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Bio-electrographic method in detecting heterogeneity and unique features in autism

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Abstract:
Six families were screened during the Autism Awareness Walk that took place on the 18th of April 2009 at the Winner's Circle Park in Flowood and Brandon, Mississippi. The aim of this pilot study was to test autistic children and their parents to record bio-electrographic parameters of the autonomic nervous system to assess the general functional state of the autistic individuals and their relatives.
Hypothesis: We hypothesize that the bio-electrographic method (also referred to as gas discharge visualization, or GDV) will enable us to evaluate unique features associated with mild autism spectrum disorder (ASD) as well as to determine the heterogeneity in the electro-photonic emissions obtained from participants with mild ASD.
Results: The autistic children tested were previously diagnosed with mild autism and/or Asperger's Syndrome. Results revealed that heterogeneity exists and unique features are detected in parents and in their children diagnosed with mild ASD and/or Asperger's Syndrome. The unique signature detected in the participants was related to an imbalance in the zones of the gastro-intestinal tract, immune system, cerebral cortex, and cerebral vessels. Unlike the results of previous studies, our findings also indicated an imbalance in the following zones: epiphysis, kidneys, adrenal gland, cervix, thorax and sacrum of the autistic children in this study. Similarly, their parents exhibited an imbalance of electro-photonic emission in the zones of cerebral cortex and cerebral vessels. Furthermore, heterogeneity was demonstrated in the variability of values obtained from the GDV readings derived from the recordings of the fingertip sectors corresponding to their respective organs and systems of the body.

Keywords: autism, heterogeneity, bio-electrography, electro-photonic emission

1. Introduction

Bio-electrography is a non-invasive imaging technique used to assess the functional state of the human body by recording the response of the autonomic nervous system to a high intensity electromagnetic field created by using an electro-photonic impulse analyzer to measure the electrical conductance of fingertip tissue. According to the eastern philosophy of the acupuncture approach, sectors of the fingertips correspond to specific physiological systems including the immune, respiratory, digestive, cardiovascular, central nervous, peripheral nervous, urogenital, and endocrine systems (1-5). Using this philosophical approach and the bio-electrographic method, the image of each fingertip is captured individually as a single snapshot with an optical camera that is placed underneath the glass surface on which the participant puts each finger. When the skin has direct contact with the glass surface of the electro-photonic impulse analyzer, the quality and consistency of the image depends on the activity of the eccrine sweat glands. These glands produce ionic sweat fluid (predominantly water) that is associated with the activity of the sympathetic nervous system. The amount of sweat produced is directly related to the level of fractality in the captured image. A fractal image contains gaps that may cause some fingertip sectors to be completely absent providing little if any information on the status of the physiological system or organ to which that sector corresponds. The electrical conductance of the fingertip tissue is possible to measure by applying specially designed, thin, plastic film to the glass surface of the electro-photonic impulse analyzer. The film prevents the participant's skin from making direct contact with the glass surface. In this case, the image quality depends on the concentration of conductive substances, mainly sodium chloride, present in sweat. This preparation facilitates the visualization of electro-photonic emission levels indicative of the physiological activity of the systems and organs corresponding to the fingertip sectors. As a result, the response of the sympathetic nervous system can reflect deficiencies existing in the human body, and these deficiencies can be caused by environmental factors. Likewise, the response of the parasympathetic nervous system can reflect the status of the physiological system or organ of the body as indicated by the GDV readings obtained from the corresponding fingertip sectors. Any observed anomalies can be attributed to an imbalance in specific zones influenced by environmental factors as well.

According to the United States Department of Developmental Services, the prevalence of autism spectrum disorders increased 556% from 1991 to 1997 (6). One in every eight boys is diagnosed with autism, and boys are four times more likely to be affected by this disease than girls. Also, one out of every sixty-eight families has a child with autism. Incidences of autism are increasing by 3.8% per year worldwide and by 15% in the USA (6). The common signs of autism are marked by 1) qualitative impairment in social interaction; 2) qualitative impairments in communication; 3) restricted repetitive and stereotyped patterns of behavior. Autism covers a continuum of disorders beginning from mild autism and Asperger's Syndrome to severe autism. Autism Spectrum Disorder is defined only behaviorally, which often contributes to the heterogeneity of cohort studies. Factors such as age, gender, IQ, and behavioral traits often diverge considerably, with non-uniform matching of controls.
The six autistic participants, their parents, and siblings included in our pilot study exhibited a unifying lower level of electro-photonic emission in the sectors of the fingertips corresponding to cerebral cortex and cerebral vessels while showing heterogeneity in responsiveness to the stimulation by the electromagnetic field.

2. Experimental Section

A. The Institutional Review Board (IRB) Approval

The IRB approval of the consent form was obtained according to the guidelines prescribed by the Review Board at Jackson State University. All participants were residents of Mississippi. The participants of the study and their parents were informed that the results will be published in a medical book or journal, or findings will be used to teach others. The parents were asked to sign the consent form where it was emphasized that their participation was voluntary and that they could withdraw at any time. Before signing the consent form, the participants could refuse to take part in the study.

B. Participants

The autistic children in this study were previously diagnosed with mild autism and/or Asperger's Syndrome. The screenings of autistic children were done randomly. However, the age of the autistic children fell into a range of five to twelve years old, 9.3 being the mean age. All autistic participants were males.

C. Equipment, Software, and Procedure

The study was conducted using an electro-photonic impulse analyzer "GDV Compact". To reduce the barrier of a new setting for autistic children, parents were asked to participate first. Each participant was asked to place each finger correctly on a glass surface. The images of the electro-photonic emissions of all ten fingertips were taken twice. First, we recorded the response of the sympathetic nervous system, which was measured using the properties of electrical conductance of skin tissue in high intensity electromagnetic field. Second, to assess the physiological state of autistic individuals and their parents, we used thin plastic film that allowed no direct contact of skin with the glass surface thereby enabling the recording of the response of the parasympathetic nervous system.

Under a high intensity electromagnetic field, the finger emits a burst of electrons and photons. With the help of an optical system and camera, the electro-photonic emissions are transformed into video-signals, which are recorded in the form of single snapshots or fingertip images called GDV-grams. The data processor utilizes a specialized software complex that permits the calculation of the system parameters. The software GDV Diagram facilitates the implementation of standardized processing of GDV-images. The process involves capturing GDV-images, filtrating GDV-images, obtaining numerical characteristics, creating graphs and diagrams, and saving data as well as transferring data for additional processing. Prior to conducting research, quality control testing was done in Russia on the software employed in the present study.

3. Results and Discussion

The results of the screening of autistic individuals, their parents and siblings are presented graphically by the figures 1, 2, 3, and 4. Because of the uneven distribution of electro-photonic emissions (EPE), we present our data separately for left and right hands. Anatomical regions including the blind gut (secum), appendix, ascending colon, gallbladder, duodenum, ileum, right kidney and heart are projected only on the right hand; whereas descending colon, sigmoid colon, rectum, left kidney and abdominal zone are projected only on the left hand. Therefore, zero value was assigned to respective organs if they were not present in the graph. Figures 1(a) and 1(b) exhibit the values of autistic children corresponding to the recordings of the response of the sympathetic nervous system. Common tendencies to low activity can be seen in the following zones: epiphysis, ileum, right kidney, spleen, adrenal gland, cerebral vessels, sacrum, cerebral cortex, cervix, and thorax. Figures 1(c) and 1(d) present the values corresponding to the recordings of the parasympathetic nervous system. The cerebral cortex, cerebral vessels, spleen, epiphysis, left kidney, gallbladder, abdomen, sacrum and thorax show lower activity compared to the rest of the organs.

