

PREVENTING MENTAL ILLNESS

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Many more resources are devoted to treating mental illness than to preventing it. Yet most gains in public health over the past century have come from prevention rather than cure. It is high time we developed strategies for bolstering psychological resilience in the general population.

Here we outline one proposal for helping caregivers to strengthen the emotional wellbeing of infants. Our proposal involves exposing infants to certain pheromones in carefully controlled conditions.

Our proposal is based on an understanding of how emotional communication between infants and caregivers evolved. Hence we begin by describing the evolutionary context.

1. The evolutionary context

It's a typical day on the African savannah one hundred thousand years ago. A small band of people – our ancestors – are making their way slowly across the open grassland. The bravest men lead the way, parting the tall grasses carefully with their wooden spears. Behind them come the women, some holding small babies, while their children walk by their side. A few elders follow, with a couple of young men acting as the rear guard.

Suddenly, the leader freezes and holds up his spear in warning. He turns around to look at the rest of the tribe. His eyes are wide with fear. His fear is contagious. Everyone halts, and the women crouch down, signalling to the children to be quiet – by visible gestures, facial expressions and, invisibly, by the fear pheromones that the mothers emit instinctively. The babies freeze too. The band waits for the danger to pass, hoping that whatever it is hasn't spotted them.

All they can hear is the rustling of the grasses – the tell-tale sound of a large beast on the prowl. A lion, perhaps? Or a cheetah? Either way, the group is no match for such a creature out here on the plains, even armed with their sharp wooden lances.

Then one of the babies scrunches up his eyes, as if about to cry. The mother who is cradling the infant is horrified. But she doesn't put her hand over the babe's mouth. Instead, she simply looks at him intensely, fixing his eyes with her fearful gaze.

Instantly, the infant relaxes. His mouth closes, his breathing slows down and almost ceases, as his blood flow decreases. The infant becomes largely insensitive to pain, and he seems to drift into some kind of trance. The predator remains still for what seems like an eternity, pricking up its ears in the hope of locating the prey that it senses is nearby. Eventually, it gives up, and continues on its way. The leader breathes a sigh of relief, followed by a brief burst of laughter. The rest of the band relaxes, smiling at each other in recognition that the danger has passed. The infant begins to emerge from his trance, awakened by another pheromone,

one that is only emitted in happy circumstances, and which nullifies the effect of the fear pheromone.

The leader raises his spear once more, and the band continues on its way.

This kind of situation must have been a common occurrence for our ancestors during the thousands of years that they spent as hunter-gatherers on the African plains. Coming across large predators was an occupational hazard, and the most important thing in such situations was to avoid attracting attention. If evolution hadn't found a way to prevent infants from crying when predators were nearby, humans might well have become extinct.

We suggest that natural selection provided our ancestors with a solution to this problem. We believe that a special freezing response evolved to ensure that human infants would not cry or otherwise attract the attention of nearby predators. This freezing response would be triggered by the sight of a fearful face in combination with the detection of a chemosignal associated with fear, such as a pheromone. If the baby was old enough (between six and twelve months) it would see its mother's fearful face, and interpret this facial expression correctly due to prior exposure to the pheromone.

2. The decline of the fear response

The transition from a nomadic lifestyle to a sedentary, domesticated one meant that our ancestors became less and less exposed to wild animals and other life-threatening dangers. As a result, infants were less frequently exposed to fear pheromones, and the biological mechanism underlying the freezing response began to atrophy.

In the absence of these pheromones, infants are more likely to misread facial expressions of emotion. In particular, without the fear pheromone to accompany facial expressions of fear, other facial expressions of emotion may be mistaken for expressions of fear. The freezing response is consequently triggered by these other facial expressions. For example, infants may now freeze in response to, say, an angry face, or merely by being told off by a caregiver. This has serious consequences for child development. The child's ability to interpret facial expressions of emotion can be permanently impaired, and this can set in motion a series of developmental deficits that culminate in the onset of schizophrenia in later life.

It is plausible that facial expressions of emotion were more pronounced, and therefore easier to read, when our ancestors relied more heavily on non-verbal forms of communication in the distant past, and that the increasing role of language has led to a corresponding diminution in our capacity to communicate via non-verbal means.

The problems that began with the transition to a sedentary lifestyle are compounded in the modern world by a series of other factors including technological and social changes.

Relevant technological changes include the omnipresence of screens in the modern world (TV screens, computers, mobile phones, etc.), which means that children spend much less time looking at faces, further impairing their ability to interpret facial expressions of emotion.

Relevant social changes include the smaller number of caregivers. Children no longer grow up in extended families. Indeed, many now grow up with a single caregiver. Increased time in the classroom, where a group of children see only one adult for extended periods also mean that children are exposed to fewer adult faces. This also impairs their ability to interpret facial expressions of emotion.

3. New forms of prevention

The mismatch between the evolutionary context in which emotional communication evolved, and the modern environment is a likely cause of much mental illness.

Recent research by Biagio D'Aniello of the University of Naples Federico II has shown that dogs can display differential responses to the distinctive biochemical signatures of the body odours that humans excrete under different emotional states. Sweat was collected from the armpits of adults watching fear or happiness-inducing videos, and dogs were then exposed to these sweat samples. The dogs exhibited different behaviours when exposed to the sweat samples collected under different conditions. This research thus demonstrated for the first time that humans excrete a specific pheromone when happy, as well as confirming that humans excrete a specific pheromone when afraid.

These pheromones are of crucial importance to babies since without them it is hard for babies to identify the corresponding facial expressions of emotion in their caregivers. We therefore propose, as a prophylactic therapy for mental illness, that babies aged between three to six months be exposed to the relevant pheromones in the close presence of their caregivers. This could be achieved very simply by the caregiver watching videos that would trigger relevant emotional responses in the caregiver, including the release of relevant pheromones. The effectiveness of this treatment could be evaluated by a prospective cohort study comparing the emotional health of the children so treated with untreated infants as they progress through kindergarten and primary school.

4. Genetic aspects

The genes underlying the freezing response have not been properly investigated, although they may be related to the genes for hypnotic suggestibility, which have been the subject of several studies. Based on the ideas set out here, we would expect to find considerable overlap between the genes underlying the freezing response and those associated with greater risk for schizophrenia.

Nevertheless, all genetic explanations of schizophrenia run up against the fact that less than 50 per cent of MZ twins of those with schizophrenia also suffer from the disease. It follows that developmental (i.e. non-genetic) factors also play a large role in the aetiology of schizophrenia. The proposed aetiology we have described here is the first detailed theory that reconciles these facts.

There are also similarities between the frozen state, as we have described it here, and the state of hypnosis. In both cases breathing slows down, blood flow decreases, and one becomes less sensitive to painful stimuli. Therefore we would also expect to find some

overlap between the genes underlying the freezing response and those associated with susceptibility to hypnosis.

This implies that the new method for preventing psychosis, which we have outlined above, should be targeted in the first instance at those with a close relative (such as a parent or grandparent) who has suffered from psychosis.

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