an increased risk of mountain accidents. To assess the modification of cognitive functions during acclimatisation to altitude, 17 climbers were studied at 5350 m a.s.l. by means of a neuropsychological learning test. The results clearly show that by extending the

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		period spent at elevations above 5350 m to more than 15 days, the response to a memory task was significantly enhanced. The improvements resulting from acclimatisation were more evident in the organisation of information than in information storage. We suggest that inappropriate acclimatisation has a detrimental effect on cognitive functions and the resulting impairment may particularly affect the more demanding technical tasks.

Year of Publication 1999

Authors	Title	Abstract
Caffarra, P., Durante, D, Previdi, P, Ghidoni, E, Malvezzi, L, Salmaso, D.	Serial memory in Parkinson's disease.	Objective. One aspect of recall that appears to be related to frontal lobe function is memory for temporal order. patients with frontal lesions exhibit difficulty in remembering the order of the items in a list but are not impaired in tests of recognition or recall. In Parkinson's disease (PD) the motor component is prevalent but usually not isolated symptomatology. Basal ganglia and frontal cortex participate in a partially closed feed6ack loop system ("complex loop") which could explain the occurrence in PD of neuropsychological deficits more closely related to frontal dysfunction. The present study was designed to ascertain whether PD patients show poor memory in a serial verbal recall paradigm aimed at exploring different organizational mnestic processing. Materials and methods. 20 non demented PD subjects and II conwls(C) matched far age and school level, underwent neuropsychological examination (MMSE. PM47. Snoop tests. WCST, Digit and Corsi span. Logical memory) and experimental serial memory test consisting of seven high frequency disyllabic words displayed for 200 msec on a videoscreen at a rate of one every two second. Subjects were invited to recall as many words as possible in the same order they appeared until the cnterion or at the end of 12 trials. Analysis was performed on a global index of storage (A) and indexes of organization as items organization, and interval-distance between words (D). Results. No significant differences emerged on standard neuropsychological measures between PD and C. with exception of perseverative errors on WCST (t=2.240; DF=21; p=0.036). On experimental memory test PD needed more trials to reach criterion than controls (t(29)=5.006; p=0.000) and had more intrusions (F(1,29)=7.144: p=0.012). They were also significantly impaired on ITR (F(1.29)=15.84: p=.000) and on different measures of memory organization versus global mnestic capacity. where significant interaction appears for A vs ITR (F=15.84; p=.000) and A vs D (F=15.42: p-.O00). Clinical stage is also significantly involved on global retention and organizational

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		memory processes, but not on number of repetitions. Conclusions. Quantitative retention of information to he retained is not a complete measure of the processes involved in memory. PD patients exhibited poor performance not only on measures of global memory, but particularly on the ability to retain the sequential order of information. which is attained after several attempts. The ability to organize the items in serial order is resulted to be an index of mnestic efficacy which may prove useful in monitoring the disease progression or drug-induced cognitive changes. This pattern seems to be related to the disease severity.
Pagani, M., Jacobsson, H., Salmaso, D., Ramstrom, C., Jonsson, C., Schnell, P.O., Thurfjell, L., Lundqvist, R., Wagner, A., Larsson, S.A.	Mapping pathological rCBF in Alzheimer disease and frontal lobe dementia using a standardized brain atlas.	Alzheimer Disease (AD) and Frontal Lobe Dementia (FLD) are well-characterized entities with regard to cortical rCBF SPECT. The purpose of this study was to investigate the additional diagnostic information that can be given by visual and statistical evaluation comparing pathological standardised data sets to aged matched normal individuals 17 AD pts, 8 FLD pts and 20 age matched normal subjects (NOR) were studied. AD and FLD were diagnosed according to clinical presentation,EEG pattern and Mini Mental Score Examination. 99m-Tc-HMPAO SPECT was performed with a three head gamma camera. A Computerised Brain Atlas was fitted to the data and allowed for spatial normalisation. Hence it was possible to average across the subjects in the same group, compare data between groups and determine the recovered activity in allcerebral lobes, hippocampus, thalamus and basal ganglia. REGIONS ALL AD-NOR FLD-NOR AD-FLD Frontal Lobe ns 0.000 0.000 0.000 Insular Lobe 0.000 0.000 0.000 Occipital Lobe 0.000 0.042 0.000 0.000 Parietal Lobe 0.000 0.000 0.010 Temporal Lobe 0.000 0.000 0.000 0.043 Hippocampus 0.000 0.000 0.001 Caudatus 0.000 0.003 0.000 Putamen ns 0.015 0.014 0.019 Thalamus ns ns 0.013 ns ANOVA resulted in a significant overall difference in all consideredregions with the exception of the talamus (Table). AD differed significantly from NOR in all lobes but the frontal one. FLD did thesame with the exclusion of parietal lobe. FLD and AD differed in alllobes but the insular lobe. Subtracting the AD and FLD images from theNOR resulted in highlighted caudatus, insular lobe andtemporo-parietal lobes and frontal lobes, respectively. We conclude that standardising SPECT in a common space and subtracting data from a control group results in a better visual interpretation of data. Standardising SPECT in a

Authors	Title	Abstract
		common space may be a useful quantitative tool in the diagnosis of early AD and FLD.

Year of Publication 2000

Authors	Title	Abstract
Caffarra, P., Vezzadini G, Messa G, Mayer S, Salmaso, D.	Memory for serial order in patients with frontal lobe lesions.	OBJECTIVE: To measure the ability of patients with frontal lobe damage on learning a fixed sequence of unrelated words, according to a different time presentation and verbal-pictorial modality. BACKGROUND: Patients with frontal lesions develop memory problems qualitatively different from those of classica1 amnesias. Cognitive deficits involve problem-solving, metamemory, verbal fluency, category shifting, planning of complex sequence of actions, cognitive estimation and memory for serial order. These deficits have been attributed to disruption of learning caused by an increased susceptibility to interference, retrieval strategies and impaired organization of the material to be learned. DESIGN/METHODS: 21 patients with frontal lobe lesions (8 left, 9 right, 4 bilateral) and 21 controls matched for age and educational level, undervent a standard neuropsychological examination (MMSE, PM47, Stroop test, WCST, Digit and spatial span, Logical Memory, Tower of London, Fluency tests, WAIS Picture Arrangement subtest and Dual Task) and an experimental test for serial memory. It consisted of seven unrelated, high-frequency words or equivalent figures displayed for 200 msec on a videoscreen at a rate of one every two seconds (normal presentation) or every five seconds (slow presentation). Subjects were invited to recall as many words or figures as possible in the same order they appeared unti1 the criterion or a t the end of 12 trials. Four lists were presented on a balanced order: 2 word and 2 figure hsts for both norma1 and slow presentation rate. Performance was evaluated taking into account the number of repetitions needed to learn the correct sequence and the following indices: index A, related to the number of items correctly recalled independently of their order and index ITR (Sternberg and Tulving,l977) based on the sum of pairs of correct items in two adjacent repetitions. RESULTS: Analysis of variance revealed significant differences between patients and controls in most of the neuropsychological tests, with the exception of digit span and PM47. On serial memory test, frontal patients needed more trials [F(1,27)= 11.453; p=.OO2] to reach the criterion than controls. A significant group difference for index A (storage) and ITR (organization) [F(1,40) =32.85; p c .O011 and measure x group

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		interaction [F(1,40) = 34,036; p = .000]and types x group interaction [F(1,40) = 7.593); p = .009] was found. For verbal-memory test, frontal pafients were more impaired on index A and ITR, with greater difference on the latter, while on pictorial task the difference was smaller. CONCLUSIONS: Frontal patients were impaired on most of the neuropsychological measures, according to the previous literature (cognitive flexibility, interference effect, planning). On serial memory task, patients had more difficulties for item organization than for storage. However, such a difficulty was attenuated when figures were presented or when list items were displayed a t a slow frequency rate. Thus, the present study seems to suggest that a) the frontal lobe play a critica1 role on memory for temporal order and b) performance may be changed by manipulating the rate of presentation and the target modality.
Jacopini, A.G., Zinzi, P., Frustaci, A., Salmaso, D.	Riflessioni sull'esperienza di assistenza domiciliare in un modello di patologia genetica, cronico-degenerativa: la malattia di Huntington.	Home assistance has recently received wide approval among the facilities provided to the individuals suffering from chronic-degenerative diseases. This mode of caring seems to offer both the opportunities to reduce costs and to allow the affected individual to live in a familiar environment. The increasing relevance of genetic diseases in the context of the National Health Service suggested the Authors to analyze, by means of an ad hoc questionnaire, the experience of home assistance in a group of families with Huntington's Disease (HD). HD is a chronic, degenerative, genetic disease characterized by neurological and/or mental symptoms. The article underlines the peculiar and complex needs of individuals affected by genetic diseases and of their families.
Pagani, M.; Ansjon, R.; Lind, F.; Uusijarvi, J.; Sumen, G.; Jonsson, C.; Salmaso, D.; Jacobsson, H.; Larsson, S.A.	Effects of acute hypobaric hypoxia on regional cerebral blood flow distribution: a single photon emission computed tomography study in humans	Single Photon Emission Computed Tomography (SPECT) and radiopharmaceutical stabilizing agents allowed us to investigate regional cerebral blood flow (CBF) distribution in six resting healthy subjects during acute laboratory hypobaric hypoxic conditions. In the hypobaric experiment stabilized 99mTc-D, L-hexamethyl-propylene amine oxime was injected 40 min after reaching hypoxic conditions corresponding to an altitude of 5500 m above sea level. Arterial blood sample was taken after five additional minutes. Mean arterial oxygen pressure and haemoglobin saturation were 28 mmHg and 56%, respectively. The control experiment was performed similarly, apart from barometric pressure and blood gas analysis. We analysed CBF distribution in 12 regions of functional interest bilaterally in frontal, parietal, temporal, occipital cortex, in the hippocampus, in the basal ganglia and other central structures of brain. No

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		overall effect of hypoxia on normalized regional CBF distribution in the considered regions was found. Motor cortex (Brodmann 4) and basal ganglia were the only regions in which hypobaric hypoxia significantly increased relative distribution of the radiopharmaceutical [F(1,5)=18.30; P < 0.008 and F(1,5)=10.85; P < 0.022, respectively]. Despite severe hypoxia, we did not observe any major regional CBF redistribution. We found a small relative increase in blood flow to the motor cortex and the basal ganglia, at rest after 40 min of hypobaric hypoxia, suggesting a preferential compensatory mechanism of these functional regions of brain.
Pagani, M.; Salmaso, D.; Jonsson, C.;, ...	Effect of attenuation correction on regional cerebral blood flow distribution in normal subjects at rest.	Brain volume standardisation techniques are nowadays often implemented to improve the diagnostic accuracy.They require a data base of control cases to be matched to pathological studies.Hence the assessment of the rCBF distribution in control subjects is of utmost importance.Evaluation was made with (A) as well as without (NA) uniform Chang attenuation correction.This was made in order to explore the impact of attenuation correction on rCBF distribution.Principal component analysis (PCA) was used in order to reduce the number of analysed variables.

Year of Publication 2001

Authors	Title	Abstract
Caffarra, P., Vezzadini, G, Scaglioni, A, Salmaso, D.	The effect of Parkinson's disease and frontal lobe lesions on serial learning.	In Parkinson`s disease (PD) the motor component is the prevalent but usually not isolated symptomatology. Basal ganglia and frontal cortex participate in a partially closed feedback loop system which could explain the occurrence in PD of neuropsychological deficits more closely related to frontal dysfunction. Learning is a complex function. that depends on the contribution of different brain areas and its measures through a single index gives us very lew information on how this function works. The ability of learning a series of elements is normally described by the number of repetitions need to learn them or the total number of recalled elements (Lezak. l983; Spreen et al. L991). Analysis of serial learning (following the order of the given elements) must take into consideration both the information to be learnt and their order. The frontal lobe seems to be involved in serial memory and in particular patients with frontal lesions although not amnesic. show difficulties on temporal elaboration of informations. Performance was evaluated by means of two different analyses. The first considered the number of repetitions needed to learn

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		the correct sequence, while the second was based on two separate indices: index A referring to the number of correct elements recalled for each repetition independently of their order, and index ITR (see Sternherg, Tulving. IUT7') based on the sum of pairs of correct elements present in two adjacent repetitions. The present study was designed to compare the performance of PD patients and frontal lobe patients (FL] in a serial learning paradigm aimed at exploring different organizational mnestic processing. Moreover, the rate of presentation (slow or normal) and the type of material (words or figures) were manipulated to obtain information on their role on rehabilitation processes. We tested 2l FL. patients (8 left, 9 right, 4 bilateral). 2l PD patients with Parkinson's disease and 42 healthy controls matched for age and school level. They underwent a standard neuropsychological examination and an experimental test for serial memory. It consists of seven unrelated, high-frequency words or equivalent figures displayed for 200 msec on a videoscreen at a rate of one every two seconds (normal presentation) or every five seconds (slow presentation). Subjects were invited to recall as many words or figures as possible in the same order they appeared until the criterion or at the end of I2 trials. Four lists were presented on a balanced order: two word and two figure lists for both normal and slow presentation rate. Patients need more trials to reach the criterion than controls (p=.000). More trials are also necessary for words than for figures (p=.O00) and for normal rate of item presentation than for slow rate (p=.0O0). Overall FL and PD patients are inferior to controls both for index A and ITR (F(1,82)=57.26, p=.000). While FL and PD do not show any difference. However. as revealed by the measure*group interaction, patients performance decreases more for items organization (ITR) than for storage (A) but such impairnmnt is attenuated when figures are presented (instead of word) (F(1,82)=14.3, p=0.000). When list items are displayed at a slow frequency rate there is an overall increase of performance (F(1,82)=115.5, p=.000). We hypothesised that frontal lobe andfor the subcortical frontal circuit, is involved in serial memory, due to the absence of cognitive difference in this type of paradigm between FL and FD patients. Number of repetitions or number of element reported are supposed not to be valid in understanding the nature of different processes involved in learning. The ability to organise items in serial order result to be a good index of mnestic efficiency which may prove useful in monitoring the

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		disease progression or the eflect of rehabilitation processes.
Pagani, M.; Gardner, A., Salmaso, D.; Lindberg G, Jonsson, C.:, Hatherly R, Finnbogason M, Johansson L, Jacobsson H, Hälström T, Larsson, S.A.	Changes in rCBF distribution associated with muscular tension and psychasthenia. first 99m-tc-hmpao spect study.	Aim: Muscular Tension (MT), subjective muscular tenseness and aches, and Psychasthenia (PA), low mental energy and difficulties in compensating for energy consumption, show altered corresponding scores on the Karolinska Scale of Personality (KSP). This scale rates 135 items with a four-point response format summed up to 15 scales focused on personality traits that are thought to have biological correlates. This study aims to investigate for the first time the regional cerebral blood flow (rCBF) changes in patients with significantly increased KSP scores in either Muscular Tension or Psychastenia scales. Methods: The rCBF distribution at rest in a group of 19 MT and in a second group of 19 PA patients was compared to that of 28 age-matched normal controls (CTR). 99mTc-HMPAO SPECT was performed using a three-headed gamma camera and intersubject group analysis was carried out by a Computerised Brain Atlas able to standardise brain anatomy in 3D space. The bilateral uptake in 27 functional subvolumes of the brain, including the most of Brodmann (B) areas, basal ganglia and thalamus, was analyzed by analysis of variance. The significance level was set at p = 0.05.Results: Both patients to controls comparisons showed a significant global interaction (p<0.03). In the CTX/MT comparison group x VOI interaction was significant with increases in prefrontal cortex in B9 and B10 and decreases in posterior cingulate and parietal cortex in B31 and B39 respectively. Significant increases where found in the CTR/PA comparison in B9, B10 and in the putamen. In none of the 2 comparisons hemispheric effect was seen neither did the KSP scores correlate to rCBF in any of the analysed functional subvolumes. Conclusions: rCBF changes in patients showing altered Muscular Tension and Psychastenia KSP scores were investigated for the first time. Prefrontal cortex, bilaterally, showed rCBF increase in both groups when compared to normal controls. Posterior cingulate and parietal associative cortex showed significant decreases in MT. These findings confirm that the symptoms reported by patients suffering of Muscular Tension and Psychastenia have an organic basis. They also suggest the usefulness of standardisation software and normal controls in reliably identifying both rCBF increases and decreases in psychiatric disorders.
Pagani, M.; Gardner, A., Salmaso, D.; Lindberg G,	Cerebral blood flow changes as assessed by 99m-TC-HMPAO spect in two subgroups	Aim: The Karolinska Scale of Personality (KSP) rates 135 items with a four-point response format summed up to 15 scales focused on personality traits that are thought to have biological correlates. It includes scales associated with vulnerability to

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Jonsson, C.;, Jacobsson H, Danielsson AM, Sanchez-Crespo A, Schnell PO, Hälström T, Larsson, S.A.	of major depressive disorder patients.	depressive disorder. Altered scores have been reported in Major Depressive Disorders (MDD), including patients suffering of Psychic Anxiety (ANX) and Socialisation (SOC) disorders. The aim of this study was to identify the cortical and subcortical brain regions showing regional cerebral blood flow (rCBF) changes in patients with altered Anxiety and Socialisation KSP scores. Methods: The rCBF distribution at rest in two sub-groups of 19 MDD patients each with high ANX score and low SOC score was compared to that of 28 normal controls (CTR). 99mTc-HMPAO SPECT, using a three-headed gamma camera, was performed and intersubject group analysis was carried out by a Computerised Brain Atlas able to standardize brain anatomy in 3D space. The uptake in 27 functional subvolumes of the brain bilaterally, including the most of Brodmann (B) areas, basal ganglia and thalamus, was analyzed by analysis of variance. The significance level was set at p = 0.05.Results: No age difference was found between the groups. Both patients to control comparisons showed a significant global interaction ($p<0.02$). No effect of hemispheres was found in neither comparison. In the CTR/ANX comparison, group x VOI interaction was significant in the prefrontal cortex for B9, B10, B46, basal ganglia and the thalamus. Significant interactions where also found in CTR/SOC comparison in B9, B10, in auditory cortex, in the Broca area, thalamus and putamen. In all these regions there was a significant rCBF increase. The KSP scores did not correlate to rCBF in any of the functional subvolumes. Conclusions: Two sub-groups of major depressed patients selected according to their altered Anxiety and Socialisation KSP scores showed significant rCBF increases. These changes were evident in the prefrontal cortex and central structures in both pathological groups. Patients with Socialisation disorders showed an increased flow also in auditory and language production cortex. These findings confirm rCBF changes in psychiatric disorders and encourage the use of standardisation software for comparison to normal controls and for making group and individual diagnosis.
Pagani, M.; Salmaso, D.; Ramstrom, C., Jonsson, C.; Lundqvist, R., Thurfjell, L., Schnell, P.O., Wägner, A., Jacobsson, H.,	Mapping pathological (99m)Tc-d,l-hexamethylpropylene amine oxime uptake in Alzheimer's disease and frontal lobe dementia with SPECT.	Seventeen patients with probable Alzheimer's disease (AD), 7 patients with frontal lobe dementia (FLD) and 19 control subjects (NOR) were examined by (99m)Tc-d,l-hexamethylpropylene amine oxime ((99m)Tc-HMPAO) SPECT. Images were standardised in the same 3D space and averaged within each group. After normalisation, the three sets of images were analysed in all cerebral lobes, hippocampus, thalamus and basal ganglia. In AD, the (99m)Tc-HMPAO uptake values were significantly reduced, as compared to NOR, in the parietal,