Brothers and sisters of the autistic children exhibited common tendencies towards low activity in the zones of the immune system, pancreas, epiphysis, cerebral cortex, cerebral vessels, left and right kidney, and pelvis minor as shown in figures 2(a), 2(b), 2(c) and 2(d). The distribution of the values assigned to EPE was more consistent as compared to autistic individuals. Fathers had significantly decreased values in the zones of the cerebral cortex, cerebral vessels, liver, transverse colon, descending colon, epiphysis, spleen, respiratory system, cardiovascular system and coronary vessels as presented in the figures 3(a), 3(b), 3(c) and 3(d). Mothers' showed low activity in the zones of the cerebral cortex, transverse colon, immune system, epiphysis, pancreas, cerebral vessels, left and right kidney, and urogenital system (Figures 4(a), 4(b), 4(c) and 4(d). Some of the obtained images had fractal character, especially the recordings of the response of the sympathetic nervous system. The images were characterized by inconsistency and gaps pertaining to a certain fingertip sector. The outer isoline of some images had specific outbursts in a form of thin "tails" of brown color which could be the evidence of emotional tension or stress (Fig.5 (a) and 5 (b)).

Autism is a severe neurodevelopmental disorder with the development prior to 3 years of age (7). The cause of autism remains unknown, and it is a heterogeneous disorder as to its etiology and phenotype. Autistic children are vulnerable to oxidative stress and are easily influenced by genetic, environmental, and immunological factors (8). There is no single gene that has been found to be associated with autism. Instead, multiple genes have been reported as being associated with autism (9-11). The unequivocal detection of autism susceptibility genes remains uncertain (12). Environmental aspects, such as mercury, lead, measles, rubella virus, retinoic acid, maternal thalidomide, valproic acid and alcohol use during pregnancy and stress have been implicated in autism (13-17). In addition, patients with autism are described as having behavior impairments, gastrointestinal deviations (18-22) and epilepsy (23). Immune (9;24-26), autoimmune (27-29), and infectious factors (15;16;30-34) have also been mentioned as playing role in the manifestation of autism. Recent clinical evidence emphasizes the significance of oxidative stress in the development and expression of autism (35;36). Patients with autism can differ in the severity and scope of their symptoms suggesting that multiple factors contribute to explaining the disorder's symptoms. Autistic children also have abnormal cerebral blood flow. There are numerous studies in the medical literature (37-44) that confirm cerebral hypoperfusion (decreased blood flow to the brain) in as many as 86% of individuals with autism (37). Furthermore, this diminished blood flow typically correlates with many core autistic symptoms. Thus, it has been suggested that abnormal areas in the cerebral cortex are related to the cognitive impairments (such as deficits in language, impaired executive function and abnormal responses to sensory stimuli) observed in autistic children. In fact, sometimes the cerebral blood flow actually decreases, and this appears to be mediated, in part, by inappropriate vasoconstriction (narrowing of blood vessels) instead of vasodilation (45-47). Cerebral hypoperfusion appears to lead to cerebral hypoxia (impaired oxygen delivery) to the brain in some autistic individuals. The cause of cerebral hypoperfusion in autistic individuals is unknown, but might be due to inflammation. Inflammation around blood vessels can cause the vessel wall to become stiff and inflexible. Vasculitis decreases the ability of the blood vessel to dilate and can lead to diminished blood flow. Other studies confirm the presence of inflammation in the brain of some autistic individuals (48-50). Inflammation, generally associated with increased content of water (edema), can increase the space between cells (51), and might increase the amount of fluid present inside cells (52;53). Furthermore, the ability of one brain cell to communicate to another cell is reduced in some autistic children when compared to neurotypical children (54). Thus, there exists a high probability that inflammation present in the brain of some autistic individuals is leading to diminished blood flow, impaired functional connectivity, impaired cognition, and increased fluid inside brain cells. Researchers at the Pennsylvania School of Medicine have shown constricted blood vessels and low blood flow in autistic individuals via biochemical analysis (55).

The low activities that we found in the zones of gastro-intestinal tract, immune system, cerebral cortex, and cerebral vessels have been described in the literature and confirm previous data on autistic patients. These zones were found to be present in all autistic children we tested and therefore are unique signatures of autism in our pilot study. Additionally, the bio-electrographic method detected epiphysis, kidneys, adrenal gland, cervix, thorax, and sacrum as the zones of imbalance in autistic children. Despite being diagnosed with Asperger's Syndrome and mild autism, these children had different values assigned to the zones of cerebral cortex and cerebral vessels. This indicates that there exists heterogeneity in the population studied implying that an individualized approach to the diagnosis and treatment strategy for each autistic person should be employed.

Although labeled as neurotypical, brothers and sisters of the autistic children also exhibited unique features common to their autistic siblings. In addition, their EPE values are low in pancreas and pelvis minor zones as shown in figures 2(a), 2(b), 2(c) and 2(d). The only difference between the autistic children and their siblings is in the distribution of EPE values. In autistic children, the distribution is very uneven between left and right hand while in the siblings the distribution is fairly even.

The fathers of the autistic children show low EPE values in the cerebral cortex, cerebral vessels, epiphysis and spleen as shown in figures 3(a) and 3(b). Characteristically fathers show low activity in the liver, transverse colon, descending colon, respiratory system, cardiovascular system and coronary vessels as presented in figures 3(a), 3(b), 3(c) and 3(d). Mothers of the autistic children share some unique features of autism such as low EPE values in the cerebral cortex, cerebral vessels, immune system, epiphysis and kidneys. Distinguishing features of mothers include low EPE values of transverse colon, pancreas, and the urogenital system as shown in figures 4(a), 4(b), 4(c) and 4(d). In comparing parents and siblings of autistic children, the cerebral zones (cortex and vessels) have been exhibited in figures 5(a) and 5(b). Figure 5(a) clearly shows that an autistic child along with his sibling (brother) and his father have similar specific outbursts in a form of thin "tails" of brown color while the mother exhibited none of these features. In Figure 5(b), a mother and one sibling (sister) show similar outbursts in the form of a "tail." The father of the autistic child and the sister show low activity in the zone of cerebral vessels. The images were characterized by inconsistency and gaps appearing in certain fingertip sectors. The outer isoline of some images were characterized by fractality which could indicate emotional tension or stress in the individual from which the image was taken. A fractal image analysis is being conducted to assist with discriminating autistic individuals from normal controls. The main difficulty is solving the problem of quantifying visual fractality in complex situations as those encountered in EPE analysis. Because of the lack of reliable quantitative measurement data and to increase accuracy of detecting autism, automated visual inspection is required. Consequently, a process accompanying image acquisition, automatic evaluation and control is currently under development. The results of this process could form the basis for a system that would ensure a very high degree of quality control in the analysis of EPE images with respect to autism. These image analyses are being conducted to actively investigate autism using computer software currently being developed and further tested for quality assurance.

4. Conclusions

In conclusion, the bioelectrographic method is a promising step towards creating an autism profile and identifying unique signatures pertaining to the parents and their siblings. Further work should involve more participants in order to augment our findings by the bioelectrographic approach.

Figure 1(a). Individual EPE values of autistic children. Images without filter corresponding to the left hand.

