environments, computer-generated navigation systems, cognitive tutors, decision aids, guidelines for eyewitness interrogation, neuro-marketing, speech recognition and synthesis, team-oriented technology, cognitive war, human-computer interface, and intelligent therapies. There are several studies on the clinical application of cognitive science in cancer and chemo brain curing. In the first part of the paper the effect of mind on ordering the disordered body members and cellular signaling pathway are reviewed. Cell signaling such as Wnt Signaling, Hedgehog signaling, Notch signaling, neurotensin signaling are component of a complex communication system among cell that govern activities and actions such as development, tissue repairing, and immunity as well as homeostasis. In the second part of the paper the effect of cognitive images, cognitive concept of colors, emotional intelligence, cognitive therapy, and social mind on the minds of patient with cancer and chemo brain which is a cognitive dysfunction are reviewed. Fig. 1 shows the aim of this research. The organization of the rest of this paper is as follows: Section 2 reviews the related works. Section 3 summarizes this paper.

**State of the Art:** The first foot print of cognitive science that we can refer to is psycho-oncology, which is an interdisciplinary study at the intersection of lifestyle, psychology and oncology. The major specialties in psycho-oncology are clinical disciplines (surgery, medicine, pediatrics, radiotherapy), epidemiology, immunology, endocrinology, biology, pathology, bioethics, palliative care, rehabilitation medicine, clinical trials research and decision making, as well as psychiatry and psychology. The field is concerned both with the effects of cancer on a person’s psychological health as well as the social and behavioral factors that may affect the disease process of cancer and/or the remission of it. Upon defining psycho-oncology, mind-body therapy for cancer in a reversing manner is presented. Cognitive Therapy (CT) as a part of mind therapy is presented for treating distress among cancer patients. CT is used to promote coping and adaptation, to control fear of recurrence, to think positive, to analyze the vital role of empathy in cancer problem solving. Several common mind–body therapies that have positive influence on cancer curing include yoga, praying, hypnotherapy, cognitive behavioral therapy, meditation, guided imagery, and biofeedback training. Beside positive effect of mind-body therapy on cancer curing, there are several other healing application of this therapy on disease improvement such as mind-body therapeutic program for infertile women, mind–body therapies for functional bowel disorders, and effect of positive emotions on gene expression in humans and an animal model. For example, laughter altered the expression of genes involved in immune reactions, cell signaling, the cell cycle, apoptosis, and cell adhesion. Furthermore, colors which are a different wave-lengths of light acts on the body by two pathways include the primary optic tract that governs visual perception and responses whereas the retinohypothalamic tract that governs circadian, endocrine, and neurobehavioral function. Therefore it affects the primary body functions including growth, sleep, appetite, circulation, nervous, mental and emotional state, and immune system.

For example, colors are able to trigger hormone production and as a result influence the entire complex system of the body. Treatment with colored light is named color therapy. It achieved very significant healing results such as changes of blood oxygenation in the brain and muscles. Also there is a body of evidence examining the association between Emotional Intelligence (EI), personality, and its relation to health-related quality of life in patients with cancer and chemo brain. EI helps the patient with cancer in finding awareness of self, actions of self, awareness of others, interaction with others, and resilience. Predefined guided cognitive images through social mind process may consider a future proper tool for controlling and curing disease like cancer.

**Conclusions:** Cancer, a disease complex, needs a personalized therapy. Flavor of cognitive science with the main pillar as mind, recommended to be considered as a personalized therapy. In this paper the merits of cognitive science in cancer therapy will be discussed in two phases including effect of mind on ordering the disordered body members and cellular signaling pathway and the effect of cognitive images, cognitive concept of colors, emotional intelligence, cognitive therapy, and social mind on the minds of patient with cancer and chemo brain.

**Keywords:** Cognitive science, Cognitive personalized medicine, Chemo brain, Mind, Cancer.

![Cognitive science application in cancer curing](image)

**Computational investigation of hsa-mir-196a-2 targetome pathway and its SNP function in patients with gastric carcinoma: probable association between alleles and patients prognosis**

Narges Tabatabaei a, Hamzeh Mesrian Tanha b, Kamran Ghaedi b, c, Mansoureh Azadeh c

a Division of Cellular and Molecular Biology, Department of Biology, Nourdansheh University of Meymeh, Meymeh, Isfahan, Iran b Division of Cellular and Molecular Biology, Department of Biology, Faculty of Science, University of Isfahan, Isfahan, Iran c Zistfanavari Novin Biotecnology Institute, Isfahan, Iran