Authors	Title	Abstract
Larsson, S.A.		temporal and insular lobes. In patients with FLD, the uptake was altered in all lobes with the exception of the parietal lobe. The uptake in the nucleus caudatus decreased significantly in both AD and FLD as compared to NOR. The uptake in the anterior cingulate cortex was significantly reduced in FLD. Subtraction images highlighted all significantly decreased areas. In conclusion, standardising SPECT in a common space and subtracting data from a control group improves the visual interpretation of images. In this study, the typical temporo-parietal and fronto-parietal (99m)Tc-HMPAO uptake reductions were found in AD and FLD, respectively. The uptake in the nucleus caudatus was found to decrease significantly in AD and FLD and the one in the anterior cingulate cortex was reduced in FLD.
Vezzadini, G, Caffarra, P, Messa, G, Majer, S, Dieci, F, Copelli, S, Salmaso, D.	La memoria seriale nelle lesioni frontali focali.	INTRODUZIONE. Soggetti con lesioni del lobo frontale sviluppano un deficit di apprendimento e di memoria che è qualitativamente diverso dall'amnesia classica. Essi non sono amnesici, ma possono presentare vari deficit quali una riduzione della memoria di lavoro, una aumentata sensibilità all'effetto interferenza durante prove di apprendimento, un deficit della metamemoria, e della capacità di memorizzare gli elementi secondo l'ordine in cui essi vengono presentati. Tali disturbi potrebbero risiedere nell'incapacità dei pazienti frontali ad organizzare e recuperare la sequenza in cui l'informazione è presentata. OBIETTIVO. Il compito che meglio dimostra ciò che è preservato e ciò che è perso in questa tipologia di pazienti è l'apprendimento di una lista di parole. Mediante l'applicazione di un paradigma sperimentale (test di apprendimento seriale - TAS) abbiamo cercato di indagare come si modifichi l'apprendimento valutando il ruolo svolto sulla memorizzazione, dal tipo di materiale (immagine e parola) e dalla frequenza di presentazione. MATERIALI E METODI: 21 pazienti con lesioni frontali focali (8 sinistri, 9 destri, 4 bilaterali) e 21 soggetti di controllo, paragonabili per sesso, età e scolarità, sono stati sottoposti ad una estesa batteria neuropsicologica standard (MMSE, PM47, Stroop test, WCST, Digit e Corsi span, Memoria di prosa, Torre di Londra, Fluenza semantica e fonemica, Riordinamento di storie figurate-WAIS e ed al paradigma sperimentale (TAS). In quest'ultimo il compito dato al soggetto riguardava l'apprendimento, in ordine, di una lista di sette elementi (parole od immagini corrispondenti, di alta frequenza e tra loro non correlate) presentati per 200 msec. con una frequenza di uno ogni 2 o 5 sec. a seconda della condizione sperimentale, sul display di un monitor collegato ad un PC. Il

Authors	Title	Abstract
		soggetto aveva 30 sec. per rievocare i memoranda. Successivamente la stessa sequenza veniva proposta con le stesse modalità fino al raggiungimento del criterio (due rievocazioni corrette consecutive), oppure fino alla dodicesima prova. Mediante la presentazione di 4 liste, lista parole e figure a presentazione rapida, lista parole e figure a presentazione lenta, si è cercato di indagare la quantità di informazioni memorizzate (indice A) e l'abilità nel mantenere l'organizzazione del materiale presentato (indice ITR) nei due gruppi di soggetti. RISULTATI: L'analisi della varianza ha mostrato differenze statisticamente significative tra i 2 gruppi nella maggior parte dei test neuropsicologici ad eccezione per il Digit span, le PM47, e la prima parte del test di Stroop. Nel TAS i soggetti frontali necessitano di un maggior numero di ripetizioni rispetto ai controlli [F(1,27)=11,453; p=0,002], ma soprattutto risultano meno abili nell'organizzare il materiale da memorizzare, come risulta dall'interazione misure x gruppo [F(1,40)=34.04; p<0.001]. Per entrambi le immagini sono risultate più facili da memorizzare rispetto alle parole, ma per i frontali la differenza fra i due tipi di materiale è maggiore [F(1,40)=7.59; p<0.01]. CONCLUSIONI: I pazienti frontali presentano una maggiore difficoltà nell'organizzazione temporale del materiale da ricordare piuttosto che nella sua memorizzazione. La loro performance può però essere migliorata se il materiale è costituito da figure piuttosto che da parole o se la frequenza di presentazione è rallentata. Il presente studio suggerisce quindi, il ruolo centrale svolto dal lobo frontale sulla memoria per l'ordine temporale e la possibilità di influenzare tale aspetto manipolando la frequenza e il tipo di presentazione.

Year of Publication 2002

Authors	Title	Abstract
Pagani, M.; Gardner, A., Salmaso, D.; Sanchez-Crespo A, Jonsson, C.:, Jacobsson H, Wägner A, Hällström T, Larsson, S.A.	Regional cerebral blood flow changes as assessed by 99m-Tc-HMPAO SPECT in 70 Unipolar Depressed patients at rest.	Aim: Alterations in excitatory or inhibitory signals between cortical and sub-cortical regions in patients with unipolar depression (MDD) may be assessed by investigating changes in regional cerebral blood flow (rCBF). Regions with abnormal metabolic activity might participate in neural networks and affect the rCBF distribution in functionally connected structures. The aim of this study was to identify the brain regions showing rCBF changes in MDD by means of SPECT and Principal Component Analysis (PCA). Materials and Methods: The rCBF distributions in 70 MDD and 66 control (CTR) subjects, at rest, were compared. 99mTc-HMPAO SPECT, using a three-headed gamma camera, was performed and the uptake in 27

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		functional bilateral sub-volumes of the brain was assessed by a standardised digitalised brain atlas. Data were grouped into functional regions by means of PCA analysis performed on all 136 individuals. Analysis of variance (ANOVA) was used to test the significance of the differences in flow in such functional regions.Results: In the global analysis, rCBF significantly differed between groups (0.02). There were also significant hemispheres x groups interaction ($p<0.003$) and gender difference ($p=0.003$), with right hemisphere rCBF specifically increased in MDD and females showing a higher CBF. PCA identified 11 anatomo-functional regions that interacted with groups ($p<0.001$) and gender ($p<0.001$). As compared to CTR, MDD rCBF increased, bilaterally, in the right associative temporo-parietal cortex ($p<0.007$), in right frontal cortex and prefrontal cortex ($p=0.002$), in the temporal poles ($p<0.03$) and in thalamus and basal ganglia ($p<0.001$),. Conclusions: Higher rCBF in MDD at rest was found in 4 clusters of regions sharing close anatomical and functional relationships. These regions represented large parts of the right hemisphere and the downstream central structures. These findings confirm rCBF changes in unipolar depressive disorders, suggest mutual rCBF relationships among different regions participating to critical networks and encourage the use of standardisation software and PCA for group evaluation.
Pagani, M.; Gardner, A., Salmaso, D.; Sanchez-Crespo A, Jonsson, C.:, Ramström C, Wägner A, Jacobsson H, Larsson, S.A.	Value of Nucleus Caudatus and Thalamus SPECT rCBF in discriminating among Alzheimer Disease, Unipolar Depression and normal individuals.	Background: Basal ganglia and thalamus play a central role, via the cortico-basal ganglia-thalamus-cortical loop, in the processing of the neuronal signal from and to the cerebral cortex. Metabolic alterations in the neocortex, causing proportional regional cerebral blood flow (rCBF) changes, affect neuronal signal also in such structures. The aim of this study was to investigate the possibility of using the rCBF of the central structures in discriminating Alzheimer Disease (AD) and Unipolar Depression (UNI) patients from normal controls (CTR).Methods: 47 AD patients, 70 UNI patients and 66 CTR were included in the study. rCBF was assessed by 99m-Tc-HMPAO and using a three-headed gamma camera. A standardised brain atlas was used to define volumes of interest corresponding to nc. caudatus, putamen and thalamus. Analysis of variance (ANOVA) was used to test the significance of the differences in flow and data were covariated for age. Receiver Operating Characteristic (ROC) curves were implemented to evaluate the ability of the rCBF in the different structures to discriminate between the groups. Results: ANOVA showed a significant overall rCBF group difference ($p<0.001$). As compared to CTR, rCBF in nc. caudatus and thalamus decreased

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		in AD and increased in UNI. The blood flow in putamen was significantly increased only in the CTR/UNI comparison (p<0.001). Thalamus blood flow significantly differed in the CTR/AD (p<0.02) and CTR/UNI (p< 0.001) comparisons. Nc. caudatus blood flow significantly discriminated all three groups (CTR/AD:p<0.001; CTR/UNI: p<0.001; AD/UNI:p<0.01). According to ROC curves, nc. caudatus correctly categorised 74% of the individuals in the CTR-AD group pair and 72% in the CRT-UNI group pair.Conclusions: The blood flow in nc. caudatus and thalamus reflected corresponding changes in cortical regions in both AD and UNI. The decreased perfusion in the temporo-parietal cortex of the AD patients and the increased blood flow in the fronto-temporal cortex of the UNI patients were concomitant in nc. caudatus and thalamus. This is consistent with the anatomical path of the cortico-basal ganglia-thalamus-cortical loop projecting the fronto-temporo-parietal association cortex fibres in a segregated manner to nc. caudatus and thalamus. The putamen receives fibres mainly from motor and pre-motor cortices not involved in AD.
Pagani, M.; Högberg, G., Salmaso, D.; Soares J, Åberg-Wistedt A, Jacobsson H, Hällström T, Larsson, S.A.; Sundin, Ö.	Effects of auditory recall experience on regional cerebral blood flow as assessed by 99m-Tc-HMPAO SPECT in 13 Post Traumatic Stress Disorder patients.	Aim: Post Traumatic Stress Disorder (PTSD) is a severe condition affecting about 8% of population and increasing the risk of depression. PTSD patients, among other symptoms, suffer from intrusive distressing recollections of the traumatic event and avoidance of stimuli related to trauma. The aim of this study was to investigate the differences in regional cerebral blood flow (rCBF) between two groups of subjects exposed to the same type of traumatic stressor either developing PTSD or not.Materials and Methods: Thirteen subway drivers developing PTSD (PTSD) and 19 not developing PTSD (CTR) after being exposed to earlier person-under-the-train accident were included in the study. The rCBF distribution was compared between the two groups during a situation involving an auditory evoked re-experiencing of their traumatic event. 99mTc-HMPAO SPECT, using a three-headed gamma camera, was performed and the radiopharmaceutical uptake in 7 bilateral regions of the brain was assessed using a standardised digitalised brain atlas. The chosen regions were those supposed to be involved in fear and emotional response and were located in the thalamus, limbic cortex and prefrontal, temporal and parietal lobes. Analysis of variance (ANOVA) was used to test the significance of the differences in flow in such functional regions.Results: In the global analysis, rCBF significantly differed between groups (0.04), hemispheres (p<0.02) and regions (p<0.0001). There was also a significant region x hemisphere interaction (p<0.0001). As compared to CTR, PTSD

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		rCBF increased in the primary and associative auditory cortex ($p<0.03$) and in the temporal poles ($p<0.02$). Significant hemispheric differences were found in these latter regions ($p<0.001$ and $p<0.0001$, respectively), anterior cingulate cortex ($p<0001$) and multi-medial parietal association cortex ($p<0.0001$). Conclusions: Higher rCBF values in PTSD patients under recall of their traumatic experience were found as compared to CTR. The regions with increased flow were part of the temporal limbic system and the primary and secondary auditory pathways. No significant changes were found in prefrontal and orbito-frontal cortex between the two groups. A higher rCBF response in some regions of the brain involved in emotional processes during re-experiencing the traumatic stressor was found in symptomatic subjects as compared to the symptoms-free ones. This study encourages the use of SPECT and standardisation software for group comparison investigations in psychiatry.
Pagani, M.; Kovalev VA, Salmaso, D.; Jonsson, C.;, Thurfjell L, Lundqvist R, Wägner A, Jacobsson H, Larsson, S.A.	Classification of early and severe Alzheimer Disease. Differences in accuracy basing the analysis of SPECT CBF data on either hippocampus, temporo-parietal lobes or factorial analysis.	Background: Hippocampus and temporo-parietal regional cerebral blood flow (rCBF) reductions are well known to be specific of early (eAD) and severe Alzheimer Disease (AD). The specificity and the sensitivity of SPECT rCBF in discriminating the two stages of the disease vary across different investigations. The aim of this study is to develop a new method to increase the accuracy in the classification of eAD and AD.Methods: Twenty eAD and 21 controls (CTR), and 15 AD and 13 further CTR were included in the study. The two group pairs were age-matched and rCBF was assessed by 99m-Tc-HMPAO and using a three-headed gamma camera. Regions were identified and signal intensity was evaluated by a standardised brain atlas. Hippocampus, temporal and parietal lobes and four factors, derived from a previous principal components analysis, and whose rCBF was proven to significantly differ between groups, were considered for data analysis. These four factors were functionally connected clusters of Brodmann areas belonging to the temporo-parietal lobes (n=3) and to central structures (n=1) and were analysed together. The accuracy of the classification of eAD, AD and CTR utilising the K-means clustering method was separately tested for each group pair and for each region.Results: In AD/CTR evaluation, hippocampus uptake could correctly classify the 82.1% of the subjects, while the accuracy of both temporo-parietal lobes and the four joint factors was 96.4%. When the correct classification to eAD/CTR groups was tested, the accuracy of 99m-Tc-HMPAO uptake intensity in discriminating the groups was 85.4% for hippocampus, 80.5% for temporo-parietal lobes and 87.8% for the four joint factors. Discussion: Utilising separately sensitive

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		regions (hippocampus), lobes (temporo-parietal) and functionally connected regions in classifying eAD and AD yielded different results. Severe AD was better classified by data from lobes and from the functionally connected regions affected by the disease. Early AD was classified with higher accuracy by hippocampus and the functionally connected regions in temporo-parietal lobes and central structures. Such differences are consistent with the progression of the disease which is supposed to start in the medial temporal lobe and spread through the temporo-parietal cortex. The proposed method adds information mainly in the early stage of the disease.
Pagani, M.; Salmaso, D.; Jonsson, C.;, Hatherly R, Jacobsson H, Larsson, S.A.; Wägner A	Regional cerebral blood flow as assessed by principal component analysis and 99m Tc-HMPAO SPET in healthy subjects at rest: normal distribution and effect of age and gender.	The increasing implementation of standardisation techniques in brain research and clinical diagnosis has highlighted the importance of reliable baseline data from normal control subjects for inter-subject analysis. In this context, knowledge of the regional cerebral blood flow (rCBF) distribution in normal ageing is a factor of the utmost importance. In the present study, rCBF was investigated in 50 healthy volunteers (25 men, 25 women), aged 31-78 years, who were examined at rest by means of single-photon emission tomography (SPET) using technetium-99m d,l-hexamethylpropylene amine oxime (HMPAO). After normalising the CBF data, 27 left and 27 right volumes of interest (VOIs) were selected and automatically outlined by standardisation software (computerised brain atlas). The heavy load of flow data thus obtained was reduced in number and grouped in factors by means of principal component analysis (PCA). PCA extracted 12 components explaining 81% of the variance and including the vast majority of cortical and subcortical regions. Analysis of variance and regression analyses were performed for rCBF, age and gender before PCA was applied and subsequently for each single extracted factor. There was a significantly higher CBF on the right side than on the left side ($P<0.001$). In the overall analysis, a significant decrease was found in CBF ($P=0.05$) with increasing age, and this decrease was particularly evident in the left hemisphere ($P=0.006$). When gender was specifically analysed, CBF was found to decrease significantly with increasing age in females ($P=0.037$) but not in males. Furthermore, a significant decrease in rCBF with increasing age was found in the brain vertex ($P=0.05$), left frontotemporal cortex ($P=0.012$) and temporocingulate cortex ($P=0.003$). By contrast, relative rCBF in central structures increased with age ($P=0.001$). The ability of standardisation software and PCA to identify functionally connected brain regions might contribute to a better understanding of the relationships between rCBF at rest,

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		anatomically defined brain structures, ageing and gender.
Pagani, M.; Salmaso, D.; Sanchez-Crespo A, Jonsson, C.:, Engelin L, Danielsson AM, Jacobsson H, Wägner A, Larsson, S.A.	Regional Cerebral Blood Flow differences in early and severe Alzheimer's Disease as assessed by SPECT and Principal Component Analysis.	Aim: In its development into severe Alzheimer's Disease (AD), early Alzheimer Disease (eAD) involves progressively larger regions of the brain. These regions share close anatomo-functional relationships. The aim of this study was to investigate the rCBF changes occurring in eAD and AD as compared to a group of normal individuals by means of SPECT and Principal Component Analysis. Materials and Methods. Thirty eAD, 17 AD and 66 normal controls (CTR) were included in the study. 99mTc-HMPAO SPECT, using a three-headed gamma camera, was performed at rest and the uptake in 27 functional bilateral sub-volumes of the brain was assessed by a standardised digitalised brain atlas. Data were grouped into anatomo-functionally connected regions by means of PCA analysis performed on all 113 individuals. Analysis of variance (ANOVA) was used to test the significance of the differences in flow in such functional regions and data were covariated for age differences.Results. In the global analysis, rCBF significantly differed between groups (0.001) with a progressive reduction of flow from CTR to AD. PCA reduced the 54 variables to 11 anatomo-functional regions that interacted with groups ($p<0.001$) and gender ($p<0.001$). In the overall analysis the three groups differed significantly in all functional regions except for bilateral occipital cortex, anterior cingulated cortex, thalamus and putamen. In both CTR/eAD and CTR/AD comparisons the largest rCBF reductions were found in functional regions including left ($p<0.0001$) and right ($p<0.0001$) temporo-parietal cortex and associative parietal cortex ($p<0.0001$). When eAD was compared to AD, this latter showed the largest reductions in right temporo-parietal cortex ($p<0.0001$) and in right prefrontal cortex ($p<0.005$).Conclusions. In this study the rCBF was investigated in early and severe Alzheimer's Disease taking into account the functional connectivity among brain regions. Our results confirm previous findings on the progression of the disease and validate the use of principal component analysis as a statistical tool able to highlight neural networks in neurodegenerative disorders.
Salmaso, D.	Sono di sinistra.	Il genio è di sinistra? Nella migliore delle ipotesi un difetto da correggere o una cattiva abitudine. Nella tradizione cristiana ed ebraica addirittura associato all'idea del demonio. Ma anche nel mondo scientifico il mancinismo ha vissuto di pregiudizi in quanto spesso è stato collegato a psicosi, demenza e dislessia. E ancora, per alcuni i mancini sono geniali, fantasiosi e creativi, per altri

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		soggetti a malattie del sistema immunitario. Questo esercito silenzioso che rappresenta il 15 – 20 per cento della popolazione mondiale e il 6 per cento di quella italiana, non ha avuto mai vita facile. Costretto ogni giorno a cimentarsi con forbici, posate, mouse, e apriscatole, insomma utensili pensati unicamente per i destrimani e, soprattutto considerato "diverso", il mancino può prendersi la sua rivincita. Infatti oggi, il mancinismo non è solo un deficit, ma una probabile virtù. Poiché tuttavia non ci sono certezze scientifiche, cerchiamo di trovarne alcune intervistando Dario Salmaso, ricercatore dell'Istituto di scienze e tecnologie cognitive del Cnr, che per anni ha studiato il fenomeno. Che cosa si intende per mancinismo ? Apparentemente la domanda sembra molto semplice. Sarebbe facile infatti rispondere che i mancini sono tutti quei soggetti che hanno una preferenza per la mano sinistra. Questa preferenza viene contrapposta a quella della maggioranza della popolazione che ha invece una predisposizione nell'uso della mano destra. In realtà questa definizione dice poco sul perché solo un ristretto numero di persone usa prevalentemente la mano sinistra. Perché vi sono soprattutto destrimani ? Qualsiasi sia l'epoca storica considerata, la posizione geografica o lo sviluppo culturale, si ritrova sempre che la maggior parte degli uomini sono prevalentemente destrimani e che solo una piccola parte devia da tale norma, essendo sinistri o ambidestri. Non esiste ancora una risposta definitiva a questo interrogativo, ma l'ipotesi più attendibile è che sia dovuto all'organizzazione del cervello umano e in particolare al fatto che per quasi tutti i destrimani l'emisfero sinistro, che ha il prevalente controllo sensoriale e motorio della mano destra, si occupa soprattutto del linguaggio verbale e gestuale, mentre l'emisfero destro è più direttamente coinvolto nell'attività visuospaziale. Nei mancini e negli ambidestri questa organizzazione cerebrale è in genere molto meno marcata e, in alcuni casi, addirittura rovesciata. Fattori biologici o fattori culturali nella determinazione della preferenza manuale ? Il fatto che la preferenza manuale destra sia presente in modo consistente sin dai primi passi dell'evoluzione umana fa ritenere che le cause siano prevalentemente biologiche e più in particolare neurologiche. E' sicuramente presente una componente genetica dimostrata, anche se non in maniera definitiva, nella maggiore incidenza di mancinismo tra i gemelli e tra le persone che hanno parenti mancini. E' un'anomalia essere mancini ?