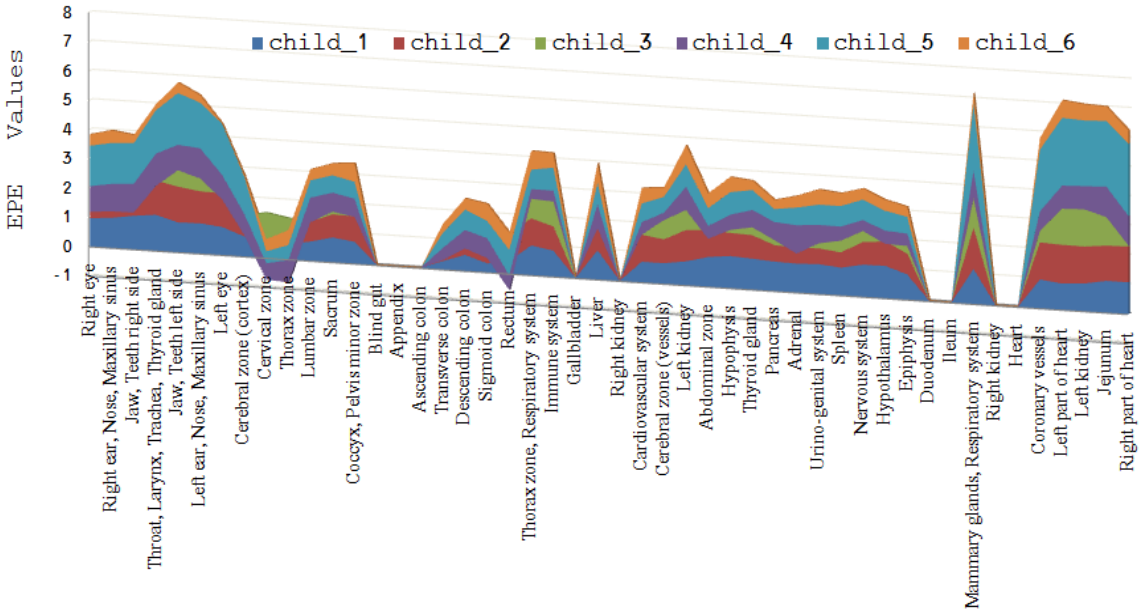


Figure 1 (b). Individual EPE values of autistic children. Images without filter corresponding to the right hand

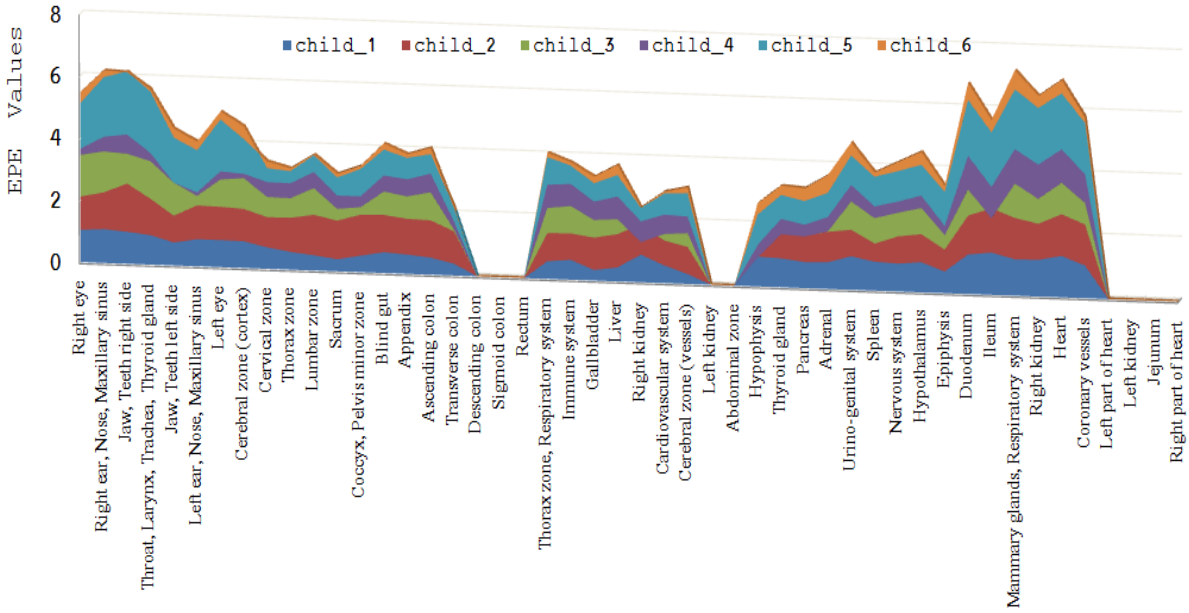


Figure 1(c). Individual EPE values of autistic children. Images with filter corresponding to the left hand.

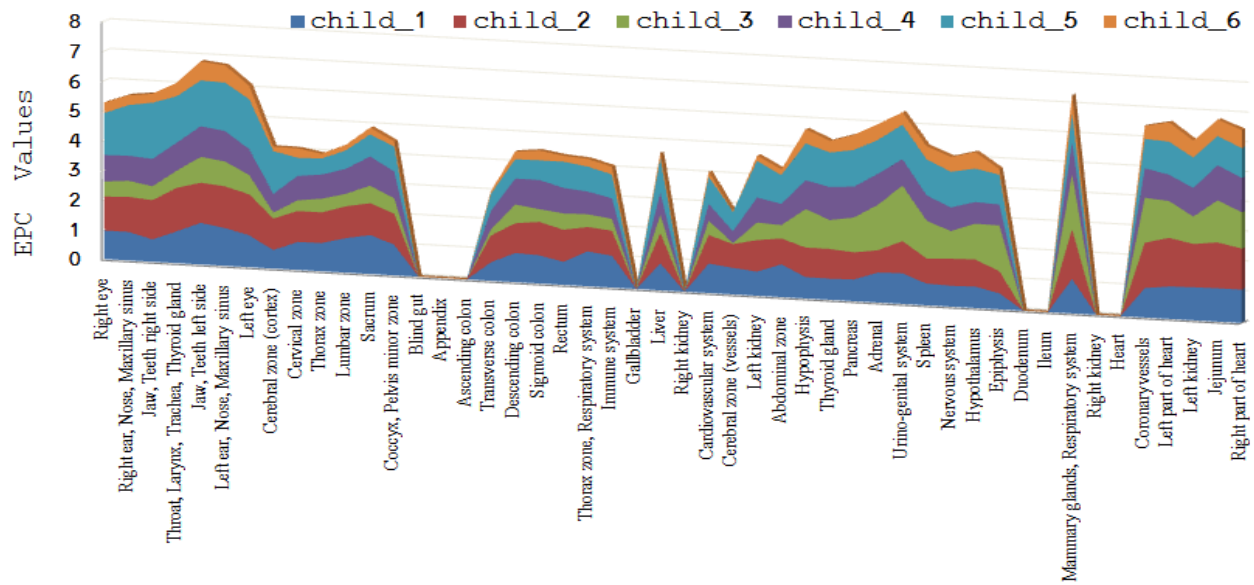


Figure 1 (d). Individual EPE values of autistic children. Images with filter corresponding to the right hand