E-mail address: kamranghaedi@yahoo.com

**Extended abstract**

**Introduction:** Gastric cancer (GC) is the third most common cancer over the world with nearly one million new cases every year. It is the second leading cause of cancer fatality with a 5-year survival rate of just 20%. Gastric cancer in Iran is twice the global average and each sixty-six minutes one Iranian dies of GC. GC is a heterogeneous illness that several factors such as molecular pathways alteration and environmental factors are involved in the progression of disease. Generally, chronic inflammation is an important risk factor for most cancers and one of the main causes of gastric chronic inflammation is *Helicobacter pylori* colonization in mucosa. MicroRNAs (miRNAs) are endogenous small noncoding RNAs that act as post-transcriptional regulator of geneexpression by repressing translation or decomposing mRNAs and have been involved in initiation, development and treatment results of various cancers. Approximately 50% of miRNA genes are associated with cancer. Growing evidence has offered that miRNAs play a significant role in tumorigenesis. It has been established, miRNAs expression patterns in *Helicobacter pylori*-infected and -infected gastric normal tissues were distinct. Single nucleotide polymorphisms (SNPs) which are located in miRNA genes can result in change in miRNA expression leading to various and important functional outcomes. Polymorphism in miR-196a-2 was identified in 2008.
Rs11614913 is reportedly related to the susceptibility, beginning and lower survival rates of diverse tumors, including gastric cancer. This functional polymorphism is related to G2 cell cycle delay that plays a main role in carcinogenesis.

**Objective:** The goal of our study is to expand current information about molecular function of miR-196a-2 and its SNP in gastric cancer cells by bioinformatics tools.

**Methods:** 3.1. Search strategy: An extensive research was accomplished using the composition of the following search terms: “gastric cancer”, “miR-196a-2”, “stomach adenocarcinoma”, “gastric carcinoma”, “H. pylori infection”, “microRNA”, and “rs11614913” in many electronic databases including PubMed, Science Direct, the Cochrane Library, Elsevier, Wiley Online Library, Springer Link, and Wanfang databases.

**Bioinformatics analysis:** NCBI database was utilized for determination major and minor alleles in miR-196a-2. MiRNA SNP database illustrates SNP in miR-196a-2 and predicts the effect of SNP on the maturation of the miRNA. MiRBase database gives general information about miR-196a-2 and its stem-loop structure. Predicted targets of miR-196a-2 were obtained from miRWalk database.

Information on retrieved targetome expression in gastric cancer tissue was evaluated in UniGene database. At last gastric cancer specific targetome were entered into DAVID database for molecular pathways enrichment analysis.

**Results:** MiR-196a-2 is located in long arm of chromosome 12 among HOXC9 and HOXC10. The major/minor alleles for miR-196a-2 rs11614913 are C/T. According to the data collected from miRWalk database, 3626 genes have been predicted as target goals of miR-196a-2 which are approved by five databases out of 12 (RNA22, RNA hybrid, miRDB, Miranda, Microt4, miRMap, Targetscan, miRWalk, miRNAmap, pictar2, PITA). These 3626 genes have been compared in terms of expression level in both healthy and cancerous tissue. However, 14 genes in epithelial cell signaling in Helicobacter pylori infection pathway were considered for further analysis. It is predicted that miR-196a-2 functions as a remarkable tumor suppressor miRNA by inhibiting some critical genes of epithelial cell signaling in Helicobacter pylori infection including, PTPN11, NFKBIA, EGFR, GIT1, ATP6V0A2, ATP6V1A, ATP6V1B2, ATP6V1C2, ATP6V1C1, ATP6V1F, ATP6V1G2, PAK1, JNK, and IcBz (Figure 1A). PAK1, JNK, and IcBz genes play a vital role in chemotactic effect which may increase Helicobacter pylori colonization and infection. Furthermore, minor allele (T allele) causes the stability reduction of miR-196a-2 structure (Figure 1B). Subsequently, there is a probable connection between T allele and poor prognosis of GC. In other words, rs11614913 may contribute to increase Helicobacter pylori infection and GC susceptibility due to alteration of epithelial cell signaling.

**Conclusion:** Published results on the connection between miR-196a-2 polymorphism rs11614913 and gastric cancer risk are inconsistent among different studies and the role of this polymorphism in GC susceptibility is yet unknown. On the one hand, rs11614913 polymorphism can be a risk factor for gastric cancer development especially in Asian populations. On the other hand, some studies suggest that this variant may contribute to reduce GC susceptibility. Moreover, some studies illustrated that rs11614913 has not association with cancer risk. However, miR-196a-2 and rs11614913 may play different roles in various tissue s. For example, Tian et al, reported a correlation between homogyzote CC and lung carcinoma. In contrast, CT and TT genotypes were associated with glioma. Our finding suggests that has-miR-196a-2 and its SNP may be involved in gastric cancer and its prognosis by altering regulation of epithelial cell signaling in Helicobacter pylori infection and some other critical signaling pathways. To sum it up, T allele in this location can have prognostic value for GC.