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		Sono certamente passati i tempi in cui si costringevano i bambini ad usare la mano destra, credendo di fare il loro bene. In realtà non c'erano motivazioni scientifiche che potessero giustificare tale atteggiamento, mentre erano più forti le ragioni culturali che vedevano ogni diversità come un fattore negativo. Ricordiamo che la mano sinistra è stata spesso associata nel mito e nella religione ad aspetti negativi. La mano destra è stata vista come la mano della forza e dell'azione, mentre la sinistra come la mano debole, la mano profana. Con l'aumentare delle conoscenze scientifiche queste antitesi tra le due mani perdono di significato, perché la mano sinistra spesso, come ad esempio tra i musicisti e gli sportivi, si presenta più abile. Nessuna anomalia, ma diversità! Mancinismo : deficit o supercapacità ? I mancini sono diventati sempre più di interesse sia per la maggior presenza di deficit di vario tipo, come le balbuzie o i problemi di lettura, sia, all'opposto, per una loro elevata presenza in categorie particolari di persone come gli artisti o gli sportivi. Grandi geni del passato come Leonardo, Einstein o Beethoven erano mancini. La relazione tra mancinismo e deficit nasce sostanzialmente in qualche tipo di alterazione nell'organizzazione cerebrale. Naturalmente quest'ipotesi non spiega affatto perché invece dovrebbero esserci delle supercapacità. Vantaggi e svantaggi sembrano comunque oggi spiegabili sulla base di una diversa organizzazione cerebrale del "cervello mancino".

Year of Publication 2003

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Pagani, M.; Gardner, A., Salmaso, D.; Sánchez-Crespo A, Jonsson, C.:, Jacobsson H, Hällström T, Larsson, S.A.	Principal Component Analysis and Volumes of Interest Analysis in Depressed Patients by 99m-Tc-HMPAO SPET - A Methodological Comparison.	Aim: Several methods have been proposed to analyse radiopharmaceutical uptake in regional cerebral blood flow (rCBF) studies. Volume of Interest (VOI) analysis evaluates the 3D data in a predefined region. Principal Component Analysis (PCA), by reducing the number of VOIs to factors, takes also into account correlations between variables, reflecting presumably human brain anatomo-functional connectivity. The aim of this study was to assess rCBF differences in two groups of depressed patients and normal controls and to compare the results according to these two analysis methods.Material and Methods: 70 outpatients bearer of Major Depressive Disorder (MDD) along with audiological and physical symptoms and 66 normal controls (CTR) were studied by 99m-Tc-HMPAO SPET. rCBF was analysed in twenty-seven VOIs, bilaterally, automatically defined by a standardisation software (CBA). PCA was used to reduce the number of variables by grouping the

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		VOIs in positively correlated factors. The differences between radiopharmaceutical uptake in MDD and CTR found at VOI level were then compared to those found at factor level.Results: PCA resulted in 11 factors that significantly interacted with groups ($p<0.001$). Increased rCBF was shown by both methods with several overlaps in frontal and temporal lobes and in central structures. All VOIs differing significantly between MDD and CTR were included in three out of the four significantly different factors. The last significant factor, that grouped VOIs belonging to temporal and parietal lobe, did not include any VOI reaching singularly the level of significance ($p<0.05$). Conclusion: Increased rCBF was found in a selected group of MDD outpatients. PCA grouped regions in factors according to their reciprocal rCBF positive relationships and highlighted significances in areas larger than those found at VOI level. One factor was significantly different between groups independently from significance in the single VOIs strengthening the value of investigating the correlation between variables. Factors represent cerebral areas with possible anatomo-functional connections and their analysis might help in shedding light on the interactions between different regions in MDD.
Pagani, M.; Gardner, A., Salmaso, D.; Sánchez-Crespo A, Jonsson, C.:, Jacobsson H, Hällström T., Larsson, S.A.	Effect of Gender on Cerebral Hemispheres and Lobes Uptake in 183 Subjects Examined at Rest by 99m-Tc-HMPAO SPET.	Aim: Recent magnetic resonance studies have demonstrated a higher decline with age in grey matter volume in man as compared to woman. On the other hand gender differences in regional cerebral blood flow studies have seldom been extensively taken into account. The aim of this study was to investigate by means of 99m-Tc-HMPAO and SPET the gender-related differences in rCBF in a large population of patients and normal controls.Material and Methods: Forty-seven patients with Alzheimer Disease, 70 with Major Depression and 66 Controls were studied by 99m-Tc-HMPAO SPET. Radiopharmaceutical uptake was analysed by a standardisation software (CBA) automatically defining hemispheric (n=2) and cerebral lobes (n=10) outfits and calculating rCBF values. Group, gender and regional differences were assessed, after covariation for age, by analysis of co-variance (ANCOVA). Results: There was no interaction between group and gender at any level and so we could consider the sex differences in all 183 subjects to be independent from groups. Gender accounted for significant differences at hemispheric ($p<0.005$) and cerebral lobes (0.001) level. At cerebral lobes level there was an overall interaction between gender and lobes ($p<0.001$) and more specifically gender differences were found in occipital ($p<0.001$), parietal ($p<0.005$) and temporal lobes ($p<0.001$). Significant interactions between sex and hemispheres were

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		shown in frontal (p<0.05) and parietal (p<0.05) lobes. Overall right hemisphere and females had higher CBF than left hemisphere and males respectively.Conclusions: Significant differences related to gender were found at hemispheric and cerebral lobes level. Females had a higher rCBF and there was a trend towards a least laterality. These findings suggest to perform an accurate gender matching when investigating group differences. Since gender influenced rCBF in frontal, parietal and temporal lobes particular attention should be paid in Alzheimer and Frontal Lobe Dementia studies.
Pagani, M.; Högberg, G., Salmaso, D.; Soares J, Åberg-Wistedt A, Sanchez-Crespo A, Jacobsson H, Hällström T, Larsson, S.A.; Sundin, Ö.	Influence of Type of Traumatic Stressor on rCBF Response to Auditory Experience Recall in Post Traumatic Stress Disorder. A SPET study.	Aim: Post traumatic stress disorder (PTSD) is a clinical condition that occurs in victims of major psychological trauma. Subjects reporting assaultive events (A) are more likely to be affected by PTSD as compared to those reporting not-assaultive events (NA). The aim of this study was to investigate the differences in regional cerebral blood flow (rCBF) between two groups of subjects exposed to either assaultive or not-assaultive traumas and developing or not PTSD.Material and Methods: Fourteen A and 33 NA subjects were included in the study. Among them 20 developed PTSD (S) and 27 did not (NS). The rCBF distribution was compared between groups during an auditory evoked re-experiencing of their traumatic event. 99mTc-HMPAO SPECT, using a three-headed gamma camera, was performed and the uptake in 29 bilateral regions of the brain was assessed using a standardised brain atlas. Analysis of variance (ANOVA) was used to test the significance of the differences in flow.Results: In the global analysis, rCBF significantly differed between groups (p<0.001), clinical status (p<0.05) and hemispheres (p<0.001). There was also a significant group x hemisphere interaction (p<0.02). The higher flow was found in the right hemisphere of the A group. The larger differences between A and NA were found in hippocampus, nc.caudatus, anterior cingulate, prefrontal and auditory cortex. When S and NS were compared the most striking differences where in nc.caudatus, anterior cingulate, prefrontal and anterior temporal cortex.Conclusion: Higher rCBF values under recall of their traumatic experience were found in A as compared to NA. A higher rCBF response was also found in S as compared to NS. The regions that seem to be mostly involved in the emotional response to the auditory re-experiencing are nc.caudatus and some cortical regions considered to be part of the limbic system. These findings confirm the higher morbidity of assaultive traumas and the functional substrate of PTSD symptoms.

Year of Publication 2004		
Authors	**Title**	**Abstract**
Pagani, M.; Gardner, A.; Salmaso, D.; Sanchez Crespo, A.; Jonsson, C.; Jacobsson, H.; Lindberg, G.; Wagner, A.; Hallstrom, T.; Larsson, S.A.	Principal component and volume of interest analyses in depressed patients imaged by 99mTc-HMPAO SPET: a methodological comparison	Previous regional cerebral blood flow (rCBF) studies on patients with unipolar major depressive disorder (MDD) have analysed clusters of voxels or single regions and yielded conflicting results, showing either higher or lower rCBF in MDD as compared to normal controls (CTR). The aim of this study was to assess rCBF distribution changes in 68 MDD patients, investigating the data set with both volume of interest (VOI) analysis and principal component analysis (PCA). The rCBF distribution in 68 MDD and 66 CTR, at rest, was compared. Technetium-99m d, lhexamethylpropylene amine oxime single-photon emission tomography was performed and the uptake in 27 VOIs, bilaterally, was assessed using a standardising brain atlas. Data were then grouped into factors by means of PCA performed on rCBF of all 134 subjects and based on all 54 VOIs. VOI analysis showed a significant group x VOI x hemisphere interaction (P<0.001). rCBF in eight VOIs (in the prefrontal, temporal, occipital and central structures) differed significantly between groups at the P<0.05 level. PCA identified 11 anatomo-functional regions that interacted with groups (P<0.001). As compared to CTR, MDD rCBF was relatively higher in right associative temporo-parietal-occipital cortex (P<0.01) and bilaterally in prefrontal (P<0.005) and frontal cortex (P<0.025), anterior temporal cortex and central structures (P<0.05 and P<0.001 respectively). Higher rCBF in a selected group of MDD as compared to CTR at rest was found using PCA in five clusters of regions sharing close anatomical and functional relationships. At the single VOI level, all eight regions showing group differences were included in such clusters. PCA is a data-driven method for recasting VOIs to be used for group evaluation and comparison. The appearance of significant differences absent at the VOI level emphasises the value of analysing the relationships among brain regions for the investigation of psychiatric disease.
Pagani, M.; Salmaso, D.; Nardo, D.; Jonsson, C.;, Danielsson AM, Jacobsson H and Larsson, S.A.	Accuracy of possible and probable Alzheimer Disease diagnosis: a methodological comparison using SPM and Principal Component Analysis.	Aim: Principal Component Analysis (PCA) has recently been proposed as statistical tool to investigate functional connectivity in human brain. The Aim of the present study is to compare the diagnostic accuracy of PCA as compared to Statistical Parametric Mapping (SPM) in discriminating Alzheimer Disease patients (AD) from control subjects (CTR). Material and Methods: 53 CTR, 30 possible AD (eAD) and 17 probable AD (AD) were investigated with 99m-Tc-HMPAO and a three headed gamma camera. Regional cerebral blood flow (rCBF) differences were compared between the three groups with both SPM (z-

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		score differences at clusters of voxels level, significance set at p<0.05 corrected) and PCA. The latter identified 11 factors representing regions with strong anatomo-functional correlations that were submitted to ANCOVA for group analysis. Discriminant analysis was used to identify the factors mostly predictive of group differences and to calculate the accuracy of the method. Results: SPM analysis identified CBF distribution differences in 5 large temporo-parietal cortex clusters bilaterally at CTR/AD comparison, in 2 smaller right parietal cortex clusters at CTR/eAD comparison and did not show any difference at AD/eAD comparison. PCA identified, in fronto-parietal-temporo-limbic cortex, 7 factors at CTR/AD and 4 at CTR/eAD comparisons in which CBF was statistically different at p<0.05 level between groups. The involved factors in both comparisons covered a brain area far larger than the one covered by the corresponding SPM clusters. At eAD/AD comparison CBF resulted to be statistically significant in one factor in the left parieto-frontal cortex (p<0.025). The overall accuracy of the 3 mostly predictive factors in assigning the subjects to the correct clinical group was 90%. Conclusion: As compared to SPM, PCA showed a better accuracy in identifying CBF differences and discriminating between groups when comparing CTR, eAD and AD. The appearance of significant regional differences absent at voxel-to-voxel analysis emphasised the value of analysing the relationships among brain regions for rCBF investigations.
Zinzi, P., Salmaso, D.; Zappata, P., Frontali, M., Jacopini, A.G.	Rehabilitation treatment in HD: benefits beyond motor and verbal improvement.	Huntington's disease (HD) is a neuro-degenerative, autosomal dominant, late-onset disease characterized by slowly progressive movement disorders, cognitive deterioration and psychiatric manifestations. In 1999 we started a rehabilitation protocol for HD patients at the Caring Home "Nova Salus" of Trasacco, in Abruzzo Region. The interdisciplinary treatments were performed at an intensive regimen for 8 hours a day per 6 ½ days (Saturday only in the morning, Sunday free), for 3 weeks for a maximum number of 3 admissions per year. The effect of the rehabilitation was evaluated both in terms of motor performance, quantitatively assessed through motor scales, and in terms of subjective evaluation by patients and caregivers. Here we report the results obtained through the latter approach. An ad hoc Questionnaire was devised and sent to 59 subjects. Forty-five of them (76%) sent back the filled in questionnaire. Overall positive effects of the rehabilitation experience were

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		reported by 97.6% of respondents. Improvements were reported for body control (89.7%), speech (85.3%), balance (81.3%), gait (80.9%) and swallowing (80.9%). Positive effects were also reported for several psychosocial aspects, namely mood state (89.4%), establishing new friendships (88.8%), reducing apathy (81,3%), family relationship (78%) and social relationship (74.4%). The positive, although temporary, effects obtained with the treatment will constitute the base for developing education programs for health care providers in our country.

Year of Publication 2005

Authors	Title	Abstract
Pagani, M.; Salmaso, D.; Borbely, K.	Optimisation of statistical methodologies for a better diagnosis of neurological and psychiatric disorders by means of SPECT.	In the last years there has been a wide consensus on the importance of brain imaging in assessing neurodegenerative and psychiatric disorders. Different techniques for functional and anatomical examination are currently clinically implemented in neurology and psychiatry to improve sensitivity, specificity and accuracy of the diagnosis of various diseases. In addition, the increasing life expectancy in the Western world raises the social importance and the economical impact of age-related neurodegenerative disorders since the incidence of Alzheimer disease and Parkinson disease is higher in the elderly. An early diagnosis of neuro-psychiatric diseases and the assessment of "natural" changes of regional cerebral blood flow (rCBF) distribution during normal aging are hence of utmost importance. In the recent past brain disorders have extensively been investigated by means of optimised nuclear medicine techniques, instruments and algorithms. Diagnosis can be better achieved by identifying those structures in which CBF or metabolism deviate from normality resulting in significant changes as compared to a reference database. In the present paper we present some studies investigating, by means of recently implemented diagnostic tools, patients bearer of various neuro-psychiatric disorders. The improved nuclear medicine techniques and instrumentation, the state-of-the-art software for brain imaging standardisation and the use of sophisticated multivariate data analysis are extensively reviewed.
Pagani, M.; Gardner, A., Salmaso, D.; Jonsson, C.;, Finnbogason M,	Increased rCBF in Atypical Depression as compared to Major Depressive Disorder and Normal Controls.	Aim: Atypical Depression (AtD) is a subtype of Major Depressive Disorder (MDD) and is considered to be neurotic in nature resulting in an increased psychopathological response to external stimuli. A previous study found that AtD as compared to normal controls (CTR) showed global brain and especially

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Rickman C, Jacobsson C, Larsson, S.A.; Hällström T	A SPECT study.	right frontal lobe hypoperfusion. The aim of the present study was to assess regional cerebral blood flow (rCBF) differences at hemispheric and Volume of Interest level between AtD and MDD patients and CTR.Material and Methods: Eleven AtD and 12 MDD outpatients and 12 CTR were studied. 99mTc-HMPAO SPECT, using a three-headed gamma camera, was performed and group analysis was carried out by a Computerised Brain Atlas able to standardise brain anatomy in 3D space. The uptake in 27 functional sub-volumes (VOIs) of the brain bilaterally, including the most of Brodmann (B) areas, basal ganglia and thalamus, was analyzed by ANOVA. The significance level was set at p = 0.05. Results: No age difference was found between the groups. The were a significant hemispheric difference ($p<0.001$) and a nVOI*group interaction ($p<0.001$). In the CTR/AtD comparison, there were significant rCBF differences in nc.caudatus ($p<0.025$) and in right hemisphere ($p<0.005$). A significant rCBF difference was also found in MDD/AtD comparison in B5. In all these regions there was a significant rCBF increase in Atd as compared to the other groups. Conclusion: This study confirms previous findings of neurobiological abnormalities underlying Atypical Depression. Atypical Depression as compared to Major Depressive Disorder showed increased rCBF in parietal associative cortex previously described as the core perfusion deficit in depressed patients. Furthermore, we found in Atypical Depression patients as compared to normal controls, raised rCBF in nc.caudatus, gathering all nervous fibres from associative cortices, and in the whole right hemisphere, known to be involved in processing emotions. These findings confirm rCBF changes in psychiatric disorders and support the concept of considering Atypical Depression reactive in origin.
Pagani, M.; Högberg, G.; Salmaso, D.; Tarnell, B.; Sanchez-Crespo, A.; Soares, J.; Åberg-Wistedt, A.; Jacobsson, H.; Hällström, T.; Larsson, S.A.; Sundin, O.	Regional cerebral blood flow during auditory recall in 47 subjects exposed to assaultive and non-assaultive trauma and developing or not PostTraumatic Stress Disorder.	OBJECTIVE: Psychological trauma leads to posttraumatic stress disorder (PTSD) in susceptible subjects. The aim of this study was to investigate the differences in regional cerebral blood flow (rCBF) between two groups of subjects exposed to different types of traumatic stressor either developing or not developing PTSD. METHODS: Twenty subjects developing (S) and 27 not developing (NS) PTSD after being exposed to either earlier person-under-the-train accident (NA) or being assaulted in the underground environment (A) were included in the study. 99mTc-HMPAO SPECT was performed and the uptake in 29 regions of the brain (VOIs), bilaterally, was assessed. rCBF distribution was compared, using analysis of variance (ANOVA), between groups (S/NS) and type (A/NA) during a situation involving an auditory evoked re-experiencing of the traumatic event. Discriminant analysis was applied to test the concordance