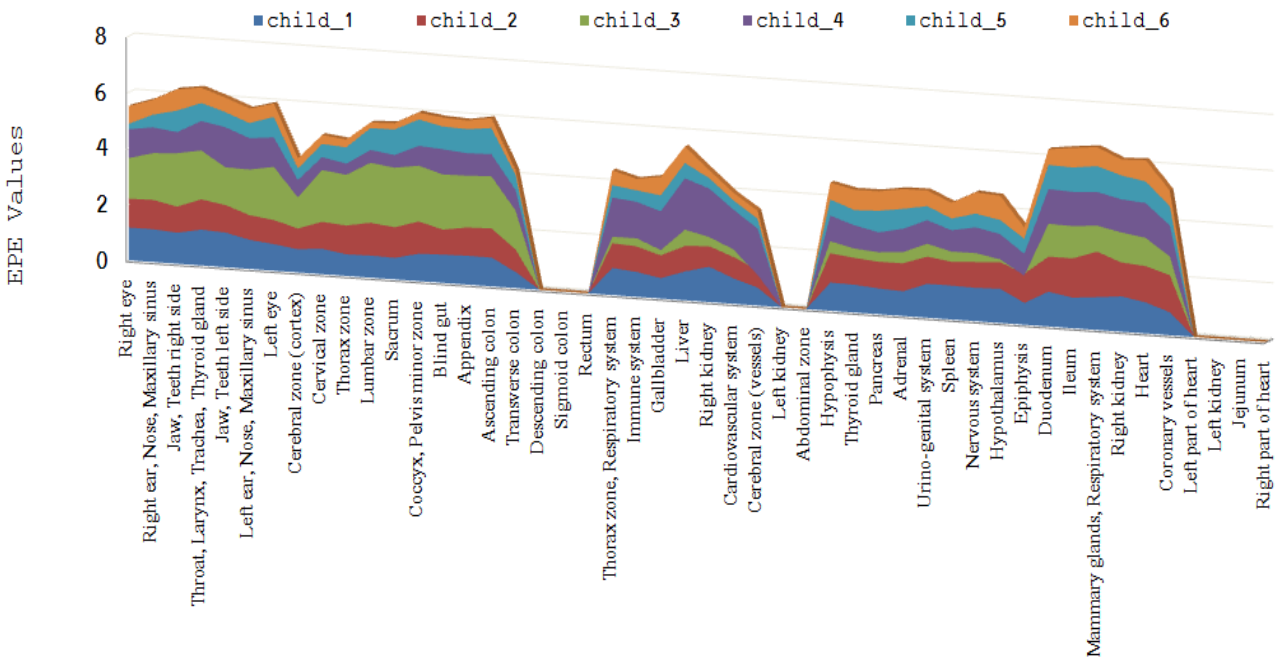


Figure 2 (a). Individual EPE values of siblings. Images without filter corresponding to the left hand.

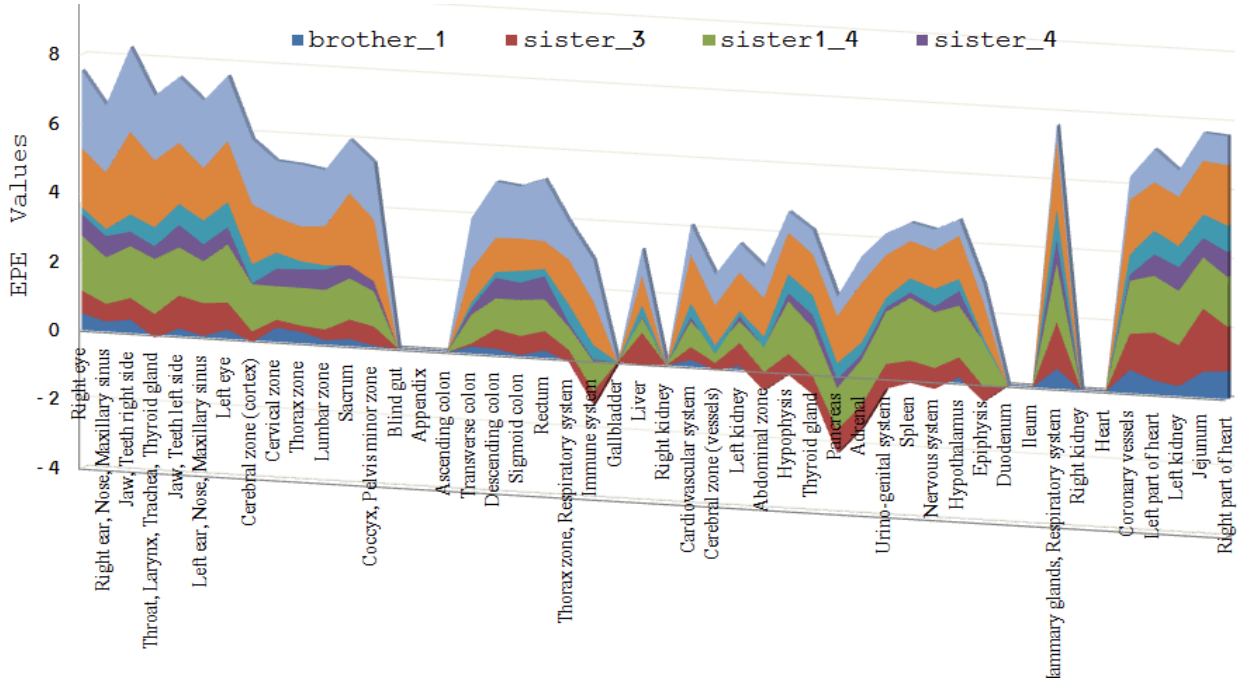


Figure 2 (b). Individual EPE values of siblings. Images without filter corresponding to the right hand.

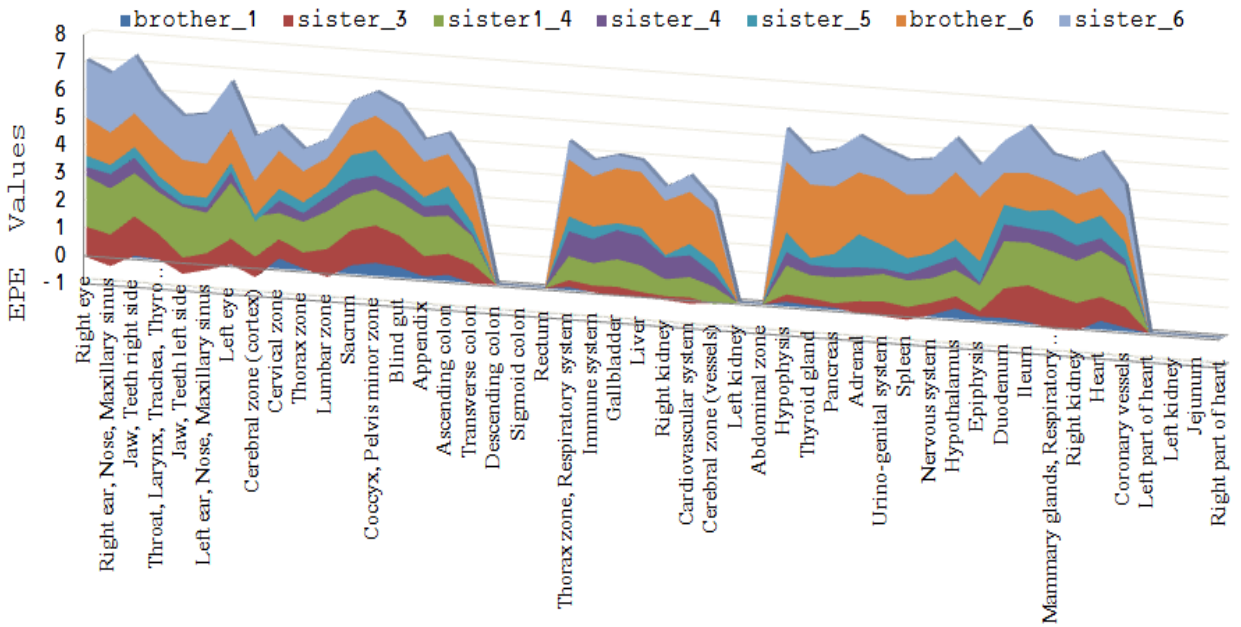


Figure 2 (c). Individual EPE values of siblings. Images with filter corresponding to the left hand.

