



## **ROLE OF BIOLOGY AND NEUROSCIENCE IN PSYCHIATRY**

All aspects of psychiatry have a biological dimension and this must be considered in education, CPD and in clinical decision making. Working as medical doctors constitutes an important aspect of the psychiatrist's role in the psychiatric clinic and this has implications for pursuing the professional role. The need for continued scientific development in respect of biological aspects of clinical psychiatry is self evident. Scientific improvements influence the understanding of genetic and molecular mechanisms underlying the aetiology, pathophysiology and treatment of mental disorders. Structured programs for training and professional development are needed for maintenance of best practice and for the further development of clinical professional skills.

Major psychiatric disorders have been shown to include significant and systematic disturbances in brain neuroanatomy and neurophysiology. Changes can be demonstrated as an early developmental feature or appear later in life. The living brain is a much more plastic organ than we assumed not long ago. It should be understood that effective treatments can be expected to involve adaptive changes in the affected neuronal networks of the brain. In summary the neuroscientific perspective must be included amongst the competences necessary for a fully trained professional psychiatrist.

The aims of this report are:

- to underline important progress in psychiatric neuroscience and implications for most aspects of psychiatry
- to promote a translational perspective for effective implementation of neuroscientific achievements in clinical psychiatry
- to promote an integrated neuroscientific perspective in training and professional development in European psychiatry

### **1. Developments in psychiatric neuroscience**

Knowledge in psychiatric neuroscience is growing fast, reflecting extensive research. The combination of findings from fields such as molecular genetics, epidemiology, brain imaging, pharmacology, basic neuroscience, cognitive neuroscience, psychotherapy and phenotype descriptions provides essential elements for an integrated view of psychiatric disorders and offers extensive opportunities for research and further development of clinical psychiatry. This report provides a background with examples and considers some of the implications for specialist training and continuous professional development with a view to deeper understanding of the aetiology, pathophysiology and treatment of mental disorders.

Traditionally biological psychiatry has been concerned with diagnostic procedures such as tissue examination, and with treatments such as psychotropic drugs, electroconvulsive therapy and psychosurgery. However, the concept of biological psychiatry as a restricted part of psychiatry, separate from e.g. psychotherapy is becoming increasingly problematic. With more exact measures and instruments we can detect the involvement of specific pathways and networks in the brain during episodes of psychiatric disorders. These are changes that help to explain the specific psychobiology of disorders, and lead to the understanding of mechanisms of action of effective treatments.

Experimental models using the intermediate phenotype concept (i.e. quantitative biological markers) together with molecular genetics have been used to display brain structure and function and its relation to specific cognition and emotions. A functional anatomy of neural systems, important for better understanding mental disorders, is thus emerging. Hence links

---

can be made, through imaging and genetics, between brain structure, functional variation, cognition and emotions.

So as to have a reasonable chance of perusing this development and implementing new treatments for the benefit of patients, psychiatrists will need to structure basic training and continuous professional training in such a way as to develop and maintain relevant knowledge.

Psychiatric neuroscience is providing insight into previously unexpected domains. Modern brain imaging, cognitive neuroscience and molecular genetics increasingly show that, counter to prevailing understanding, even traditionally “non-biological” interventions such as psychotherapy are associated with adaptive change in brain function. From other perspectives, new possibilities in molecular genetics provide proof of important roles in the aetiology of major disorders in psychiatry. It is now recognised that specific genotypes result in different levels of sensitivity to stress and consequent risk for mental disorder.

## **2. Aetiology and Diagnostics**

Gene-environment interaction has always been a matter for discussion in psychiatry. Molecular genetics combined with epidemiology and systematic clinical evaluation already show promise for treatment selection. Life stress is a well known risk factor for mental disorders.

Polymorphisms in e.g. the serotonin transporter (5-HTT) or monoamine oxidase A (MAO-A) genes seem to distinguish individuals with varying risk for depression, aggressive behaviour, temperament and suicide following stressful early life events. This finding implies gene-environment interaction. However, it has not yet been possible to find single genes determining most of the risk for mental disorders. The study of gene-environment interaction in psychiatry is a challenge for the future. Functional genomics that study genetic expression to explain the functional consequences of a genetic makeup provide a natural extension and complementary method in molecular genetic studies in the search for aetiology and pathophysiology of psychiatric disorders and individual response to treatment. Knowledge of results from this research will have implications for diagnostics, treatment and prevention.