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		between clinical diagnosis and SPECT findings. RESULTS: In the general analyses significant differences were found between groups and types and there was a significant hemisphere x type interaction. S showed higher CBF than NS and so did A as compared to NA, particularly in the right hemisphere. Discriminant analysis correctly classified 66\% of cases (p < 0001) in testing S/NS and 72\% (p < 0001) in testing NA/A. CONCLUSIONS: Under recall of their traumatic experience we found higher relative CBF distribution values in S as compared to NS. CBF was higher in the right hemisphere and particularly in assaulted subjects. These findings underscore the role upon trauma recall of both the right hemisphere and the nature of the stressing event.
Pagani, M.; Nobili, F.; Salmaso, D.; Jonsson, C., Finnbogason, M., Rickman, C., Larsson, SA, Rodriguez, G.	Improved Diagnosis of Moderate Alzheimer's Disease by Optimising Counts Normalisation. A CBA-based Principal Component Analysis of Perfusion SPECT.	Aim: In brain perfusion SPECT studies normalising voxel intensity to values chosen with different modalities might affect the results in group comparisons. Already in the moderate phase of Alzheimer's Disease (AD) decreased count density distribution involves a large amount of voxels not only in parietal and temporal cortex but more diffusely across the brain. Including their values to calculate the common denominator chosen for normalisation could result in lower analysis sensitivity. The aim of this study was to normalise the data sets of moderate AD and normal controls (CTR) to a variety of common denominators representing voxels with different intensities and to identify those yielding better groups discrimination. Material and Methods: Thirty-seven CTR and 27 patients with moderate AD (mean MMSE score: 14.6) were investigated with 99mTc-HMPAO and SPECT. Raw data were normalised to 8 common denominators ranging from the average of the 40% of voxel with the lowest intensity value to the average of the 80% of voxels with the highest intensity value. Principal Component Analysis (PCA) was implemented for each normalisation on 27 VOIs in each hemisphere, thus identifying the factors to be analysed. The statistical differences relative to each normalisation procedure were assessed by ANCOVA and step-wise discriminant analysis was performed to assess the concordance between SPECT data and clinical diagnosis. Results: PCA grouped VOIs into a number of factors ranging from 7 to 12, varying with the common denominator chosen. Four factors including regions from anterior cingulate cortex, frontal pole, left temporal pole and visual cortex, respectively, were highly reproducible across the 8 different normalisation procedures. Group difference between AD and CTR was

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		significant after normalising the raw data for the average of the highest 20%, 40% and 60% of total counts. The corresponding accuracy values in discriminant analysis were 83%, 83% and 91%, respectively. Conclusion: Grouping of VOIs into factors varied across the different normalisation procedures. Normalising the raw SPECT data for the highest 60% of the total counts resulted in a better discrimination between AD and CTR reaching diagnostic sensitivity and specificity of 89% of 92%, respectively.
Varrone, A.; Pagani, M.; Salmaso, D.; Salvatore, E.; Sansone, V.; Nobili, F.; Rodriguez, G.; Barone, P.; Larsson, S.A.; De Michele, G.; Filla, A.; Pappatà, S.; Salvatore, M.	Anterior cingulate hypoperfusion can differentiate progressive supranuclear palsy from Parkinson's disease; voxel-based analysis and CBA-based PCA analysis of 99mTc-ECD SPECT data.	Progressive supranuclear palsy (PSP) is an akinetic-rigid syndrome that could be difficult to differentiate from Parkinson's disease (PD) based only on clinical criteria, particularly at an early stage. Various neuroimaging techniques and methods (structural-MRI/DWI-MR/VBM/PET/SPECT) including 99mTc-ECD SPECT have been proposed as tools for aid the differential diagnosis.Aim. We used voxel-based analysis (SPM2) and Computerised Brain Atlas (CBA)/Principal Component Analysis (PCA) of 99mTc-ECD SPECT data to test whether: 1) specific patterns of rCBF abnormalities could differentiate PSP from controls and PD; 2) functional connection between distinct brain regions can be found in PSP and PD.Materials & Methods. Nine PD (6M/3F, 65±6yrs, disease duration:2±2yrs), 16 PSP patients (9M/7F, 67±6yrs, disease duration:3±1yrs) and 10 controls (4M/6F, 59±16yrs) were studied with 99mTc-ECD SPECT (Ceraspect/matrix:128x128/voxel size: 1.67x1.67x1.67mm/Butterworth-cut-off: 1-order:10/Chang-ÿ=0.12 cm-1). SPM2: images were spatially normalised in the MNI space (voxel size:2x2x2mm), smoothed (12mm), and normalised to the global brain activity (proportional scaling). A single-subject condition and covariate model (sex/age:nuisance variables; disease groups:different conditions) was used (voxel-level:uncorrected p<0.001; cluster-level:corrected p<0.05). PCA: images were spatially normalised in the CBA space and activity normalised to a global preset value (50 uptake units). Normalised rCBF brain counts obtained with a set of VOIs were analysed with ANOVA/Tukey's post-hoc test. PCA was applied to the VOI data to identify sequential principal components accounting in decreasing order for the global variability between the data. Statistical significance was set at p<0.05. Results are reported relative to the clinically more affected side.Results. SPM2 analysis revealed relative hypoperfusion in: anterior cingulate (AC, BA32) and ipsilateral medial frontal cortex (BA8) in PSP<Controls (p=0.001); contralateral AC (BA32) and medial frontal gyrus (BA9) in PSP<Controls&PD (p=0.001);

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		contralateral AC (BA32) and medial frontal gyrus (BA9) (p=0.048) plus a trend (p=0.074) in contralateral prefrontal cortex (BA10/46/47) in PSP<PD. Discriminant analysis of contralateral AC (x,y,z:-4,25,30) peaks correctly classified 13/16 (81%) PSP patients.CBA analysis revealed relative hypoperfusion in: bilateral BA24/32 (PSP<Controls&PD, p<0.005); bilateral BA23 (PSP<Controls, p<0.05); ipsilateral BA39/40 (PD<PSP, p<0.05).PCA identified 3 factors including: bilateral BA23/24/caudate (PSPvs.Controls&PD, p=0.000); bilateral BA39/40 (PSPvs.PD, p=0.019); bilateral BA7/32 and ipsilateral thalamus (PSPvs.Controls, p=0.009).Conclusions. 1) AC hypoperfusion seems to be a distinct sign differentiating PSP from Controls and PD; 2) PSP patients show a relatively more preserved rCBF in parietal associative cortex and precuneus compared with PD; 3) clusters of cortical and subcortical brain regions with decreased (BA23/32/caudate) or preserved (BA39/40/7) rCBF are distinct functional components of brain abnormalities in PSP.

Year of Publication 2006

Authors	Title	Abstract
Jacopini, A.G.:, Zinzi, P., Bengala, M., Salmaso, D.; Novelli, G., Frontali, M.	Esperienza di consulenza genetica e comunicazione diagnostica nelle patologie neuromuscolari.	Il rapido sviluppo delle conoscenze genetiche ha accresciuto le possibilità di analisi e diagnosi genetiche e, con esse, la necessità di fornire consulenza genetica (CG). Questo tipo di incontro con il medico è tuttavia noto per essere più stressante di altri a causa delle implicazioni della maggior parte delle patologie genetiche (ereditarietà, inguaribilità, cronicità). In questo lavoro riportiamo uno studio sulla soddisfazione espressa da utenti di un servizio di consulenza genetica. Si tratta di pazienti affetti da, o a rischio di, patologie neuromuscolari afferiti alla Genetica Medica del Policlinico di Tor Vergata nel periodo giugno 2001-aprile 2004. Fra tutti gli utenti che si sono rivolti a quel servizio nel periodo indicato, sono stati individuati in tutto 42 casi riguardanti patologie neuromuscolari ben definite (Distrofia Muscolare Duchenne, Charcot-Marie Tooth, Distrofia Miotonica di Steinert, Atrofia Muscolare Spinale) e diverse forme di neuropatie/miopatie di varia origine (Artrogriposi, Distrofia oculo-faringea, Miopatia mitocondriale, Atrofia spinale focale). Dei 42 utenti del servizio ne sono risultati reperibili 33 che hanno tutti accettato di partecipare allo studio.Ai partecipanti è stato somministrato un questionario appositamente approntato comprendente 27 items che esploravano i principali aspetti della loro esperienza di consulenza genetica: quelli tecnici, quelli interpersonali e quelli procedurali.I risultati ottenuti suggeriscono interessanti

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		considerazioni sulle particolarità della consulenza genetica rispetto ad altri incontri di tipo medico ed evidenziano l'opportunità di attivare una modalità di consulenza integrata, genetica e psicologica.
Nobili, F.; Pagani, M.; Salmaso, D.; Piccardo A, Morbelli S, Girtler N, Bianchi P, Villavecchia G, Rodriguez G	Brain glucose metabolism and cognitive function in patients with amnestic Mild Cognitive Impairment (MCI).	Aim: The need of early diagnosis of Alzheimer's disease before the onset of dementia comes from the several ongoing phase 3 pharmacological studies that will hopefully lead to effective pathogenetic treatment of the disease in the next few years. In this frame, both brain PET and neuropsychological assessment are under extensive evaluation.Methods: Twenty-one consecutive patients (9 males; mean age:76.5±5.9; mean MMSE score:27.8±1.5) with amnestic MCI (criteria of the European Alzheimer's Disease Consortium, JNNP 2006, in press), underwent 18FDG-PET (GE Advance), 2D acquisition, OSEM reconstruction (16 subset, 2 iterations). Ten normal subjects (2 males; mean age:70.4±7.3; mean MMSE score:28.7±1.3) were recruited as control group (CTR). Neuropsychological evaluation included tests for ideomotor speed and shifting attention (trailmaking A and B), categorial verbal fluency, logic reasoning (Raven's PM38), episodic verbal memory (Buschke), spatial memory (digit symbol), visuospatial abilities (constructional apraxia and clock drawing), cognitive flexibility (Stroop colour-word). PET data were analysed by a 3-D computerized brain atlas and 27 Brodmann areas (BA) bilaterally were submitted to ANCOVA. Step-wise iscriminant analysis assessed the concordance between PET data and clinical diagnosis.Results: Overall PET analysis showed significant group ($p<0.05$), VOI*group ($p<0.001$) and VOI*hemisphere*group ($p<.025$) effects. Post-hoc analyses showed at MCI versus CTR comparison significant 18FDG uptake decreases in prefrontal cortex (BA 46), superior parietal lobule and precuneus (BA 7), posterior cingulate (BA 31), both lateral and mesial occipital cortex (BA 19), lateral temporal cortex (BA 21) and temporal pole (BA 38). Tracer uptake was relatively increased in primary motor (BA 4) and somato-sensory (BA 1- 3) cortex in patients. Significant group differences were found for Buschke ($p<0.01$) and Stroop ($p<0.05$) tests. Discriminant analysis using all significant VOI identified seven useful BAs (either in the left or in the right hemisphere) reaching 95% sensitivity and 100% specificity. Discriminant analysis with neuropsychological tests identified Buschke and clock drawing together as having 89% sensitivity and 70% specificity.Conclusions: VOI-based analysis of 18FDG-PET has showed the involvement of several associative cortical areas in amnestic MCI, including the prefrontal, lateral temporal and occipital cortex, besides the

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		classical regions affected in the disease represented by the posterior cingulate and the parietal precuneus. Both brain 18FDG-PET and neuropsychological assessment share similarly high sensitivity in amnestic MCI, but specificity is better with 18FDG-PET.
Pagani, M.; Canfora, M., Salmaso, D.	Introduzione all'analisi statistica delle immagini funzionali.	Lo sviluppo di scanner con risoluzione spaziale e sensitività sempre maggiore, le innovazioni nel campo della radiochimica e la diffusione ed importanza della medicina nucleare nella ricerca e nella pratica clinica necessitano di software per la estrazione e la gestione dei dati e di metodologie statistiche sempre più appropriati. Il continuo miglioramento delle conoscenze nel campo della neurofisiopatologia insieme alla costruzione di sistemi diagnostici validi e sensibili deve essere in grado di approfondire e rivalutare nuovi aspetti del rapporto mente-cervello. La sfida è quindi di sviluppare tecniche e metodologie che, partendo dalle conoscenze acquisite, permettano una migliore comprensione delle funzioni mentali e delle strutture cerebrali coinvolte dalle varie funzioni sia nella normalità che nella patologia. Nella pratica clinica neurologica e psichiatrica questo è passato negli ultimi anni attraverso lo sviluppo di diverse metodologie informatiche e statistiche tese a migliorare la sensibilità, la specificità e l'accuratezza della diagnosi per immagini funzionali delle diverse malattie. Inoltre, l'allungamento delle aspettative di vita nei paesi occidentali ha portato in primo piano l'importanza sociale e l'impatto economico dei disturbi neurodegenerativi legati all'età. Nei paesi in cui una attenta valutazione del rapporto costi e benefici è tenuta in seria considerazione, tutti gli studi indicano nell'applicazione diagnostica delle neuroimmagini un fattore capace di incidere notevolmente nell'abbattimento dei costi per giungere ad una corretta diagnosi. L'accuratezza diagnostica viene così a rivestire un ruolo centrale per la diffusione e l'utilizzo della PET e SPECT in Neurologia.Nei paragrafi successivi verranno revisionati e discussi brevemente i software più utilizzati nell'imaging funzionale per l'estrazione e la gestione dei dati. Verranno inoltre descritte le strategie statistiche maggiormente impiegate e quelle miranti a consentire una migliore visione d'insieme delle funzioni cerebrali. Questa analisi non mira a fornire una trattazione esaustiva delle complesse problematiche statistiche legate alle neuroimmagini ma piuttosto a servire come introduzione al lettore sia degli strumenti minimi per valutare criticamente le differenze tra i vari sistemi impiegati sia delle basi concettuali per stimolare l'approfondimento dell'argomento.

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Pagani, M.; Högberg, G., Salmaso, D.; Nardo, D.; Jonsson, C.;, Danielsson A, Engelin L, Jacobsson H, Larsson, S.A.; Hällström T, Sundin Ö	Effects of psychotherapy on 99mTc-HMPAO distribution in Post-Traumatic Stress Disorder.	Background Post-traumatic stress disorder (PTSD) is a derangement of mood control with emotional trauma recollections that may follow psychological trauma. It is treated with pharmacological and cognitive therapies as well as with eye movement desensitization and reprocessing (EMDR). However, a limited number of studies have been published dealing with job related PTSD, and an even smaller number have assessed the effects of treatment on CBF. The aim of this study was to investigate the short term outcome of occupation based PTSD after EMDR therapy by 99mTc-HMPAO SPECT. Methods Fifteen patients suffering PTSD after having experienced a person under train accident or having been assaulted at work were included into the study. 99mTc-HMPAO SPECT was performed before and after EMDR therapy while listening to a script portraying the traumatic event. Tracer distribution analysis was performed at VOI level using a 3D standardised brain atlas and at cluster of voxel level by SPM and was subjected to an analysis of treatment as well as contrasted to a group of 27 subjects exposed to the same psychological trauma and not developing PTSD. Results Eleven of 15 patients responded to treatment, i.e. they did no longer fulfil the DSM-IV criteria for PTSD after EMDR. Overall VOI analysis showed significant differences between, both before and after treatment conditions and controls ($p<0.05$) but no effect of period, i.e. treatment. However, when contrasting responders to controls the significant group difference present after treatment disappeared, indicating a normalization effect due to successful EMDR treatment. SPM analysis showed significant uptake differences in orbitofrontal cortex (Brodmann 11) and temporal pole (Brodmann 38) before as well as after treatment as compared to controls. A significant tracer uptake group difference present before treatment in uncus (Brodmann 36) disappeared after treatment while a significant difference appeared in lateral temporal lobe (Brodmann 21). No tracer uptake differences were found by SPM as an effect of treatment, nor between the 11 responders and controls. Conclusion Significant 99mTc-HMPAO uptake differences, mainly in peri-limbic cortex, between PTSD patients investigated before and after EMDR and subject exposed to trauma not developing PTSD were found. Differences between the tracer distribution in patients before and after therapy were not significant neither at SPM nor at VOI analyses but the latter showed at group level an effect of symptom remission on tracer distribution. The findings underscore the validity of psychotherapy in anxiety disorders and confirm the efficacy of SPECT in psychiatry.

Authors	Title	Abstract
Pagani, M.; Salmaso, D.; Nardo, D.; Jonsson, C.;, Danielsson A, Hatherly R, Jacobsson H, Larsson, S.A.; Gardner, A.	Impact of mitochondrial disfunction on 99mTc-HMPAO uptake in depressed patients.	Background: Few functional studies have assessed the retention of radiotracers in mitochondrial disorders. 99mTc-HMPAO fixation in brain is proportional to cerebral blood flow but is also related to the cellular content of reduced glutathione. This in turn might be affected by the intracellular concentration of free radicals caused by impaired oxidative metabolism. The aim of the present study was to investigate the correlation between mitochondial activity in muscle and 99mTc-HMPAO distribution in brain. Methods: Mitochondrial mass (CS, citrate-synthase), and respiratory chain enzymes (NCR, NADH-cytochrome-reductase; SCR, succinate-cytochrome-c-reductase and COX, cytochrome-c-oxidase) involved in ATP production, were assessed in isolated muscle mitochondria of 19 patients with chronic unipolar depression and in ten normal controls (CTR). 99mTc-HMPAO distribution was evaluated by SPECT in all patients and regional analysis was performed at cluster of voxels level by SPM. K-means clustering was performed to group patients according to the mean values of all four enzymes.Results: K-means clustered 12 patients in the group with higher enzymes values (H) and 7 in the one with lower enzymes values (L). Enzymes values in H were significantly higher than those in L but there was no difference as compared to CTR. SPM showed significantly higher tracer uptake in L as compared to H in associative parietal (Brodmann 39, 40), cingulate (Brodmann 32, 24), occipital (Brodmann 18, 19) and temporal (Brodmann 21, 22, 37) cortex, in precuneus (Brodmann 7) and the nc.caudatus. The opposite comparison highlighted a significant cluster in orbito-frontal (Brodmann 11) cortex. Conclusions: Mitochondrial mass and respiratory chain enzymes concentration in muscles had a significant impact on 99mTc-HMPAO uptake in a variety of brain regions. The patients with lower enzyme activity showed higher tracer uptake suggesting an inverse correlation between the intracellular concentration of mitochondrial enzymes and the levels of glutathione, known to be the main antioxidant in brain contributing to the scavenging of free radicals. These results support previous observations of an uneven distribution in brain of mitochondrial enzymes and the correlation of mitochondrial disorder with tracer uptake changes in brain. They also suggest a selective vulnerability to oxidative/metabolic impairment of various brain regions implicated in neurodegenerative and psychiatric disorders.