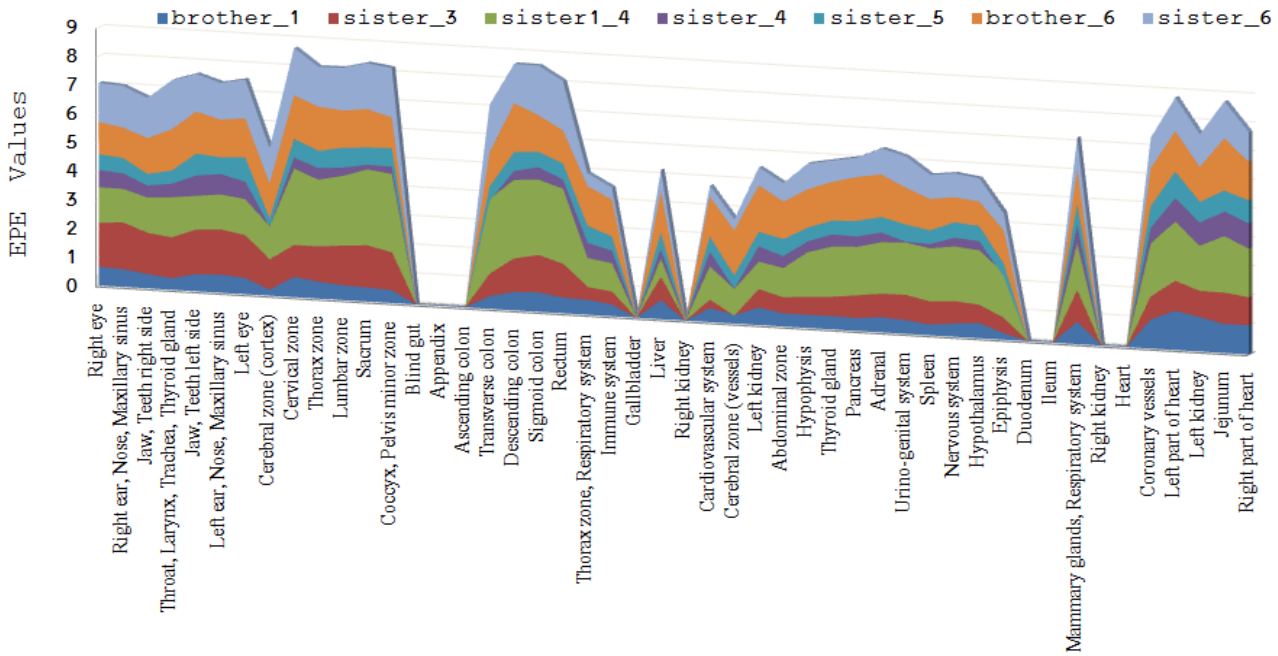


Figure 2 (d). Individual EPE values of siblings. Images with filter corresponding to the right hand.

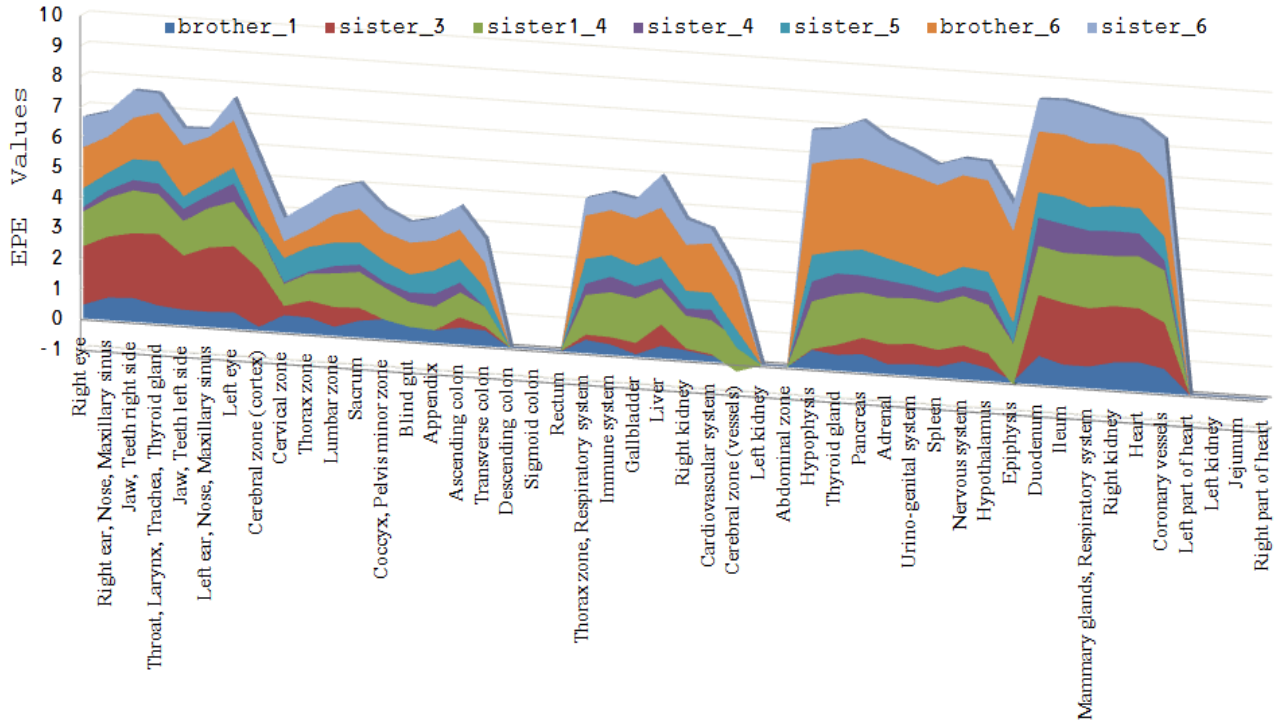


Figure 3 (a). Individual EPE values of fathers. Images without filter corresponding to the left hand

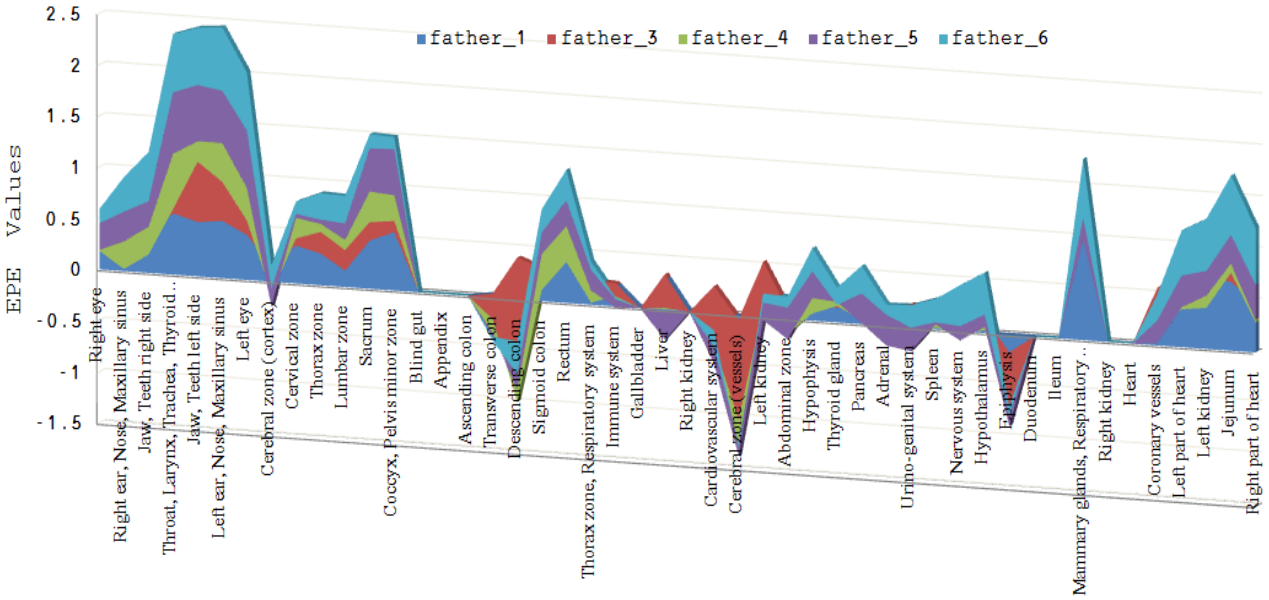


Figure 3 (b). Individual EPE values of fathers. Images without filter corresponding to the right hand.