## **3. Treatments**

Recent developments in psychopharmacology include novel mechanisms of action. Pharmacological facilitation of psychotherapy has been increasingly recognised. Treatment in anxiety disorder by behavioural therapy can be augmented by e.g. concomitant treatment with the glutamatergic *N*-methyl-D-aspartate receptor agonist D-Cycloserine. A similar synergy has been demonstrated for drug-induced facilitation of cognitive rehabilitation. Multimodal treatment is a concept that has become useful in psychiatry, combining medical management and behavioural treatment. Another example is in treatment for attention deficit hyperactivity disorder (ADHD) indicating that the multimodal approach is useful. Adopting this approach of combining various modes of treatment might possibly also be useful in striving for better outcome and remission in other psychiatric disorders. Treatments may also interact in a negative fashion. Careful dosing of drug treatment is thus critical to avoid negative impact on psychotherapeutic treatments or cognitive rehabilitation, while attention to drug-drug interactions should guide the prescribing of more than one medication, be they psychotropics or not.

Molecular genetics have been utilised to understand both individual and ethnic group variations in the workings of psychotropic drugs. Similar methods are being used to explore individual variability in response to psychological treatment. It is clear that psychiatrists will need to monitor this development and be able to implement future and more effective treatments. Brain imaging in psychiatry has historically been used mainly, to examine structure. Functional imaging has led to understanding of hypofrontality in schizophrenia. Hyperactivity in the amygdala in panic disorder and social phobia, and indications of a larger releasable pool of dopamine in schizophrenia, are further examples illustrating the impact of emerging functional anatomy in the understanding of psychiatric disorders. Positron emission tomography (PET) has been adopted in modern drug development showing the involvement of specific neurotransmitter receptors.

The effectiveness of electric convulsive treatment (ECT) has been shown in numerous evidence based research studies, and in many European (and non-European) countries it is considered effective in the treatment of severe depressive disorders, extreme mania, schizophrenic catatonia and organic delirious disorders. Other treatments are both slower and less effective. Trained psychiatrists must also have understanding of this therapy as it is life saving in some circumstances. Deep brain stimulation may potentially be another similar means of symptom relief which is currently still in the research stage.

Light therapy has evolved out of neuroscientific research. A number of clinical trials have been undertaken to examine to what extent light therapy is effective, in particular for affective disorders such as seasonal affective disorder (SAD). Light therapy for SAD is quite popular in some countries in northern Europe and is considered, by some, to be effective. However, the results from trials done, to date, have been hampered by problems to rule out placebo effects. On-going randomised clinical trials may possibly shed light on the efficacy of this treatment.

#### **4. Training and CPD in Psychiatric Neuroscience**

Neuroscience is a fundamental topic in all levels of psychiatric education, be it undergraduate, postgraduate or continued professional development (CPD/CME). The rapid scientific development in these fields, presents a considerable challenge to teachers of psychiatry. The knowledge base is increasingly specialised. Although many psychiatrists were previously able to keep track of developments, this can no longer be expected of the majority of teachers of psychiatry without a clear strategy for their own training. All psychiatrists, even when working exclusively in the psychotherapies or social psychiatry will need to update their knowledge and skills in psychiatric neuroscience. At the same time it is recognised that there is a need for an increased emphasis on the development of interpersonal skills and behavioural treatments in the education of psychiatrists, to avoid excessively narrow, technology based practice. Supervisors and teachers of psychiatric residents will need to maintain their level of understanding to ensure topical relevance to trainees

Based on this integrative approach, teaching and CPD/CME must particularly focus more specifically on:

- The consequences of the recent developments in neuroscience for diagnostics and assessment
- An integration of recent developments in neuroscience, psychopharmacotherapy and other biologically based treatments with psychotherapeutic practice and social psychiatry
- An understanding of the neurobiological processes and changes related to psychotherapeutic interventions
- A translational approach in the teaching of research methodology and skills aiming at implementation of useful knowledge in clinical practice
- Strategies to improve programmes for CPD/CME neuroscience in Europe to enable psychiatrists to keep up with the rapid developments in this field

#### **5. Future considerations**

- Competences in psychiatric education and CPD/CME in:
  - psychopharmacology
  - brain imaging
  - molecular genetics and genomics
  - principles of multimodal treatment
  - molecular genetics including personalized treatment approaches