Year of Publication 2007

Authors	Title	Abstract
Pagani, M.; Högberg, G., Salmaso, D.; Nardo, D.; Tärnell B, Jonsson, C.:, Soares J, Åberg-Wistedt A, Jacobsson H, Hällström T, Larsson, S.A.; Sundin, Ö.	Effects of EMDR psychotherapy on 99mTc-HMPAO distribution in occupation-related Post-Traumatic Stress Disorder.	BACKGROUND: Post-traumatic stress disorder (PTSD) is a derangement of mood control with involuntary, emotionally fraught recollections that may follow deep psychological trauma in susceptible individuals. This condition is treated with pharmacological and/or cognitive therapies as well as psychotherapy with eye movement desensitization and reprocessing (EMDR). However, only a very limited number of studies have been published dealing with work-related PTSD, and investigations on the effect of treatment on cerebral blood flow represent an even smaller number. AIM: To investigate the short-term outcome of occupation-related PTSD after EMDR therapy by 99mTc-HMPAO SPECT. METHOD: Fifteen patients, either train drivers suffering from PTSD after having been unintentionally responsible for a person-under-train accident or employees assaulted in the course of duty, were recruited for the study. 99mTc-HMPAO SPECT was performed on these patients both before and after EMDR therapy while they listened to a script portraying the traumatic event. Tracer distribution analysis was then carried out at volume of interest (VOI) level using a three-dimensional standardized brain atlas, and at voxel level by SPM. The CBF data of the 15 patients were compared before and after treatment as well as with those of a group of 27 controls who had been exposed to the same psychological traumas without developing PTSD. RESULTS: At VOI analysis significant CBF distribution differences were found between controls and patients before and after treatment (P=0.023 and P=0.0039, respectively). Eleven of the 15 patients responded to treatment, i.e., following EMDR they no longer fulfilled the DSM-IV criteria for PTSD. When comparing only the eleven responders with the controls, the significant group difference found before EMDR (P=0.019) disappeared after treatment. Responders and non-responders showed after therapy significant regional differences in frontal, parieto-occipital and visual cortex and in hippocampus. SPM analysis showed significant uptake differences between patients and controls in the orbitofrontal cortex (Brodmann 11) and the temporal pole (Brodmann 38) both before and after treatment. A significant tracer distribution difference present before treatment in the uncus (Brodmann 36) disappeared after treatment, while a significant difference appeared in the lateral temporal lobe (Brodmann 21). CONCLUSION: Significant 99mTc-HMPAO uptake regional differences were found, mainly in the peri-limbic cortex, between PTSD patients and controls exposed to trauma but not developing PTSD. Tracer uptake differences between responders and patients not responding to

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		EMDR were found after treatment suggesting a trend towards normalization of tracer distribution after successful therapy. These findings in occupational related PTSD are consistent with previously described effects of psychotherapy on anxiety disorders.
Pagani, M.; Salmaso, D.; Nardo, D.; Jonsson, C.; Jacobsson H, Larsson, S.A.; Gardner, A.	Imaging the neurobiological substrate of atypical depression by SPECT.	Purpose: Neurobiological abnormalities underlying atypical depression have previously been suggested. The purpose of this study was to explore differences at functional brain imaging between depressed patients with and without atypical features and healthy controls. Methods: Twenty-three out-patients with chronic depressive disorder recruited from a service for patients with audiological symptoms were investigated. Eleven fulfilled the DSM-IV criteria for atypical depression (mood reactivity and at least two of the following: weight gain, hypersomnia, leaden paralysis and interpersonal rejection sensitivity). Twenty-three healthy subjects served as controls. Voxel-based analysis was applied to explore differences in Tc-99m-HMPAO uptake between groups. Results: Patients in the atypical group had a higher prevalence of bilateral hearing impairment and higher depression and somatic distress ratings at the time of SPECT. Significantly higher tracer uptake was found bilaterally in the atypical group as compared with the non-atypicals in the sensorimotor (Brodmann areas, BA1 - 3) and premotor cortex in the superior frontal gyri (BA6), in the middle frontal cortex (BA8), in the parietal associative cortex (BA5, BA7) and in the inferior parietal lobule (BA40). Significantly lower tracer distribution was found in the right hemisphere in the non-atypicals compared with the controls in BA6, BA8, BA44, BA45 and BA46 in the frontal cortex, in the orbito-frontal cortex (BA11, BA47), in the postcentral parietal cortex (BA2) and in the multimodal association parietal cortex (BA40). Conclusion: The differences found between atypical and non-atypical depressed patients suggest different neurobiological substrates in these patient groups. The putative links with the clinical features of atypical depression are discussed. These findings encourage the use of functional neuroimaging in psychiatric disorders.
Varrone, A.; Pagani, M.; Salvatore, E.; Salmaso, D.; Sansone, V.; Amboni, M.; Nobili, F.; De	Identification by [99mTc]ECD SPECT of anterior cingulate hypoperfusion in progressive supranuclear palsy, in comparison with	PURPOSE: Progressive supranuclear palsy (PSP) is an akinetic-rigid syndrome that can be difficult to differentiate from Parkinson's disease (PD), particularly at an early stage. [99mTc]ethyl cysteinate dimer (ECD) SPECT could represent a widely available tool to assist in the differential diagnosis. In this study we used voxel-based analysis and Computerised Brain Atlas (CBA)-based principal component analysis (PCA) of

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Michele, G.; Filla, A.; Barone, P.; Pappata, S.; Salvatore, M.	Parkinson's disease	[99mTc]ECD SPECT data to test whether: (1) specific patterns of rCBF abnormalities can differentiate PSP from controls and PD; (2) networks of dysfunctional brain regions can be found in PSP vs controls and PD. METHODS: Nine PD patients, 16 PSP patients and ten controls were studied with [99mTc]ECD SPECT using a brain-dedicated device (Ceraspect). Voxel-based analysis was performed with statistical parametric mapping. PCA was applied to volume of interest data after spatial normalisation to CBA. RESULTS: The voxel-based analysis showed hypoperfusion of the anterior cingulate and medial frontal cortex in PSP compared with controls and PD. In PSP patients the rCBF impairment extended to the pre-supplementary motor area and prefrontal cortex, areas involved in executive function and motor networks. Compared with PSP patients, PD patients showed a mild rCBF decrease in associative visual areas which could be related to the known impairment of visuospatial function. The PCA identified three principal components differentiating PSP patients from controls and/or PD patients that included groups of cortical and subcortical brain regions with relatively decreased (cingulate cortex, prefrontal cortex and caudate) or increased (parietal cortex) rCBF, representing distinct functional networks in PSP. CONCLUSION: Anterior cingulate hypoperfusion seems to be an early, distinct brain abnormality in PSP as compared with PD.
Zinzi, P.; Salmaso, D.; De Grandis, R.; Graziani, G.; Maceroni, S.; Bentivoglio, A.; Zappata, P.; Frontali, M.; Jacopini, A.G.	Effects of an intensive rehabilitation programme on patients with Huntington's disease: a pilot study	OBJECTIVE: To investigate the effects of an intensive, inpatient rehabilitation programme on individuals affected by Huntington's disease. DESIGN: A pilot study. Within-subjects design. SETTING: Inpatient rehabilitation home of the Italian welfare system. SUBJECTS: Forty patients, early and middle stage of the disease, were recruited to an intensive, inpatient rehabilitation protocol. INTERVENTIONS: The treatment programme included respiratory exercises and speech therapy, physical and occupational therapy and cognitive rehabilitation exercises. The programme involved three-week admission periods of intensive treatment that could be repeated three times a year. MAIN MEASURES: A standard clinical assessment was performed at the beginning of each admission using the Zung Depression Scale, Mini-Mental State Examination (MMSE), Barthel Index, Tinetti Scale and Physical Performance Test (PPT). Tinetti and PPT were also used at the end of each admission to assess the outcomes in terms of motor and functional performance. RESULTS: Each three-week period of treatment resulted in highly significant (P < 0.001) improvements of motor performance and daily life activities. The average increase was 4.7 for Tinetti and 5.21 for PPT

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		scores. No carry-over effect from one admission to the next was apparent but at the same time, no motor decline was detected over two years, indicating that patients maintained a constant level of functional, cognitive as well as motor performance. CONCLUSIONS: Intensive rehabilitation treatments may positively influence the maintenance of functional and motor performance in patients with Huntington's disease.

Year of Publication 2008

Authors	Title	Abstract
Gardner, A., Salmaso, D., Nardo, D., Micucci, F., Nobili, F., Sanchez-Crespo, A., Jacobsson, H., Larsson, S.A., Pagani, M.	Mitochondrial function is related to alterations at brain SPECT in depressed patients.	INTRODUCTION: 99mTc-d,l-hexamethylpropylene amine oxime (99mTc-HMPAO) retention in brain is proportional to cerebral blood flow and related to both the local hemodynamic state and to the cellular content of reduced glutathione. Alterations of the regional distribution of 99mTc-HMPAO retention, with discrepant results, have been reported at functional brain imaging of unipolar depression. Since mitochondrial involvement has been reported in depressed patients, the aim of the study was to explore whether the 99mTc-HMPAO retention at single-photon emission computed tomography in depressed patients may relate to different levels of mitochondrial function. METHODS: All patients had audiological and muscular symptoms, somatic symptoms that are common in depression. Citrate synthase (CS) activity assessed in muscle mitochondria correlated strongly with the activities of three mitochondrial respiratory chain enzymes and was used as a marker of mitochondrial function. K-means clustering performed on CS grouped eight patients with low and 11 patients with normal CS. Voxel-based analysis was performed on the two groups by statistical parametric mapping. RESULTS: Voxel-based analysis showed significantly higher 99mTc-HMPAO retention in the patients with low CS compared with the patients with normal CS in the posterior and inferior frontal cortex, the superior and posterior temporal cortex, the somato-sensory cortex, and the associative parietal cortex. CONCLUSION: Low muscle CS in depressed patients is related to higher regional 99mTc-HMPAO retention that may reflect cerebrovascular adaptation to impaired intracellular metabolism and/or intracellular enzymatic changes, as previously reported in mitochondrial disorder. Mitochondrial dysfunction in varying proportions of the subjects may explain some of the discrepant results for 99mTc-HMPAO retention in depression.

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Nobili, F.; Salmaso, D.; Morbelli S, Girtler N, Piccardo A, Brugnolo A, Dessi B, Larsson, S.A.; Villavecchia G, Piccini A, Rodriguez G, Pagani, M.	Principal component analysis of FDG PET in amnestic MCI.	Purpose. To evaluate the combined accuracy of episodic memory performance and 18F-FDG-PET in identifying patients with amnestic Mild Cognitive Impairment (aMCI) converting to Alzheimer's disease (AD), aMCI non-converters, and controls.Methods. Thirty-three patients with aMCI and 15 controls (CTR) were followed-up for a mean of 21 months. Eleven patients developed AD (MCI/AD) and 22 remained aMCI (MCI/MCI). 18F-FDG-PET volumetric Regions of Interest underwent Principal Component Analysis (PCA), that identified 12 principal components (PC), expressed by coarse component scores (CCS). Discriminant analysis was performed using the significant PCs and episodic memory scores.Results. PCA highlighted relative hypometabolism in PC5, including bilateral posterior cingulate and left temporal pole, and in PC7, including the bilateral orbitofrontal cortex, both in MCI/MCI and MCI/AD versus CTR. PC5 itself plus PC12, including the left lateral frontal cortex (LFC: BAs 44,45,46,47), were significantly different between MCI/AD and MCI/MCI. By a 3-group discriminant analysis, CTR were more accurately identified by CCS+delayed recall score (100%), MCI/MCI by CCS+ either immediate or delayed recall scores (91%), while MCI/AD by CCS alone (82%). PET increased by 25% the correct allocations achieved by memory scores, while memory scores increased by 15% the correct allocations achieved by PET. Conclusion. Combining memory performance and 18F-FDG-PET yielded a higher accuracy than each single tool in identifying CTR and MCI/MCI. The PC containing bilateral posterior cingulate and left temporal pole was the hallmark of MCI/MCI patients, while the PC including the left LFC was the hallmark of conversion to AD.
Nobili, F.; Salmaso, D.; Morbelli, S.; Girtler, N.; Piccardo, A.; Brugnolo, A.; Dessi, B.; Larsson, S.A.; Rodriguez, G.; Pagani, M.	Principal component analysis of FDG PET in amnestic MCI	PURPOSE: The purpose of the study is to evaluate the combined accuracy of episodic memory performance and (18)F-FDG PET in identifying patients with amnestic mild cognitive impairment (aMCI) converting to Alzheimer's disease (AD), aMCI non-converters, and controls. METHODS: Thirty-three patients with aMCI and 15 controls (CTR) were followed up for a mean of 21 months. Eleven patients developed AD (MCI/AD) and 22 remained with aMCI (MCI/MCI). (18)F-FDG PET volumetric regions of interest underwent principal component analysis (PCA) that identified 12 principal components (PC), expressed by coarse component scores (CCS). Discriminant analysis was performed using the significant PCs and episodic memory scores. RESULTS: PCA highlighted relative hypometabolism in PC5, including bilateral posterior cingulate and left temporal pole, and in PC7, including the bilateral orbitofrontal cortex, both in

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		MCI/MCI and MCI/AD vs CTR. PC5 itself plus PC12, including the left lateral frontal cortex (LFC: BAs 44, 45, 46, 47), were significantly different between MCI/AD and MCI/MCI. By a three-group discriminant analysis, CTR were more accurately identified by PET-CCS + delayed recall score (100%), MCI/MCI by PET-CCS + either immediate or delayed recall scores (91%), while MCI/AD was identified by PET-CCS alone (82%). PET increased by 25% the correct allocations achieved by memory scores, while memory scores increased by 15% the correct allocations achieved by PET. CONCLUSION: Combining memory performance and (18)F-FDG PET yielded a higher accuracy than each single tool in identifying CTR and MCI/MCI. The PC containing bilateral posterior cingulate and left temporal pole was the hallmark of MCI/MCI patients, while the PC including the left LFC was the hallmark of conversion to AD.
Pagani, M.; Flumeri, F.; Nardo, D.; Salmaso, D.; Sanchez-Crespo, A., Danielsson, A.M., Fränden, M., Jacobsson, H., Larsson, S.A.; Högberg, G.	Correlations between cerebral blood flow and structural and neuropsychological parameters in Post-traumatic Stress Disorder.	Background: Neuroimaging investigations in Post-traumatic Stress Disorder (PTSD) have reported findings for either functional or structural data separately. Self rating scales (SRSs) are currently used to diagnose and follow-up treatment outcome. The aim of the study was to analyse by SPECT for the first time in a group of PTSD subjects both functional and structural changes in brain regions implicated in the pathophysiology of PTSD. Furthermore SRSs were validated by correlating their scores to CBF changes occurring in the disease.Subjects and Methods: Thirty three train drivers having being exposed to traumatic experiences at work were separated in two groups: symptomatic (S, n=16) or not symptomatic (NS, n=17), according to PTSD diagnosis. 99mTc-HMPAO SPECT, following administration of an individualised trauma script, and MRI were performed at an average of three years after trauma. CBF and volumetric analyses were carried out by Statistical Parametric Mapping (SPM2) and groups were compared each other. SPECT and MRI data were covaried by age and by time elapsed from trauma-to-SPECT. SPECT data were further covaried by the amount of grey matter normalised by the total intracranial volume. The SRSs Impact of Event Scale (IES), a 15-item report instrument evaluating the amount of intrusion and avoidance during the last week related to a past stressful event and Well-Being Index (WHO-10), which focuses on overall subjective well-being during one week without regard to diagnosis, were assessed and correlation analyses to tracer uptake were performed in the whole group of subjects (S + NS; n=30).Results: Significant differences ($p<0.001$) were found in both SRSs between S and NS. SPM2 analysis showed a significantly higher 99mTc-HMPAO uptake in S as compared to

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		NS in the left insula (Brodmann Area 13, BA13), inferior parietal lobe (BA40), postcentral somato-sensory gyrus (BA2) and thalamus. Both SRSs highly correlated with the tracer uptake of the 33 subjects in the same BAs in which significant differences between S and NS were found. MRI did not show any significant structural change between groups.Conclusion: Occupational trauma-exposed PTSD subjects showed a significantly higher tracer uptake mostly in limbic and inferior parietal cortex as compared to exposed subjects who did not developed PTSD. The Impact of Event Scale and the Well-Being Index highly correlated with tracer uptake changes between groups confirming their diagnostic value and suggesting a possible processing site in the brain. Volumetric MRI data were used as covariate adding value and significance to the analyses.
Pagani, M.; Flumeri, F.; Salmaso, D.; Nardo, D.; Sanchez-Crespo A, Danielsson A-M, Brolin F, Jacobsson H, Larsson, S.A.; Högberg G	Neurobiological changes in Post Traumatic Stress Disorder following treatment with Eye Movement Desensitisation Reprocessing.	Background: Only few studies have reported functional or structural modifications in Post-traumatic Stress Disorder (PTSD) patients following pharmacological or cognitive behavioural treatment. Eye movement desensitization and reprocessing (EMDR) is a novel eclectic psychotherapy utilising, among other techniques, relaxation and safe place exercises, cognitive restructuring, future projections, and imaginal exposure of the trauma combined with sensory stimulation. The aim of the study was to analyse the differences in regional cerebral blood flow distribution and in brain volumetry before and after EMDR therapy.Subjects and Methods: Fifteen subjects with chronic PTSD following occupational health hazards were treated with five sessions of EMDR. They were assessed by psychometric scales and diagnostic interviews before and directly after treatment. SPECT during administration of an individualised trauma script, was performed pre- and post-treatment using 99mTc-HMPAO. After EMDR, the subjects were subdivided into responders (R, n=10) and non-responders (NS, n=5), based on the absence or presence, respectively, of full PTSD diagnosis as assessed by DSM-IV criteria. SPECT and volumetric data (MRI, pre-treatment) analyses were carried out by Statistical Parametric Mapping (SPM2) and data were covaried by age and by time elapsed from trauma to SPECT. SPECT data were further covaried by the amount of grey matter normalised by the total intracranial volume.Results: Immediate significant post-treatment changes towards normality in all scales measuring psychological status were found in responders. As compared to NR, R showed a significantly post-treatment decreased tracer uptake in parieto-occipital (Brodmann Area, BA, 37, fusiform gyrus) and in primary visual cortex (BA17) and in the hippocampus ($p<0.001$).