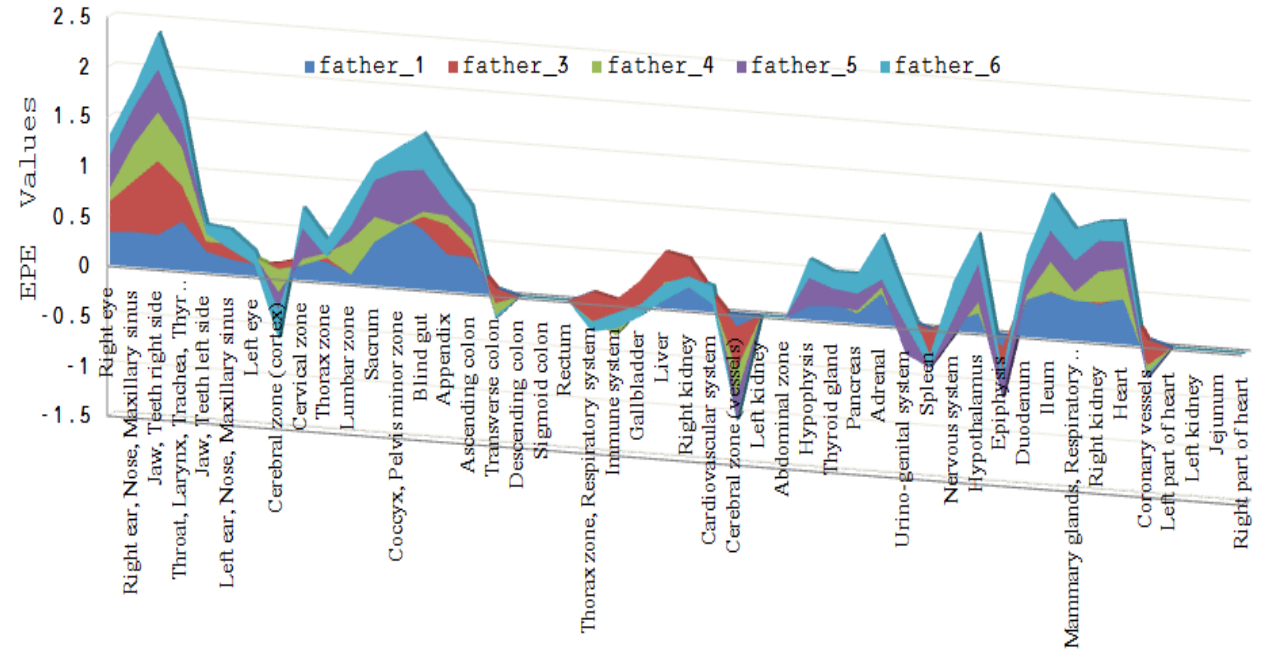


Figure 3 (c). Individual EPE values of fathers. Images with filter corresponding to the left hand.

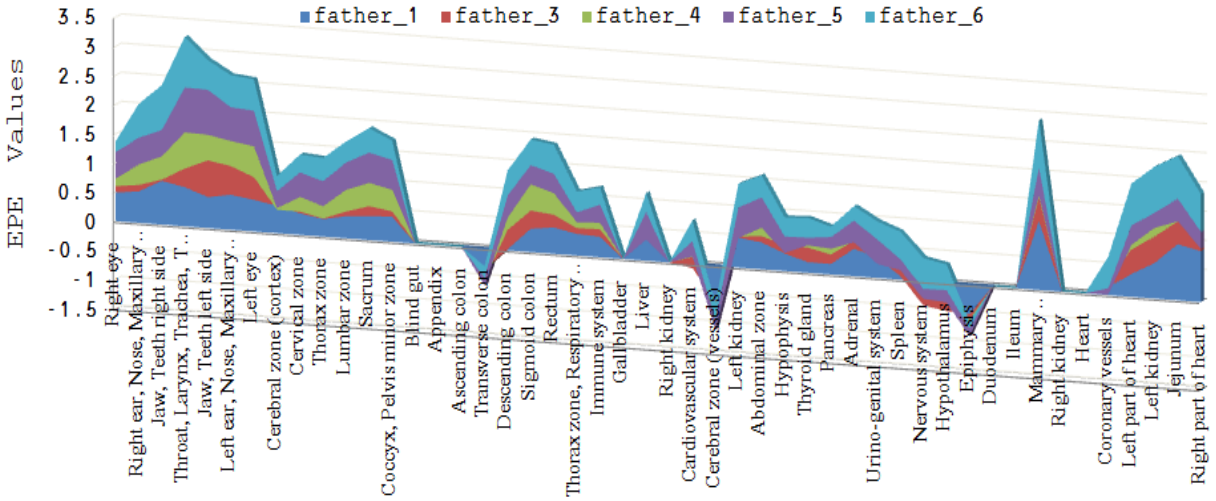


Figure 3 (d). Individual EPE values of fathers. Images with filter corresponding to the right hand.

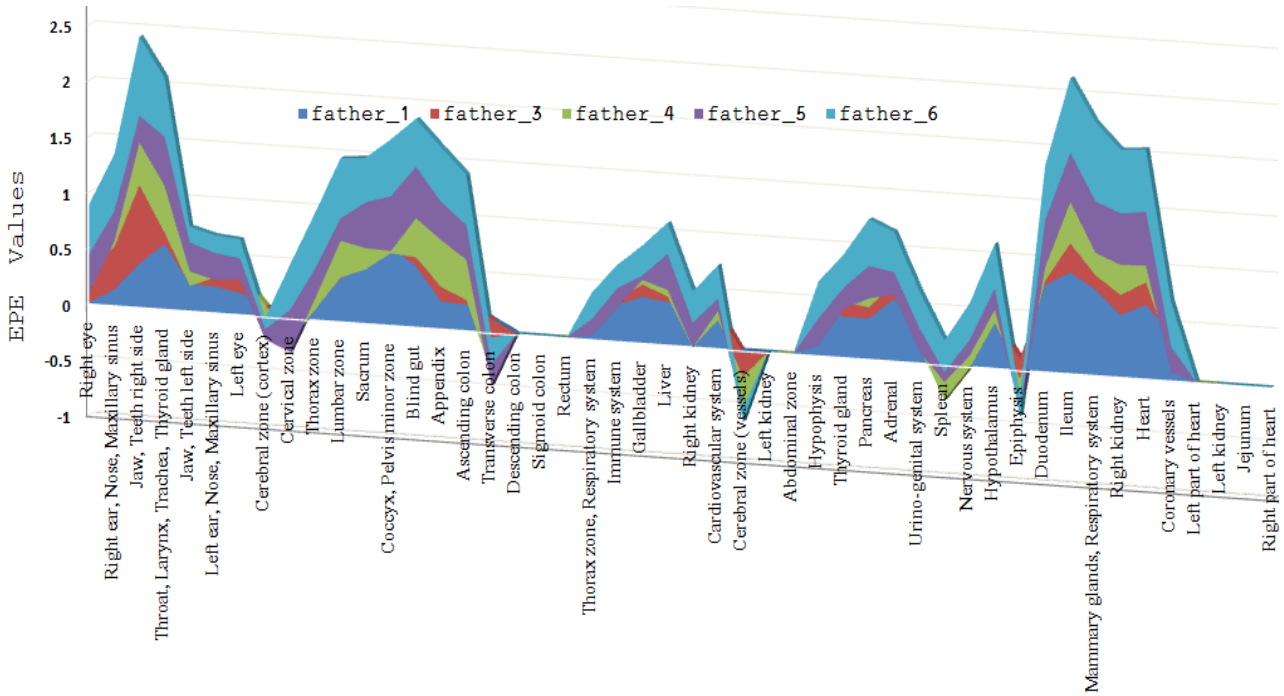


Figure 4 (a). Individual EPE values of mothers. Images without filter corresponding to the left hand.

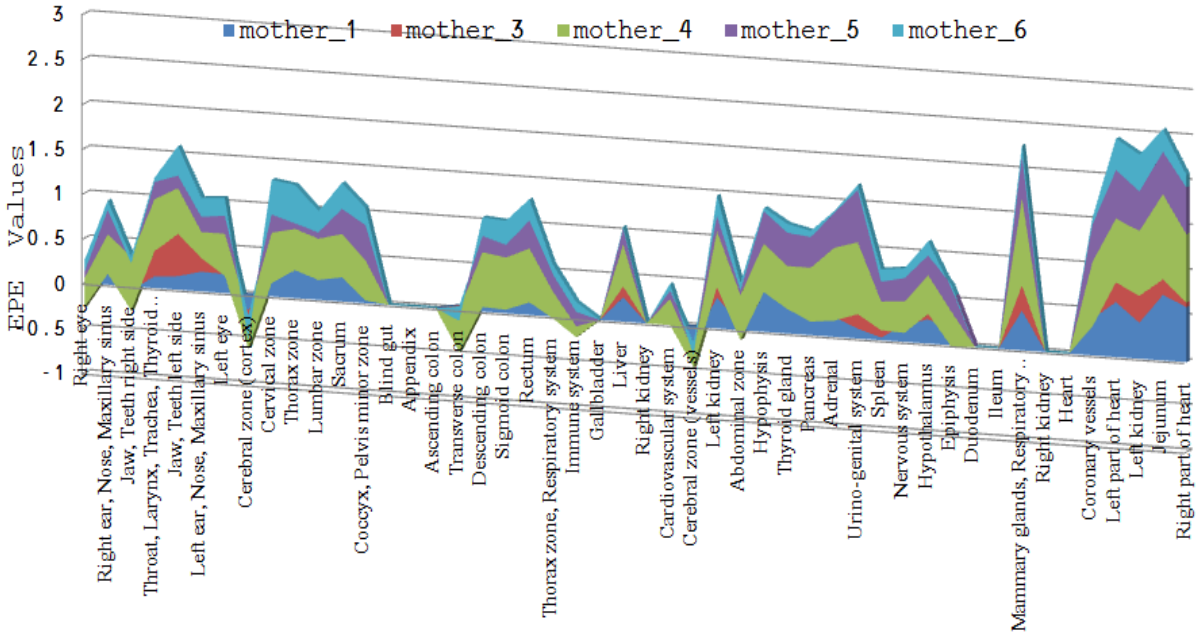


Figure 4 (b). Individual EPE values of mothers. Images without filter corresponding to the right hand.

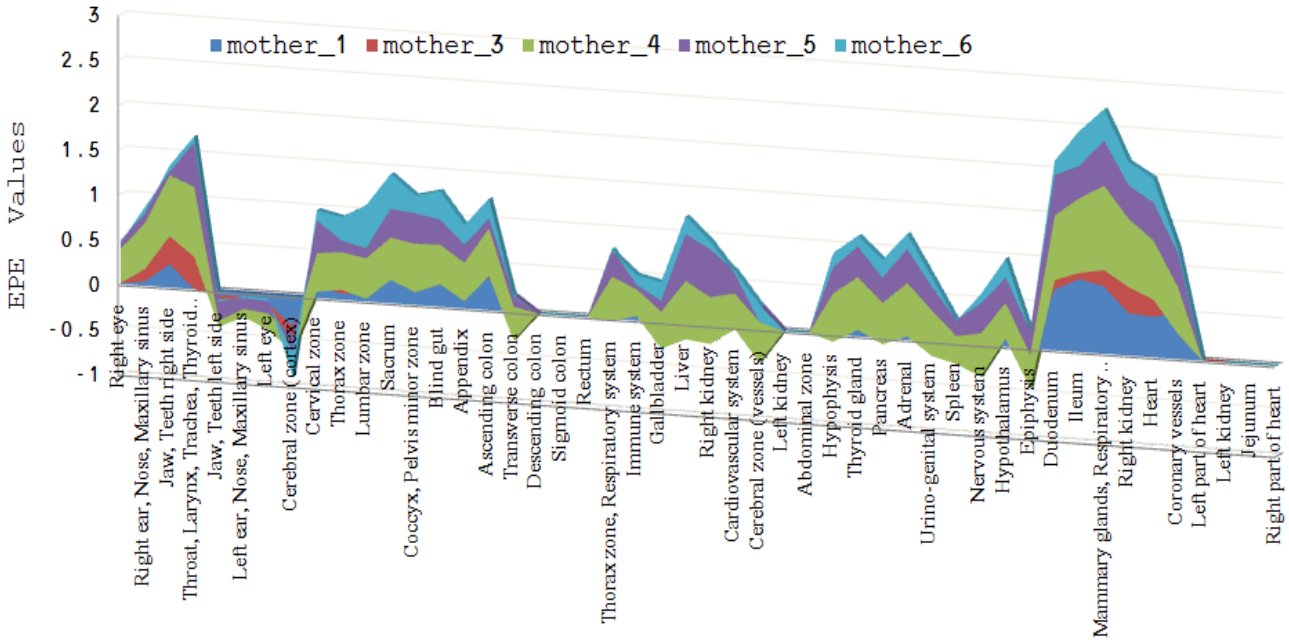


Figure 4 (c). Individual EPE values of mothers. Images with filter corresponding to the left hand.

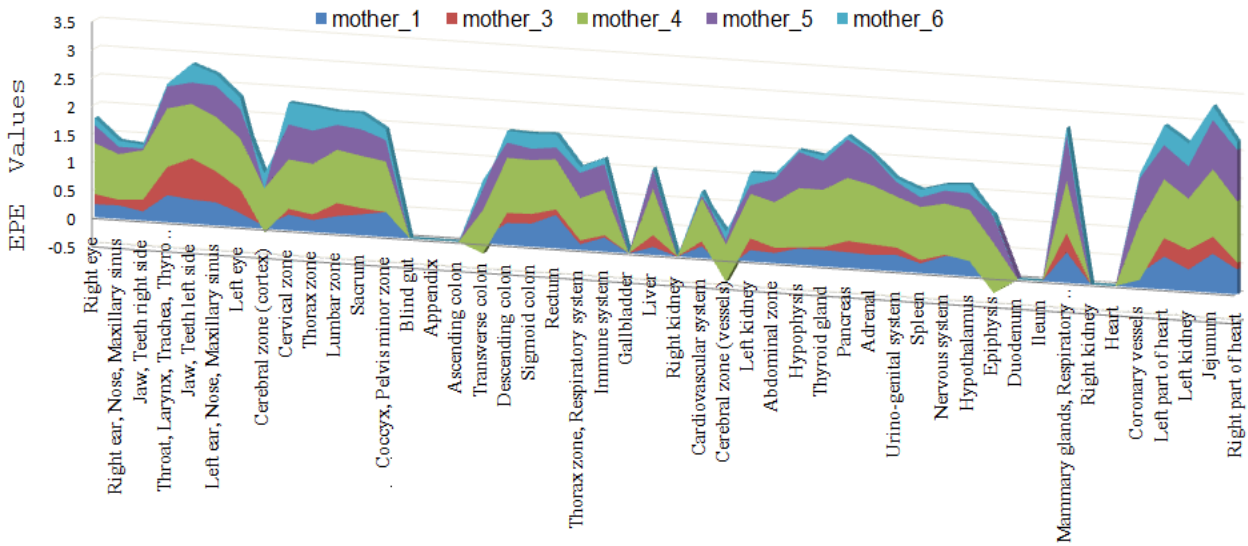


Figure 4 (d). Individual EPE values of mothers. Images with filter corresponding to the right hand.