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		The opposite comparison highlighted an increased tracer uptake in left frontal cortex (BA 44; p<0.05). Volumetric grey matter pre-treatment differences between groups were found in visual, posterior cingulate and parieto-temporal cortex (p<0.05).Conclusion: The positive EMDR outcome corresponded to increased 99mTc-HMPAO uptake in the left dorsolateral frontal cortex, processing attention and self confidence and exerting an inhibitory effect on the amygdala whose firing is supposed to be responsible for PTSD. After successful treatment significant tracer uptake decreases were found in primary visual cortex, processing images of traumatic memories and flashbacks; in fusiform gyrus, processing the memories of faces, bodies and words and in the hippocampi, involved in episodic and autobiographical memories. Volumetric changes pre-treatment superimposed the neurobiological ones in all previous regions. These findings suggest that the positive clinical effect following EMDR therapy causes functional changes and that volumetric modifications pre-treatment are good predictors of psychotherapy outcome.
Pagani, M.; Gardner, A., Varrone A, Bejerot S, Sanchez-Crespo A, Danielsson A-M, Brolin F, Jacobsson H, Larsson, S.A.; Salmaso, D.	99mTc -HMPAO distribution differences at SPECT between depressed females with and without adult ADHD	Background: Adults diagnosed with Attention Deficit Hyperactivity Disorder (ADHD) have an increased prevalence of comorbidity with depressive disorders, high medical expenses and a high rate of absences from work illustrating the elevated productivity costs associated with the disease. The aim of the study was to investigate for the first time by 99mTc-HMPAO SPECT the uptake pattern in ADHD as compare to normal state and to Major Depressive Disorder.Subjects and Methods: Thirty chronically depressed adult females of whom 16 had scores below ("not-ADHD"), and 14 scores above ("adult-ADHD") cut-offs on both the 25-items Wender Utah Retrospective Scale (WURS-25) and the Wender-Reimherr Adult Attention Deficit Disorder Scale (WRAADDS) were investigated with a depression rating scale (MADRS-S) and 99mTc-HMPAO SPECT. SPECT was analyzed by both statistical parametric mapping (SPM2) and the computerized brain atlas (CBA). Controls were 16 aged matched healthy females. Discriminant analysis was performed on the volumes of interest generated by CBA, on the Socialization subscale from the Karolinska Scales of Personality, and on the WRAADDS subscale Impulsivity.Results: The MADRS-S mean score was significantly lower in "not-ADHD" compared to "adult-ADHD" illustrating a more severe depressive state in the latter group. SPM and CBA highlighted a significantly decreased tracer uptake within the bilateral cerebellum in "adult-ADHD" as compared to controls. Significantly increased tracer uptake was found by SPM in

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		"adult-ADHD" as compared to "not-ADHD" within some bilateral grey matter regions (Brodmann Areas 8, 9, 10, 32) and in large portion of the frontal lobe white matter. In the comparison between these two latter groups decreased uptake in thalami and nc.caudati was highlighted by CBA. Impulsivity and Socialization scores along with thalamic tracer distribution discriminated the patient groups with an accuracy of 100%.Conclusion: We found decreased tracer uptake in the bilateral cerebellum as verified by different methodologies, in a group of depressed patients with adult-ADHD in comparison with healthy controls. Neurobiological differences in frontal lobe regions were observed between "adult-ADHD" and less depressed patients without ADHD. Combining the scores of single subscales of two neuropsychological tests and tracer uptake in thalamus yielded a 100% accuracy in discriminating "adult-ADHD" from "not-ADHD" patients. Mood should be considered as an analysis covariate in future studies of ADHD since mood differences between the groups may influence findings.
Pagani, M.; Salmaso, D.; Sidiras G, Jonsson, C.;, Danielsson AM, Fränden M, Jacobsson H, Larsson, S.A.; Lind, F.	Impact of Hypobaric Hypoxia on blood flow distribution in grey and white matter.	Background: The effect of acute hypoxia on cerebral hemodynamics has been mostly investigated in normobaric conditions. However the physiological response to hypoxia has been demonstrated to differ in hypobaric hypoxic conditions as compared to normobaric hypoxia implying that the barometric variables ought to be taken into account in altitude-related investigations on cognitive and pathological (i.e. acute mountain sickness) changes. The aim of the study was to compare the rCBF distribution pattern as acquired under close-to-natural severe poikilocapnic hypobaric hypoxia to that obtained at normobaric normoxia.Subjects and Methods: Six healthy subjects were exposed in a hypobaric chamber to either normobaric normoxia or hypobaric hypoxia (380 mmHg, air PO2 10%). After 40 minutes at the desired pressure they were injected 99mTc-HMPAO and they subsequently underwent SPECT. Tracer uptake differences were analysed by Statistical Parametric Mapping (SPM2). In the hypoxia branch arterial blood sample was taken to assess partial pressures of carbon dioxide (PaCO2) and oxygen Hb saturation (SatO2). Results: In hypobaric hypoxia as compared to the normoxic condition there was a significant relative tracer uptake increase in the left motor (Brodmann Areas, BAs, 4 and 6) and prefrontal (BA 9) cortex, in part of the right limbic system (anterior cingulate, BA32, orbito-frontal cortex, BAs 47 and 11, and insula, BA 13) and in the right dorso-lateral prefrontal cortex (BAs 10 and 45). Thalamus and putamen and large portions of the frontal

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		white matter bilaterally showed as well a higher 99mTc-HMPAO distribution in the hypobaric hypoxic condition.Highly significant negative correlations with SatO2 were found for tracer uptake in the right temporal lobe (BAs 20, 21 and 38) while significant positive correlations with PaCO2 were shown in the same BAs in the right temporal lobe as well as in the left temporal lobe (BAs 20, 21, 34, 36, 38). In both cases large white matter areas showed significant correlations between the two parameters.Conclusion: We found in hypobaric hypoxia a higher cerebrovascular response in the anterior circulation with a significantly increased tracer distribution in both frontal cortex grey and white matter. These findings along with the lack of correlation in these regions with oxygen and carbon dioxide changes suggest regional selective differences in brain sensitivity to hypobaric hypoxia. The specific involvement of both frontal cortex grey and white matter might play an important role in the early cognitive changes occurring under acute hypoxia.
Salmaso, D.; Pagani, M.	Il "brain imaging" nelle malattie degenerative e psichiatriche.	Il termine “brain imaging” include tutte le tecniche di analisi del cervello nelle sue componenti strutturali e/o funzionali, sia in rapporto al suo normale funzionamento che a quello patologico. Le immagini ottenute sono “in vivo” e non-invasive e rappresentano quindi uno sviluppo importante, non solo per l’aumento delle conoscenze, ma anche e, soprattutto, per la prevenzione e la diagnosi delle malattie neurologiche e psichiatriche. Le metodiche maggiormente usate sono la “single photon emission computerized tomography” (SPECT), la “positron emission tomography” (PET), la “functional magnetic resonance imaging” (fMRI) e la “magnetoencephalography” (MEG). Le prime tre hanno una buona risoluzione spaziale (nell'ordine dei mm), ma una scarsa risoluzione temporale (minuti e secondi rispettivamente). L’ultima ha invece una buona risoluzione temporale, ma una scarsa risoluzione spaziale...
Salmaso, D.; Pagani, M.; Gardner, A.	Networking rCBF gender differences in major depression.	Background: There is large evidence that major depressive disorder (MDD) has prevalence rates almost twice as high in females as in men. However, few studies have investigated in MDD the regional cerebral blood flow (rCBF) differences between genders. The aim of the study was to identify the influence of gender on the rCBF distribution in a group of depressed patients. This was performed by means of Volume of Interest (VOI) analysis and Principal Component Analysis (PCA), this latter exploring functional brain connectivity and transforming a number of correlated variables by clustering them into functionally uncorrelated factorsMethods: A group of

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		76 major depressed patients (36 males and 40 females) were investigated by 99mTc-HMPAO and SPECT. Analysis of covariance (ANCOVA) and PCA were performed on 54 VOIs. Neuropsychiatric tests (MADRS, SCID, CFQ, KSP) were also carried out to assess disease severity without finding any gender differences. Results: VOIs analysis identified in females as compared to males a significantly higher rCBF distribution ($F(1,73)=10.875$; $p=0.002$). A significant VOI*Gender interaction was also found ($F(26,1898)=2.180$; $p=0.001$) revealing that 10 regions belonging to the frontal, temporal, parietal and occipital cortex were particularly involved in gender differences. An overall effect of gender was also found for PCA ($F(1,73)=8.814$; $p=0.004$). The significant PCs*Gender interaction ($F(12,876)=3.258$; $p<0.000$) revealed lower rCBF distribution in males as compared to females in 6 PCs. Such PCs, grouped brain regions belonging to parietal-limbic cortex (PC3; $p=0.033$), parieto-temporo-occipital cortex (PCs 8 and 9; $p=0.001$), fronto-parietal cortex (PC10; $p=0.017$), fronto-temporal cortex (PC12; $p=0.001$) and hippocampi (PC 13; $p=0.017$). Age related hippocampal differences were found in PC13 in female only.Conclusion: PC8 grouped two areas involved in linguistic processing, the angular and the supramarginal gyrus of the left hemispheres for which gender differences are widely accepted. PC9 with the right angular gyrus was also likely to show rCBF differences since females are known to be more bilaterally organized. Gender differences in hippocampi confirmed previous findings. However, medial prefrontal cortex (anterior cingulate) bilaterally and right dorsolateral prefrontal cortex, regions known from the existing literature to be implicated in MDD, were grouped by PCA into different PCs (PC1 and PC4, respectively) but did not show any sex difference speaking against specific gender related rCBF changes in major depression. PCA grouping functionally connected brain regions increased the depth of the analysis yielding more information on the processes underlying perfusion distribution measurements in MDD.

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Gardner, A.; Salmaso, D.; Varrone, A.; Sanchez-Crespo, A.; Bejerot, S.; Jacobsson, H.;	Differences at brain SPECT between depressed females with and without adult ADHD and healthy controls: etiological	Background: Comorbidity between Attention Deficit Hyperactivity Disorder (ADHD) and mood disorders is common. Alterations of the cerebellum and frontal regions have been reported in neuro-imaging studies of ADHD and major depression. Methods: Thirty chronically depressed adult females of whom 16 had scores below, and 14 scores above, cut-

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Larsson, S.A.; Pagani, M.	considerations.	offs on the 25-items Wender Utah Retrospective Scale (WURS-25) and the Wender-Reimherr Adult Attention Deficit Disorder Scale (WRAADDS) were divided into subgroups designated ``Depression{''} and ``Depression + ADHD{'' respectively. Twenty-one of the patients had some audiological symptom, tinnitus and/or hearing impairment. The patients were investigated with other rating scales and Tc-99m-HMPAO SPECT. Controls for Tc-99m-HMPAO SPECT were 16 healthy females. SPECT was analyzed by both statistical parametric mapping (SPM2) and the computerized brain atlas (CBA). Discriminant analysis was performed on the volumes of interest generated by the CBA, and on the scores from rating scales with the highest group differences. Results: The mean score of a depression rating scale (MADRS-S) was significantly lower in the ``Depression{''} subgroup compared to in the ``Depression + ADHD{''} subgroup. There was significantly decreased tracer uptake within the bilateral cerebellum at both SPM and CBA in the ``Depression + ADHD{''} subgroup compared to in the controls. No decrease of cerebellar tracer uptake was observed in ``Depression{''}. Significantly increased tracer uptake was found at SPM within some bilateral frontal regions (Brodmann areas 8, 9, 10, 32) in the `` Depression + ADHD{''} subgroup compared to in ``Depression{''}. An accuracy of 100\% was obtained for the discrimination between the patient groups when thalamic uptake was used in the analysis along with scores from Socialization and Impulsivity scales. Conclusion: The findings confirm the previous observation of a cerebellar involvement in ADHD. Higher bilateral frontal Tc-99m-HMPAO uptake in `` Depression + ADHD{''} compared to in ``Depression{''} indicate a difference between these subgroups. Tc-99m-HMPAO uptake mechanisms are discussed.
Manouilenko, I; Stone-Elander, S.; Odh, R.; Salmaso, D.; Danielsson, A. M.; Hatherly, R.; Jacobsson, H.; Larsson, S.A.; Bejerot, S.; Pagani, M.	Cerebral blood flow distribution in autism spectrum disorder – A 11C- Butanol PET/CT study.	Objectives: Autism Spectrum Disorder (ASD) is regarded as an early onset behavioural syndrome but no biological markers have been established yet. Functional studies have shown localized focal hypoperfusion and abnormalities in the anatomo-functional connectivity of the limbic-striatal "social" brain. The aim of this study was to investigate the regional cerebral blood flow (rCBF) at rest in subjects with ASD as compared to a group of healthy controls.Methods: Thirteen normal intelligence patients with ASD and ten healthy controls (HC) underwent PET/CT using [1-11C]-butanol, a perfusion tracer produced from [11C]carbon dioxide. The whole examination time was less than 10 minutes. Data were analysed by SPM (p=0.05 for voxel height, pcorrected<0.001 at cluster level and puncorrected < 0.001 at voxel level).Results: As

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		compared to HC, ASD showed a highly significant CBF increase in right parahippocampal (BAs 28, 30,35), limbic (BAs13, 23), visual (BAs 17, 18, 19) and temporal cortex (BAs 21, 37, 38, 39), putamen, caudatus and cerebellum. Conclusions: Using state-of-the-art neuroimaging methodologies, reduced considerably the examination time resulting in less stress to these psychiatric patients and in robust results. The limbic and posterior associative cortices and cerebellum were found to have an increased CBF in ASD, underscoring their involvement in the disease and raising methodological and diagnostic issues to be considered when exploring the neuroanatomy of ASD.
Pagani, M.; Dessi, B., Morbelli, S.; Brugnolo, A.; Salmaso, D.; Piccini, A.; Mazzei, A.; Villavecchia, G.; Larsson, S.A.; Rodriguez, G.; Nobili, F.	MCI patients declining and not declining at mid-term follow-up: FDG-PET findings.	Patients with Mild Cognitive Impairment (MCI) not converted to dementia at one to three years follow-up represent a heterogeneous group across studies, by including 'late converters' but also patients without any neurodegenerative disease. We tested the hypothesis that the combination of memory and brain metabolic assessment could identify subgroups of memory decliners (MCI/Decl) and non-decliners (MCI/noDecl) before a long follow-up time is available. From twenty-seven patients with amnestic MCI (aMCI) at baseline, three groups were identified at follow-up: 10 patients who converted to AD (MCI/AD); 10 patients showing episodic memory worsening (MCI/Decl) and 7 patients showing no memory worsening or even improvement (MCI/noDecl). They were compared at base-line with a group of fourteen elderly controls (CTR) by FDG-PET performed by means of voxel-based analysis (SPM2), accepting an uncorrected $p<0.001$ height threshold at voxel level and a corrected $p<0.05$ threshold at cluster level. Two hypometabolic clusters were found in MCI/AD versus CTR, including the bilateral posterior cingulate cortex and the parietal precuneus, fusiform and inferior temporal gyri in the left hemisphere. The MCI/Decl showed a hypometabolic region in the left medial temporal lobe versus both CTR (hippocampus) and MCI/noDecl (fusiform gyrus). No significant difference was found in the comparison between CTR and MCI/noDecl, neither in the comparison between MCI/Decl and MCI/AD. Thus, non converter MCI patients comprised a sub-group of 'decliners' with AD-like metabolic and cognitive patterns, likely including 'late converters', and a sub-group lacking this pattern, with stable or improving memory function and a brain metabolic picture similar to that in healthy controls. Combining neuropsychological and FDG-PET information could be used for prognostic purposes in aMCI patients at medium-term follow-up.

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Pagani, M.; Manouilenko, I.; Stone-Elander, S.; Odh, R.; Salmaso, D.; Danielsson, AM; Hatherly, R.; Jacobsson, H.; Larsson, S.A.; Bejerot, S.	Neurobiological substrate of autism spectrum disorder - cerebral blood flow distribution of 11C-butanol as assessed by PET/CT.	BackgroundFunctional studies in Autism Spectrum Disorder (ASD) have shown localised focal hypoperfusion and abnormalities in the anatomo-functional connectivity of limbic-striatal 'social' brain. However, no common regional abnormalities have been found across studies.The aim of this study was to investigate the cerebral blood flow (CBF) at rest in subjects with ASD as compared to a group of healthy controls.MethodsIn this preliminary investigation six normal intelligence patients with ASD and 5 age and sex matched healthy controls (HC) were examined using PET/CT camera and, as CBF tracer, 11C-butanol, a radiopharmaceutical produced on-site. The combination of these two methodologies reduced the whole examination time to less than 10 minutes. Statistical Parametric Mapping was implemented to analyse the data.ResultsAs compared to HC, ASD showed a highly significant CBF increase (height threshold p=0.001, p< 0.0001 at voxel-level), bilaterally, in large portions of the cerebellum, of the visual associative cortex and of the posterior parietal lobe.ConclusionsThis preliminary study was performed by the state-of-the-art neuroimaging methodologies that reduced considerably the examination time and resulted in less stress and more reliable investigations. The occipital and parietal associative cortex as well as the cerebellum showed an increased CBF in ASD, underscoring their involvement in the disease and raising methodological and diagnostic issues to be considered when exploring the neuroanatomy of ASD.
Pagani, M.; Nardo, D.; Flumeri, F.; Salmaso, D.; Looi, J.; Sanchez-Crespo, A.; Larsson, S.A.; Sundin, Ö.; Högberg, G.	Volumetric changes in PTSD and in a subgroup of PTSD patients not responding to EMDR psychotherapy.	Background: Several studies have reported limbic structures volume decrease in Post-Traumatic Stress Disorder (PTSD). However, in PTSD the effect of therapy on brain structures has seldom been investigated. The aim of the study was to evaluate the grey matter (GM) loss in occupational related PTSD and to assess the volumetric differences between patients responding (R) and non-responding (NR) to psychotherapy. Methods: Pre-EMDR MRI data of 21 train drives who did develop PTSD (S) and 22 who did not develop PTSD (NS) after person-under-the-train accidents were compared. Within S further comparisons were made between 10 R to Eye Movement Desensitisation Reprocessing (EMDR) therapy and 5 NR. Data were analysed by optimised voxel-based morphometry as implemented in Statistical Parametric Mapping. Results: As compared to NS, S showed a significant GM volume reduction in precuneus, lingual gyrus, posterior cingulate and parahippocampal cortex. The R>NR comparison highlighted a significant GM reduction in NR in bilateral posterior cingulate, left middle frontal cortex and right parahippocampal, insular