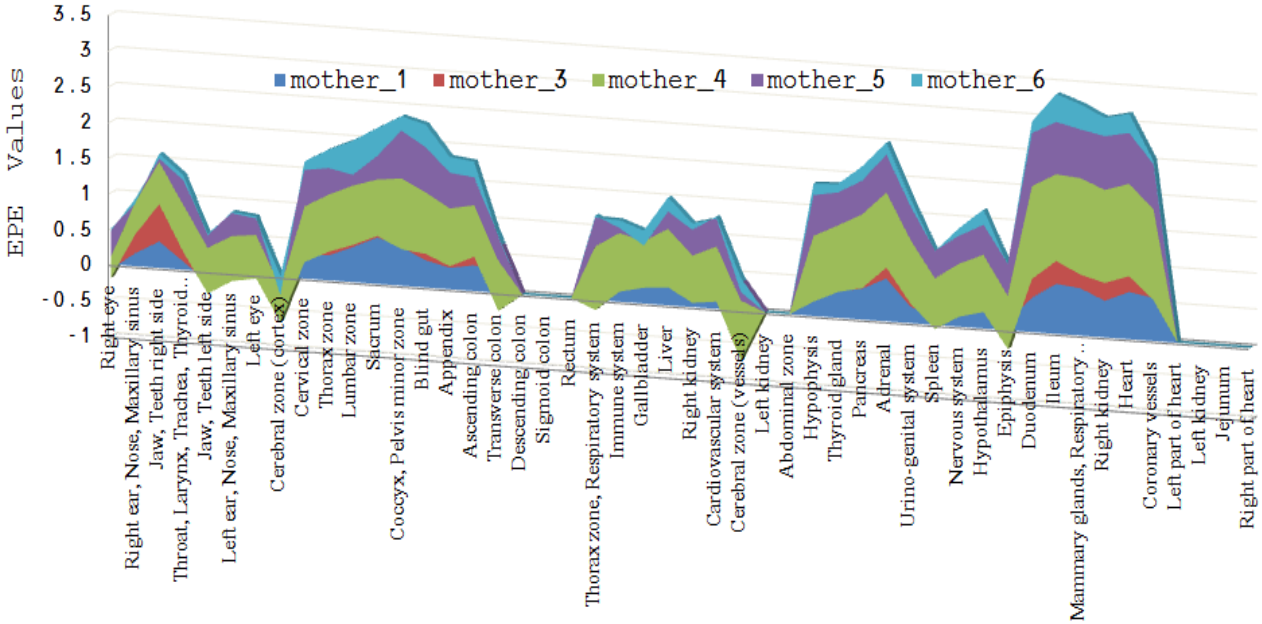


Figure 5 (a). Family 1. The images of the middle fingers of the right hand.

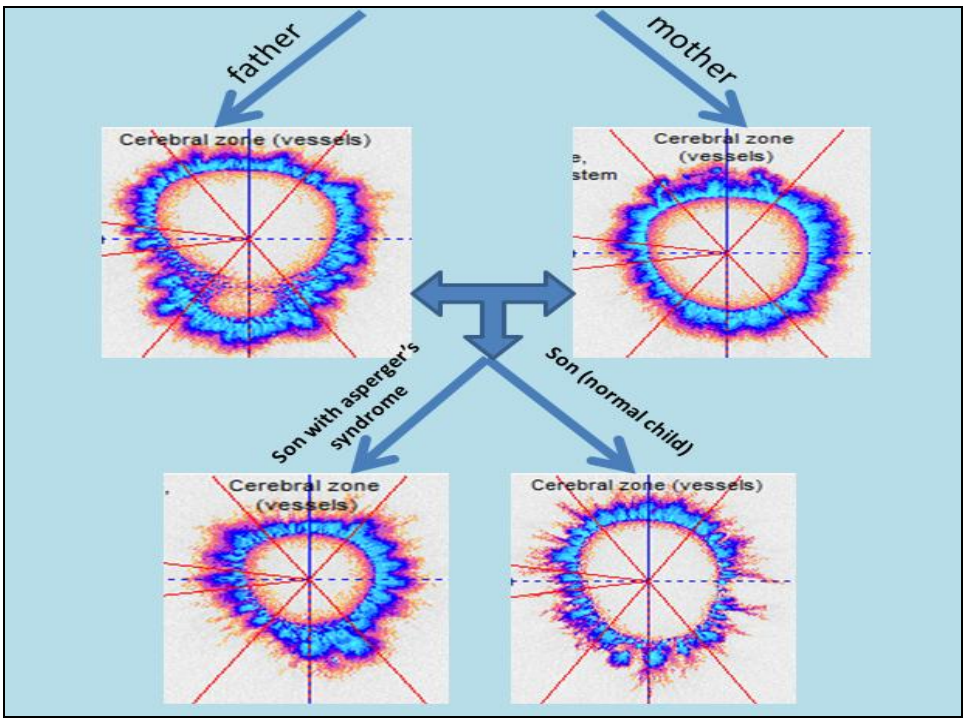
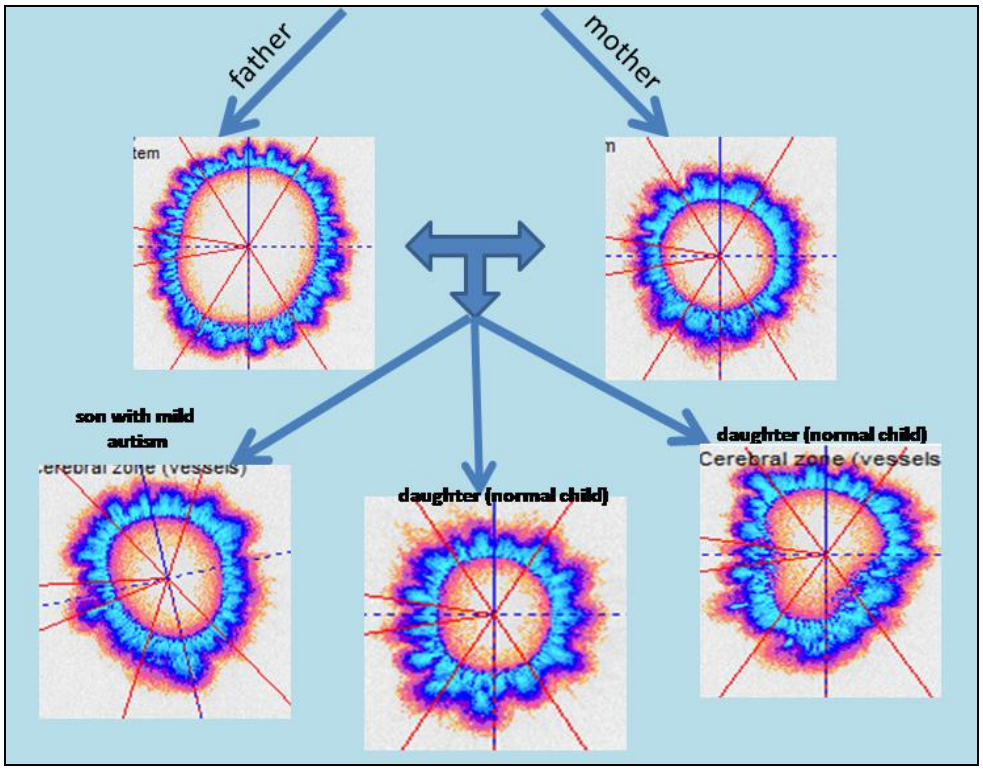


Figure 5 (b). Family 2. The images of the middle fingers of the right hand.



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