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		and temporal cortices. Conclusions: Comparing two large groups of subjects significant GM volumetric reductions were found in PTSD in posterior limbic structures. NR showed, as compared to R, volume reduction in cortical structures including posterior cingulate and parahippocampal cortex. These latter two structures seem to be the hallmark for both PTSD diagnosis and therapy outcome prediction.
Pagani, M.; Salmaso, D.; Rodriguez, G.; Nardo, D.; Nobili, F.	Principal component analysis in mild and moderate Alzheimer's disease -- A novel approach to clinical diagnosis.	Principal component analysis (PCA) provides a method to explore functional brain connectivity. The aim of this study was to identify regional cerebral blood flow (rCBF) distribution differences between Alzheimer's disease (AD) patients and controls (CTR) by means of volume of interest (VOI) analysis and PCA. Thirty-seven CTR, 30 mild AD (mildAD) and 27 moderate AD (modAD) subjects were investigated using single photon emission computed tomography with (99m)Tc-hexamethylpropylene amine oxime. Analysis of covariance (ANCOVA), PCA, and discriminant analysis (DA) were performed on 54 VOIs. VOI analysis identified in both mildAD and modAD subjects a decreased rCBF in six regions. PCA in mildAD subjects identified four principal components (PCs) in which the correlated VOIs showed a decreased level of rCBF, including regions that are typically affected early in the disease. In five PCs, including parietal-temporal-limbic cortex, and hippocampus, a significantly lower rCBF in correlated VOIs was found in modAD subjects. DA significantly discriminated the groups. The percentage of subjects correctly classified was 95, 70, and 81 for CTR, mildAD and modAD groups, respectively. PCA highlighted, in mildAD and modAD, relationships not evident when brain regions are considered as independent of each other, and it was effective in discriminating groups. These findings may allow neurophysiological inferences to be drawn regarding brain functional connectivity in AD that might not be possible with univariate analysis.
Zinzi, P., Salmaso, D.; Frontali M; Jacopini, A.G.	Patients' and caregivers' perspectives: assessing an intensive rehabilitation program outcomes in Huntington's disease.	Aim: To investigate the subjective evaluation of an intensive rehabilitation programme and outcomes by people with Huntington's disease (HD) and their caregivers. Subjects and methods: A written questionnaire was mailed to people with mild-moderate HD (n=40) who had completed at least one course of the intensive, inpatient rehabilitation protocol carried out at a facility of the Italian National Welfare System in the previous 3 years (on average 8.6 months before). Descriptive and inferential statistics were used. Thematic analyses were also conducted on written texts. Results: The response rate was 93%. A general improvement after discharge was perceived by

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		all of the respondents. Improvements were reported on gait, balance, motor control, and fall reduction. Duration of benefits was estimated to last from 1 to 3 months by 71% of informants with no carry over to the next admission, which occurred on average 5.7 months later. Ameliorations were also reported in speech and swallowing, and several psychosocial aspects: mood, apathy, familiar and social relationships (binomial test, $p<0.05$). As far as organisational aspects of structure and programme are concerned, all respondents expressed a positive evaluation (binomial test, $p<0.05$). The mean vote given to the whole rehabilitation experience by patients on a 10-point scale was 7.3, confirmed by caregivers' mean vote of 7.4. Additional free comments were added by the majority of respondents (n=35). From caregivers' and patient's perspectives, relevant themes emerged. Conclusion: An intensive rehabilitation programme in people with HD is perceived to produce relevant improvements beyond bodily motor and functional performance. Patients' and caregivers' evaluations are relevant in health-care research in order to assess the worth of a programme and to define new ones.

Year of Publication 2010

Authors	Title	Abstract
Pagani, M.; Chiò, A.; Valentini, M.C.; Morbelli, S.; Montuschi, A.; Salmaso, D.; Rodriguez, G.; Nobili, F.; Mancini, M.; Cistaro, A.	Amyotrophic lateral sclerosis: increased 18F-FDG uptake in sub-cortical structures.	Background: Amyotrophic lateral sclerosis (ALS) is a neurodegenerative diseases characterized by both upper and lower motor neuron lesion. The hypothesis of ALS being a multisystem disorder is supported by the involvement of other central nervous system structures, such as the frontal cortex. The aim of the study was to assess brain metabolic changes at PET/CT in a group of consecutive ALS patients. Subjects and Methods: The 18F-FDG PET/CT scans of sixteen ALS patients with prevalence of either upper or lower motor neuron lesion were compared to those from twenty-nine normal controls (CTRL). Differences were analyzed by statistical parametric mapping (SPM2) introducing age and sex as nuisance variables. SPM t-maps were thresholded using a $p<0.05$ threshold, corrected for multiple comparisons with the False Discovery Rate (FDR) option at voxel level and $p<0.001$ corrected for multiple comparison at cluster level. Results: As compared to CTRL, ALS patients showed a significant lower FDG uptake in right middle temporal gyrus white matter. The reverse comparison resulted in significantly higher FDG uptake ($p<0.01$ FDR corrected) in ALS patients as compared to CTRL in white matter portions (as well in corresponding adjacent grey matter regions) of the subcallosal and rectal gyri (corresponding

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		Brodmann Areas, BAs, 25 and 11), uncus and parahippocampal gyri (BAs 34 and 28), insula (BA 13), internal capsula, nc.caudatus, putamen and globus pallidus bilaterally as well as anterior cingulate (BAs 24 and 32) on the right hemisphere, and thalamus and claustrum on the left hemisphere. ALS patients showed also a highly significant increase in FDG uptake in the brainstem, particularly in the subthalamic nucleus, substantia nigra, and red nucleus. Conclusions: The main finding of this PET/CT study investigating a population of ALS was an increased 18F-FDG uptake in large white matter subcortical and brainstem regions. The pathophysiological meaning of this finding is unclear. Compensatory, hyperactivation mechanisms seem unlikely because the majority of glucose is taken up at synaptic level, thus not in the white matter. On the other hand, the hypothesis of reactive astrocytosis and/or microgliosis accounting for increased glucose metabolism in the white matter should be assessed by more specific investigations.
Pagani, M.; Dessi, B.; Morbelli, S.; Brugnolo, A.; Salmaso, D.; Piccini, A.; Mazzei, D.; Villavecchia, G.; Larsson, S.A.; Rodriguez, G.; Nobili, F.	MCI patients declining and not-declining at mid-term follow-up: FDG-PET findings	Patients with Mild Cognitive Impairment (MCI) not converted to dementia at one to three years follow-up represent a heterogeneous group across studies, by including 'late converters' but also patients without any neurodegenerative disease. We tested the hypothesis that the combination of memory and brain metabolic assessment could identify subgroups of memory decliners (MCI/Decl) and non-decliners (MCI/noDecl) before a long follow-up time is available. From twenty-nine patients with amnestic MCI (aMCI) at baseline, three groups were identified at follow-up: 10 patients who converted to AD (MCI/AD); 10 patients either showing episodic memory worsening or reaching the floor effect on memory and declining in other key tests (MCI/Decl) and 9 patients showing no memory worsening or even improvement (MCI/noDecl). They were compared with a group of fourteen elderly controls (CTR) by means of basal FDG-PET voxel-based analysis (SPM2). Two hypometabolic clusters were found in MCI/AD versus CTR, including the bilateral posterior cingulate cortex, the left parietal precuneus and the left fusiform gyrus. MCI/AD showed also a large hypometabolic region, mainly including the left medium and superior temporal gyri and inferior parietal lobule, when compared to MCI/noDecl. The MCI/Decl showed a hypometabolic region in the left medial temporal lobe versus both CTR (hippocampus) and MCI/noDecl (parahippocampal gyrus and hippocampus). No significant difference was found in the comparison between CTR and

Authors	Title	Abstract
		MCI/noDecl, neither in the comparison between MCI/Decl and MCI/AD. Thus, non converter MCI patients comprised a sub-group of 'decliners' with AD-like metabolic and cognitive patterns, likely including 'late converters', and a sub-group lacking this pattern, with stable or improving memory function and a brain metabolic picture similar to that in healthy controls. Combining neuropsychological and FDG-PET information could be used for prognostic purposes in aMCI patients at medium-term follow-up.
Zinzi, P.; Carriero, I.; Salmaso, D.; Cordi, A.; Frontali, M.; Jacopini, A.G.	Communication of risk in families living with Huntington's disease: a web survey to explore what they think, what they do	Huntington's disease (HD) is a neurodegenerative, autosomal dominant, late-onset disease neither curable nor preventable. We explored parental practices of informing children of risk for HD and the differences, if any, in truth disclosure from a generation to the other. An anonymous Internet survey was proposed to visitors from HD families on the lay Association website www.aichroma.com. The survey explored the following issues:• The way they, as children, had been informed of risk for HD• The best age to receive the information and the ideal provider• Whether being informed is useful or not• The way they, as parents, had informed (or planned to inform) their childrenEighty-five-individuals responded: 80 were HD families members and 5 partners.Preliminary data show that parents have difficulty communicating children about disease and risk. The majority of respondents had children in condition of risk: about 80% of children had a parent who was carrier or symptomatic or at risk. Among respondents, those who did not have children stated they would inform them in case they had while the majority of those who actually had children did not provide any information nor showed any clear intention of doing it in the future.Telling children the truth about HD and risk raises ambivalence. The opportunity to access good sources of counseling and support seems relevant in order to enable families to manage the emotional distress of giving such information.
Zinzi, P.; Salmaso, D.; Zappata, P.; De Grandis, R.; Maceroni, S.; Basmagi, L.; Bentivoglio, A.; Frontali, M.; Jacopini, A.G.	Intensive multidisciplinary rehabilitation for HUNTINGTON'S disease in Italy: results in a cohort of patients with consecutive treatments over 5 years	Since studies on Huntington's disease (HD) mice models have shown a positive impact of environmental enrichment on the performance of affected animals and on disease progression, research in the field of rehabilitative therapies for HD patients has been stimulated and encouraged. A pilot project on intensive multidisciplinary rehabilitation was started more than 10 years ago in Italy. This experience was the rst to achieve a quantitative, as well as qualitative, assessment of the effect of rehabilitation therapy in HD patients in the short e medium term over a 2 year period.

Authors	Title	Abstract
		At present we are completing the data collection of 10 years of rehabilitation experience (from 2000 to 2009) involving about 100 patients, Shoulson stage I e III, with no current severe psychiatric comorbidity or advanced dementia, who underwent a minimum of 1 up to 24 consecutive treatments. The treatment programme included physiotherapy, occupational therapy, cognitive rehabilitation, respiratory exercises and speech therapy. The treatment was timed on 3 weeks of inpatient intensive treatment to be repeated up to three times a year. A standard clinical assessment was performed at the beginning of each admission using: Zung Scal (depression), Mini-Mental State Examination (cognition), Barthel Index (ADL). Tinetti Scale (balance and gait) and Physical Performance Test-PPT (performance on specic tasks) were used to asses motor and functional performance at the beginning and end of each admission. First exploration of outcomes in groups with 1 (n=85), 1-2 (n=68), . , 1-13 (n=12) treatments showed that each 3 week period of intensive rehabilitation treatment had highly positive short term effects on the Tinetti Scale and PPT ($p < 0.001$). A decrease in performance was very small and became signicant only after a 2 year period (n=35). Treatment effect was on average 3.6 and 3.9 for Tinetti and PPT, respectively, while the decrease from two consecutive admissions (means 5.95 months after) was on average 0.2 and 0.5. This decline seems inferior to normal decline, suggesting a positive effect of the treatment effect. This is confirmed by the Barthel Index which showed a decrease of 2.2/year. Cognition capacity remained stable over the 5 year period while for depression scores a moderately decrease was apparent.

Year of publication 2011

Authors	Title	Abstract
Pagani, M., Salmaso, D., Sidiras, G., Jonsson, C., Jacobsson, H., Larsson, S.A., Lind, F.	IMPACT OF HYPOBARIC HYPOXIA ON BLOOD FLOW DISTRIBUTION IN BRAIN.	Aim: Acute hypobaric hypoxia is well known to alter brain circulation and to cause neuropsychological impairment. However, very few studies have examined the regional changes occurring in the brain during acute exposure to extreme hypoxic conditions. Methods: Regional cerebral blood flow response to hypoxia was investigated in six healthy subjects exposed to either normobaric normoxia or hypobaric hypoxia with ambient pressure/inspired oxygen pressure of 101/21 kPa and 50/11 kPa, respectively. After 40 minutes at the desired pressure they were injected ^{99m}Tc-HMPAO and subsequently underwent Single Photon Emission Computed Tomography. Regional Cerebral Blood Flow distribution changes in the whole brain were assessed by Statistical Parametric Mapping, a well established voxel-based analysis method. Results: Hypobaric hypoxia increased regional cerebral blood flow distribution in sensorymotor and prefrontal cortices and in central structures. $PaCO_2$ correlated positively and $SatO_2$ negatively with regional cerebral blood flow in several temporal, parahippocampal, parietal and central structures. Conclusions: These findings underscore the specific sensitivity of the frontal lobe to acute hypobaric hypoxia and of limbic and central structures to blood gas changes emphasising the involvement of these brain areas in acute hypoxia.
Calvo, A, Pagani, M, Moglia, C, Canosa, A, Gallo, S, Valentini, C, Morbelli, S, Montuschi, A, Salmaso, D, Rodriguez, G, Nobili, F, Mancini, M, Cistaro, A, Chio, A.	Increased 18F-FDG Uptake in Sub-Cortical Structures of ALS Patients	OBJECTIVE: To assess PET/CT brain metabolic changes in a series of consecutive ALS patients. BACKGROUND: Recent data suggest that ALS is a multisystem disorder, characterized by the involvement of various central nervous system areas. DESIGN/METHODS: 18F-FDG PET/CT scans of 32 ALS patients (13 bulbar, 19 spinal) were compared to those from 22 healthy controls. Differences were analyzed by statistical parametric mapping (SPM2), controlled by age and gender. A $p<0.05$ threshold was used for SPM t-maps, corrected for multiple comparisons with the False Discovery Rate (FDR) option at voxel level and $p<0.001$ corrected for multiple comparison at cluster level. RESULTS: Compared to controls, ALS patients showed a significant lower FDG uptake in the right (R) and left (L) premotorcortex (Brodmann Area [BA] 6), R and L lingual gyrus (BA 18), R primary visual cortex (BA 17), R fusiform gyrus (BA 18) and L pre-central gyrus (BA 8, 9). The reverse comparison resulted in higher FDG uptake in ALS patients in the R and L amygdala, R and L pons and midbrain, R and L cerebellar tonsil, R lateral globus pallidus. ALS patients showed also a highly significant increase in FDG uptake in the brainstem (subthalamic nucleus, substantia nigra, and red nucleus). Bulbar onset

Authors	Title	Abstract
		patients showed high FDG uptake in R and L pons, and low uptake in almost all fronto-temporal regions; in spinal patients, FDG uptake was higher in R and L midbrain (BA 21, 28), and was reduced in R and L lingual gyrus (BA 18) and R fusiform gyrus (BA 19). CONCLUSIONS: This PET/CT study revealed increased 18F-FDG uptake in large subcortical and brainstem regions in ALS. Significant differences between bulbar and spinal cases were also found. We hypothesize that the increase of glucose metabolism may be related to a reactive astrocytosis and/or microgliosis.
Zinzi, P, Salmaso, D, De Grandis, R, Maceroni, S, Basmagi, LM, Zappata, P, Bentivoglio, AR, Frontali, M., Jacopini, AG	L'ESPERIENZA ITALIANA DI RIABILITAZIONE MULTIDISCIPLINARE INTENSIVA NELLA MALATTIA DI HUNTINGTON. RISULTATI IN UNA COORTE DI PAZIENTI CON TRATTAMENTI CONSECUTIVI FINO A 5 ANNI	Dal momento che studi su modelli murini con malattia di Huntington (MH) hanno dimostrato un impatto positivo dell' arricchimento ambientale sulle prestazioni degli animali e sulla progressione della malattia(1-3), la ricerca nel campo delle terapie riabilitative per pazienti MH è stata enormemente stimolata ed incoraggiata. Un progetto pilota sulla riabilitazione multidisciplinare intensiva è stato avviato più di dieci anni fa in Italia presso la Casa di Cura di Riabilitazione «Nova Salus» in Abruzzo, da un gruppo di ricerca del Consiglio Nazionale delle Ricerche (CNR, ISTC e INMM) e l'Università Cattolica del Sacro Cuore (UCSC) Policlinico "A.Gemelli" in collaborazione con l'Associazione AICH-Roma Onlus. Questa esperienza fu la prima a realizzare una valutazione, quantitativa e qualitativa, degli effetti della terapia riabilitativa in pazienti con MH in stadio iniziale ed intermedio, dimostrando che un approccio riabilitativo può avere un'influenza positiva di breve-medio termine sui pazienti lungo un periodo di due anni (4,5). Molte altre esperienze nazionali ed internazionali si sono sviluppate a partire da questo punto di svolta. Il programma di trattamento incluso fisioterapia, riabilitazione cognitiva, esercizi respiratori e logopedia. Il trattamento è stato somministrato in 3 settimane di trattamento intensivo in regime di ricovero e poteva essere ripetuto fino a 3 volte l'anno. Una valutazione clinica standard era effettuata all'inizio di ogni nuovo ricovero utilizzando i seguenti strumenti: Scala di Zung (depressione), Mini Mental State Examination (cognizione), Barthel Index (ADL). La Scala di Tinetti (equilibrio e l'andatura) e il Physical Performance Test-PPT (prestazioni su compiti specifici, tra cui scrivere una frase, simulazione del mangiare, sollevare un libro e riporlo su una mensola, indossare e togliere una giacca, raccolta di una moneta da terra, giravolta a 360 gradi, camminare, salire le scale) sono stati utilizzati per valutare le prestazioni motorie e funzionali all'inizio e alla fine di ciascun trattamento intensivo. Il primo trattamento riabilitativo intensivo valutato in 85 soggetti ha avuto effetti a breve termine (pre-post) molto

Authors	Title	Abstract
		positivi: + 4,24 per la Scala Tinetti e 4,76 per il PPT (P <.001). Una esplorazione dei risultati nei gruppi con 1 (n = 85), 1-2 (n = 68), 1-3 (n = 52) ... ... 1-13 (n = 12) trattamenti di riabilitazione intensiva hanno mostrato che le 3 settimane di programma hanno sempre avuto effetti a breve termine molto positivi sulle prestazioni motorie (Scala Tinetti) e funzionali(PPT) (P <.001). Il calo nelle performances è di ridotta entità e diventa significativo solo dopo un periodo di 2 anni (n = 35). L'effetto del trattamento è in media 3,6 e 3,9 rispettivamente per Tinetti e PPT, mentre la riduzione per due trattamenti consecutivi (in media dopo 5,95 mesi) è in media di 0,2 e 0,5. Questo declino appare minimo e suggerisce un effetto positivo del trattamento. A supporto di ciò le prestazioni del Barthel Index che mostrano un decremento di 2.2/anno. Le abilità cognitive globali misurate dal MMSE rimangono stabili nei 35 pazienti per tutto il periodo di cinque anni, mentre compare una moderata diminuzione dei punteggi sulla Scala di Zung per la depressione che corrisponde ad un miglioramento dell'umore.

Year of publication 2012

Authors	Title	Abstract
Pagani, M, Manouilenko, I., Stone-Elander, S, Odh, R, Salmaso, D., Hatherly, R, Brolin, F., Jacobsson, H., Larsson, SA, Bejerot, S.	Alterations in cerebral blood flow as assessed by PET/CT in adults with Autism Spectrum Disorder with normal IQ.	Specific biological markers for Autism Spectrum Disorder (ASD) have not yet been established. Functional studies have shown abnormalities in the anatomo-functional connectivity of the limbic-striatal "social" brain. This study aimed to investigate regional cerebral blood flow (rCBF) at rest. Thirteen patients with ASD of normal intelligence and ten IQ-, sex- and age-matched healthy controls (HC) underwent PET/CT using [1-11C]butanol, a perfusion tracer. As compared to HC, ASD showed significant CBF increases in the right parahippocampal, posterior cingulate, primary visual and temporal cortex, putamen, caudatus, substantia nigra and cerebellum. No statistically significant correlation between CBF and IQ was found. The limbic, posterior associative and cerebellar cortices showed increased blood flow in ASD, confirming previous findings about the neuroanatomy of ASD.
Cistaro, A., Valentini, M.C., Chiò, A., Nobili, F., Calvo, A., Moglia, C., Montuschi, A., Morbell, S., Salmaso, D., Fania, P., Carrara, G., Pagani, M.	Brain hypermetabolism in amyotrophic lateral sclerosis: a FDG PET study in ALS of spinal and bulbar onset	Purpose To identify the neurobiological traits of amyotrophic lateral sclerosis (ALS) and to elucidate functional differences between ALS of spinal and bulbar onset. We hypothesized that glucose metabolism distribution might vary between groups. Methods The study groups comprised 32 patients with ALS of either bulbar (n = 13) or spinal (n = 19) onset and 22 subjects as controls. They were investigated by [18 F]fluorodeoxyglucose (FDG) positron emission tomography (FDG PET), comparing the patient groups with each other and with the controls by statistical parametric mapping. Results Highly significant relative increases in glucose metabolism distribution were found in the group comprising all 32 ALS patients as compared with the controls in the bilateral amygdalae, midbrain, pons and cerebellum. Relative hypermetabolism was also found in patients with spinal onset as compared with the controls in the right midbrain. In patients with bulbar onset compared with the controls and with patients with spinal onset, large relatively hypometabolic areas were found in the bilateral frontal cortex, right insula, anterior cingulate, precuneus and inferior parietal lobe. Patients with spinal onset had significantly higher scores in a neuropsychological test assessing verbal fluency compared with patients with bulbar onset. Conclusion This large FDG PET investigation provided unprecedented evidence of relatively increased metabolism in the amygdalae, midbrain and pons in ALS patients as compared with control subjects, possibly due to local activation of astrocytes and microglia. Highly significant relative decreases in metabolism were found in large frontal and parietal regions in the bulbar onset patients as compared with the spinal onset patients and the controls, suggesting a

Authors	Title	Abstract
		differential metabolic and neuropsychological state between the two conditions.

Elenchi

Reference_Type	
Book Edited	2
Book Section	16
Conference Proceedings	96
Generic	4
Journal Article	101
Magazine Article	1
Manuscript	35
Newspaper Article	1

Year of Publication	
1975	1
1976	5
1977	3
1978	6
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Elenco autori

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Ansjon, R.	1
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Carrara, G.	1
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Cassanelli, L.	1
Chee Leong Looi, J.	1
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Fania, P.	1
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Flumeri, F.	7
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Gadola, G.	1
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Gardner, A.	18
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Gerbino, W.	3
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Girtler, N.	3
Goldsmith, R.	1
Graziani, G.	5
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Guerra, U.P.	1
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Manouilenko, I.	6
Marsella, D.	4
Mazzei, D.	2
Mecacci, L.	11
Messa, G.	3
Micucci, F.	1
Moglia, C.	2
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Perusini, G.	1
Piccardo, A.	3
Piccini, A.	3
Placella, G.L.	1
Previdi, P.	7
Raffaele, M.	1
Rajczi, K.	1
Ramstrom, C.	4
Rao, S.M.	2
Ravagnan, G.	3
Rickman, C.	4
Riggio, L.	1
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Rodriguez, G.	13
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Rossi, B.	7
Roveri, R.	1
Rustichelli, P.	1
S.I.E.	1
Salsano, A.	1
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Sava, D.	3
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Silvestri, R.	1
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Sinclair, M.A.	1
Smirne, S.	1
Soares, J.	6
Spreafico, L.	4
Stain, R.	1
Stone-Elander, S.	6
Sumen, G.	1
Sundin, Ö.	11
Tabossi, P.	1
Tarnell, B.	2
Terzano, M.G.	2
Thurfjell, L.	5
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Tärnell, B.	1
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Uusijarvi, J.	1
Valentini, M.C.	3
Varrone, A.	5
Venneri, A.	1
Vezzadini, G.	3
Villaggio, G.	3
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Vittori, M.L.	3
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Woodley, S.W.	2
Wägner, A.	11
Zani, A.	1
Zappata, P.	8
Zeiler, K.	1
Zhang, Y.	1
Zinzi, P.	15
Zolo, P.	1

Keyword (From ISI ...)	
Acclimatisation	2
Acoustic Stimulation/methods	1
ACOUSTICAL PERCEPTION	1
Activities of Daily Living	1
Acute Disease	1
Adolescent	4
Adult	16
age	1
Age Factors	1
Age of Onset	1
Aged	12
Aged, 80 and over/psychology	1
aging	1
Aging/physiology	1
Aging/psychology	1
Algorithms	2
Altitude	1
altitude acclimatization	1
Altitude Sickness/physiopathol	1
Alzheimer Disease/diagnosis	1
Alzheimer Disease/diagnosis/ps	1
Alzheimer Disease/epidemiology	1
Alzheimer's disease	6
amine transport	1
amnesia	1
Amnesia/pathology/physiopathol	1
Amnestic mild cognitive impair	1
Analysis of Variance	3
APPLIED PSYCHOLOGY LABORATORIE	1
Arousal	1
article	5
asymmetry	1
Attention	5
Attention/physiology	1
Basal Ganglia	1
Basal Ganglia/blood supply/rad	1
Basal Ganglia/radionuclide ima	1
basal ganglion	1
Brain	1
Brain atlas	1
brain blood flow	2
Brain Damage, Chronic	1
Brain Diseases/psychology	1
Brain Mapping	6
Brain Mapping/methods	2
brain metabolism	2
brain region	2
Brain/blood supply/radionuclid	2
Brain/metabolism/radionuclide	2
Brain/radionuclide imaging	2
Breathing Exercises	1
Caregivers	1
Case-Control Studies	1
caudate nucleus	1

Keyword (From ISI ...)	
central nervous system	3
Cerebral Cortex	2
Cerebral Cortex/radionuclide	1
Cerebral Ventricles/radionucli	1
Cerebrovascular Circulation	3
Cerebrovascular Circulation/ph	3
Child	1
chronic brain disease	1
cingulate gyrus	2
Citrate (si)-Synthase/metabolism	1
classification	1
clinical article	2
Cognition	2
computer program	1
COMPUTER SOFTWARE	1
Conflict (Psychology)	1
consensus	1
controlled study	2
Cost Control	1
degenerative disease	1
dementia	1
Depression/metabolism/radionuc	1
Depression/therapy	1
Depressive Disorder, Major/dia	1
Depressive Disorder/diagnosis/	1
Depressive Disorder/radionucli	1
derivatives/diagnostic use	1
Desensitization, Psychologic/m	1
Diagnosis, Differential	1
diagnostic accuracy	1
diagnostic imaging	1
Discriminant Analysis	2
Discrimination Learning	6
disease classification	1
disease course	1
disease exacerbation	1
Dominance, Cerebral	4
Dominance, Cerebral/physiology	2
Electroencephalography	1
Electron Transport Complex I/p	1
Episodic memory	2
etiology	1
Evoked Potentials, Visual	1
Family	1
Fdg-pet	1
Female	24
fluorodeoxyglucose f 18	1
Fluorodeoxyglucose F18/diagnos	1
follow up	1
Follow-Up Studies	1
Form Perception	4
Frontal Lobe	4
Frontal lobe dementia	1
Frontal Lobe/radionuclide imag	1

Keyword (From ISI ...)		Keyword (From ISI ...)	
Functional connectivity	1	neuroimaging	1
Functional Laterality	1	neurologic disease	1
fusiform gyrus	1	Neuropsychological Tests	4
Genetic Diseases, Inborn/nursi	1	normal human	4
Gyrus Cinguli/blood supply/rad	1	numerical data	1
hand preference	1	Occipital Lobe	2
handedness	1	Occupational Diseases/metaboli	1
Handwriting	1	Occupational Therapy	1
Health Services Needs and Dema	1	Organotechnetium Compounds/dia	1
hemisphere	1	Outpatients	1
hemispheric dominance	2	Oximes	1
heredity	1	Parietal Lobe	4
hexamethylpropylene amine oxim	2	Parietal Lobe/blood supply/rad	1
Hippocampus	3	Parkinson disease	1
Hippocampus/blood supply/radio	1	Parkinson Disease/radionuclide	1
Home Care Services/economics/s	1	Patient Education as Topic	1
Home Health Aides	1	Patient Satisfaction	1
Home Nursing/statistics	1	pattern recognition	1
Human	11	Pattern Recognition, Visual	3
human cell	1	Phenotype	1
human experiment	2	Phonetics	1
Humans	22	Physical Therapy Modalities	1
Huntington Disease/economics/n	1	Physician's Practice Patterns	1
Huntington Disease/psychology/	1	physiology	1
Image Enhancement	1	Pilot Projects	1
Image Interpretation, Computer	5	Positron-Emission Tomography	2
Image Processing, Computer-Ass	1	Practice Guidelines	1
Imaging, Three-Dimensional	1	precuneus	1
inheritance	1	Principal Component Analysis	3
Italy	1	Psychiatric Status Rating Scale	1
Laterality	1	psychological aspect	3
Learning	2	Questionnaires	1
left hemisphere	1	radioisotope	1
life expectancy	1	Radiopharmaceuticals	1
Male	24	Radiopharmaceuticals/diagnosti	6
Memory	4	Railroads	1
Memory disorders	1	Reaction Time	3
mental disease	1	Reading	3
Mental Disorders	1	Reference Values	1
Mental Recall	1	Regional cerebral blood flow	1
Mental Recall/physiology	1	Reproducibility of Results	2
MICROPROCESSORS	1	Rest	1
Middle Age	2	Retention (Psychology)	1
Middle Aged	12	Retrospective Studies	2
mild cognitive impairment	1	review	1
Mitochondria, Muscle/radionucl	1	RF - 44	1
Models, Neurological	1	Semantics	1
Motor Cortex/blood supply/radi	1	Sensitivity and Specificity	5
Multivariate analysis	1	Severity of Illness Index	1
musculoskeletal system	1	sex	1
National Health Programs	1	Sex Characteristics	1
Neuro-psychiatric diseases	1	sex difference	1
neuroanatomy	1	Sex Factors	1
Neurodegenerative Diseases	1	Single photon emission compute	3

Keyword (From ISI ...)	
Software	1
SPECT	1
Speech Therapy	1
Standardisation software	1
statistical analysis	1
statistical concepts	1
Stress Disorders, Post-Traumat	2
subiculum	1
Support, Non-U.S. Gov't	1
Supranuclear Palsy, Progressiv	1
task performance	1
Technetium Tc 99m Exametazime/	6
Temporal Lobe	4
Temporal Lobe/blood supply/rad	1
Thalamus	2
three dimensional imaging	1
time	1
Time Factors	1
Tissue Distribution	2
Tomography, Emission-Computed,	11
Treatment Outcome	2
Verbal Learning	1
Visual Fields	3
VISUAL PERCEPTION	1
Visual Perception	1
Visual Perception/physiology	1

Keyword (from Google)	Occurrences	Variants encountered
99mtc	82	99mtc
activities	88	activities, activity
adhd	133	adhd
admission	76	admission, admissions
adult	109	adult, adults, adulthood
age	554	age, aging, ageing, aged, ages
alzheimer's	145	alzheimer's, alzheimer
amodal	72	amodal, amodale, amodally, amodalmente
analisi	225	analisi
analysis	501	analysis, analyses
anterior	102	anterior, anteriori, anteriore, anteriors, anteriorly
anziani	206	anziani, anziano, anziana, anziane
apprendimento	107	apprendimento
attention	116	attention, attentive
attivita	97	attivita
attività	284	attività , attivo, attiva
atypical	110	atypical, atypicals
bambino	75	bambino, bambini, bambina
biologica	80	biologica, biologico, biologiche, biologici
blood	155	blood
brain	715	brain, brains
cbf	129	cbf
cerebrale	553	cerebrale, cerebral, cerebrali
ciascun	94	ciascun, ciascuna, ciascuno
cingulate	86	cingulate
cioe	80	cioe, cio
citazione	128	citazione
clinical	131	clinical, clinically
cnr	173	cnr
cognitive	317	cognitive, cognitivi, cognitivo, cognitiva, cognitivamente
cognitive	206	cognitive, cognition
compared	75	compared, compare, comparing
comparison	85	comparison, comparisons
compito	356	compito, compiti
computer	108	computer, computers
condizione	90	condizione
confronto	91	confronto
consonanti	90	consonanti, consonants, consonante, consonant
controls	299	controls, control, controlled
coppie	85	coppie, coppia
cortex	394	cortex, cortical, cortices

Keyword (from Google)	Occurrences	Variants encountered
data	230	data
dati	207	dati, data, dat
deficit	102	deficit, deficits
dementia	147	dementia, dementias
depression	424	depression, depressed, depressive
destra	225	destra
destrimani	236	destrimani, destrimane
destro	237	destro, destri, destre
detection	92	detection, detect, detected, detecting
diagnosis	99	diagnosis, diagnostic, diagnosi, diagnostica, diagnostiche, diagnostici
differences	189	differences, difference, differencee
differenza	145	differenza, differenti, different, differente
disease	446	disease, diseases, diseased
disorder	211	disorder, disorders
distribution	110	distribution, distributions
disturbi	104	disturbi, disturbo
effect	249	effect, effects, effected
elderly	138	elderly, elderly's
emisferica	85	emisferica, emisferiche
emisfero	415	emisfero, emisferi
ergonomia	398	ergonomia, ergonomica, ergonomico, ergonomici, ergonomiche, ergonomics, ergonomic, ergonomicamente, ergonomicità
esperimento	169	esperimento, esperimenti
eta	158	eta
experiment	340	experiment, experiments, experimental, experimentally
factors	131	factors, factor
fattori	140	fattori, fattore
fig	148	fig, figs
figura	174	figura
finanziamento	124	finanziamento
flow	142	flow
frequency	126	frequency, frequencies
frequenza	107	frequenza, frequenze
frontal	251	frontal, frontali, frontals, frontale
function	136	function, functions, functioning
functional	202	functional, functionally

Keyword (from Google)	Occurrences	Variants encountered
genetic	176	genetic, genetica, genetici, genetics, genetiche, genetico
giovani	76	giovani, giovane
gyrus	117	gyrus, gyri
hand	124	hand, handed, hands
hemisphere	367	hemisphere, hemispheric, hemispheres
hmpao	121	hmpao
huntington's	134	huntington's, huntington
hypoxia	104	hypoxia, hypoxic
imaging	283	imaging, images, image, imaged
immagini	118	immagini, immagine
informazioni	220	informazioni, informazione
invecchiamento	126	invecchiamento
lavoro	523	lavoro, lavori
learning	75	learning, learn, learned, learnt
lesioni	116	lesioni, lesione, lesions, lesion, lesioned
lettere	126	lettere
letters	111	letters, letter
level	166	level, levels
liste	77	liste, lists
lobe	89	lobe, lobes
malattia	78	malattia, malattie
mancini	735	mancini, mancino, mancina, mancine
mancinismo	248	mancinismo
manuale	237	manuale, manuali, manual
matching	165	matching, matches, match, matched
mci	119	mci
memoria	339	memoria, memorie
memory	583	memory, memories
mentali	133	mentali, mentale, mental, mentally, mentall, mentalmente
mitochondrial	78	mitochondrial, mitochondria
msec	100	msec
new	72	new, news
non	90	non
normal	278	normal, normale, normali, normalmente, normals, normalitÃ , normality, normally
number	120	number, numbers
numero	178	numero
onset	103	onset
organizzazione	162	organizzazione, organizzato
ottenuti	122	ottenuti, ottenute, ottenuto, ottenuta
parte	279	parte
patients	1208	patients, patient, patient's, patienten
pazienti	185	pazienti, paziente
pca	76	pca
pcx	283	pcx
percentuale	225	percentuale, percentuali
performance	323	performance, performances
pet	102	pet
preference	82	preference, preferences
preferenza	521	preferenza, preferenze
presentato	140	presentato, presentate, presentata, presentati, presentare
presented	182	presented, present, presence
prestazione	131	prestazione, prestazioni
processing	454	processing, processi, processes, process, processed
prove	83	prove
psicologia	130	psicologia, psicologici, psicologico, psicologica, psicologiche
psp	106	psp
psychiatry	227	psychiatry, psychiatric, psychiatrist, psychiatrists
ptsd	87	ptsd
pulsante	80	pulsante, pulsanti
questionario	135	questionario, questionari
questionnaire	87	questionnaire, questionnaires
rate	73	rate, rates
rcbf	314	rcbf
recall	150	recall, recalled, recalls
regions	516	regions, regional, region
rehabilitation	111	rehabilitation
repetition	97	repetition, repetitions
ripetizioni	139	ripetizioni, ripetizione
salmaso	586	salmaso
salmaso	129	salmaso
scores	186	scores, score, scored, scoring
semantic	102	semantic, semantica, semantics, semantico, semantici, semantiche
serial	117	serial, seriale, serially
servizi	137	servizi, servizio
sex	75	sex, sexes
signal	122	signal, signals
sinistro	193	sinistro, sinistre, sinistri

Keyword (from Google)	Occurrences	Variants encountered
sistema	314	sistema, sistemi
soggetto	126	soggetto
specializzazione	100	specializzazione, specializzazioni
specifica	114	specifica, specifici, specifiche, specifico, specificamente, specificità
spect	312	spect
statistical	80	statistical, statistics, statistically, statistici, statistic, statistica
stato	599	stato, stati, state, stat, statÃ¨
stimoli	406	stimoli, stimolo
stimuli	317	stimuli, stimulus
strategie	77	strategie, strategy, strategia, strategies, strategi
studio	83	studio
study	881	study, studies, studied, studying
subjects	753	subjects, subject, subject's, subjected
tabella	114	tabella, tabelle
table	169	table, tables
target	171	target, targets
task	327	task, tasks
tempo	91	tempo
temporal	92	temporal, temporale, temporali
test	609	test, tests, tested, testing
tracer	81	tracer, tracers
treatment	180	treatment, treatments
trials	134	trials
type	80	type, types
uguale	73	uguale, uguali, ugualmente
uomo	99	uomo, uomini
uptake	122	uptake
verbal	245	verbal, verbale, verbali
vigilance	73	vigilance
visivo	190	visivo, visiva, visivi, visive
visual	263	visual, visually, visuali
vocali	77	vocali, vocale
vois	196	vois, voi
vowels	82	vowels, vowel, vowele
voxel	93	voxel, voxels
words	290	words, word
young	83	young