Universität Zürich[UZH]

Psychobiologie des Vertrauens

Prof. Dr. Beate Ditzen

Symposium der Privatklinik Hohenegg

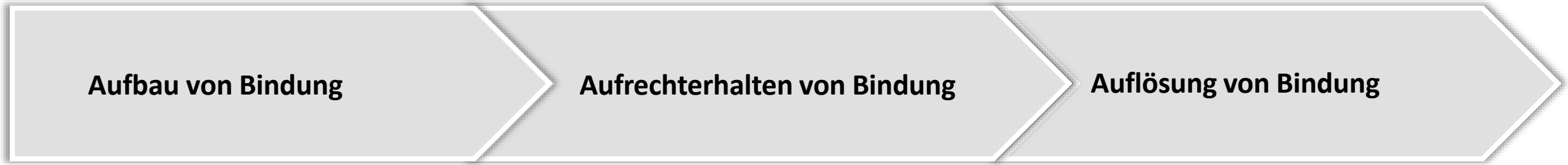
Soziale Bindungsbeziehungen

Soziale (Bindungs-)beziehungen sind bezeichnend für das menschliche Leben und beeinflussen die psychische und körperliche Gesundheit

(Fast) alle psychischen Störungen und chronischen körperlichen Erkrankungen beeinträchtigen soziale Bindungsbeziehungen

Attachment bonds are marked by two key features; they are selective (specific to attachment target) and enduring (long-lasting)

Die Wirkung von Bindungsbeziehungen ist auf psychobiologischer Ebene vermittelt über neuroendokrine und neuroimmunologische sowie belohnungsrelevante Systeme



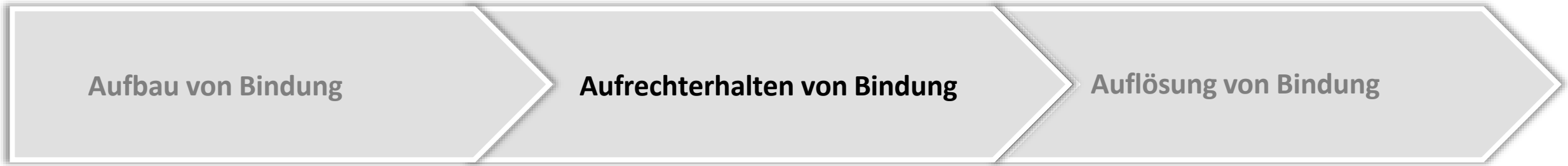
Tomasello, *Mind & Language,* 2003; Holt-Lunstad et al., *PLOS Medicine,* 2010; https://www.nimh.nih.gov/research/research-funded-by-nimh/rdoc/about-rdoc; Feldman, *Trends Cogn Sci,* 2017; Holt-Lunstad, Ditzen, & Light, *Int J Psychophysiol,* 2019; Kiecolt-Glaser, *Am Psychol,* 2019

Vertrauen in sozialen Bindungsbeziehungen

Vertrauen in sozialen Bindungsbeziehungen kann auf zwei Ebenen betrachtet werden:

1) Vertrauen in die Integrität der Person, mit der wir interagieren, in Informationen und Emotionen, die diese teilt
2) Vertrauen in die Verfügbarkeit dieser Person/ die Stabilität der Beziehung

Dieses Vertrauen vermittelt Sicherheit, welche unsere psychobiologische Stressantwort beeinflusst.



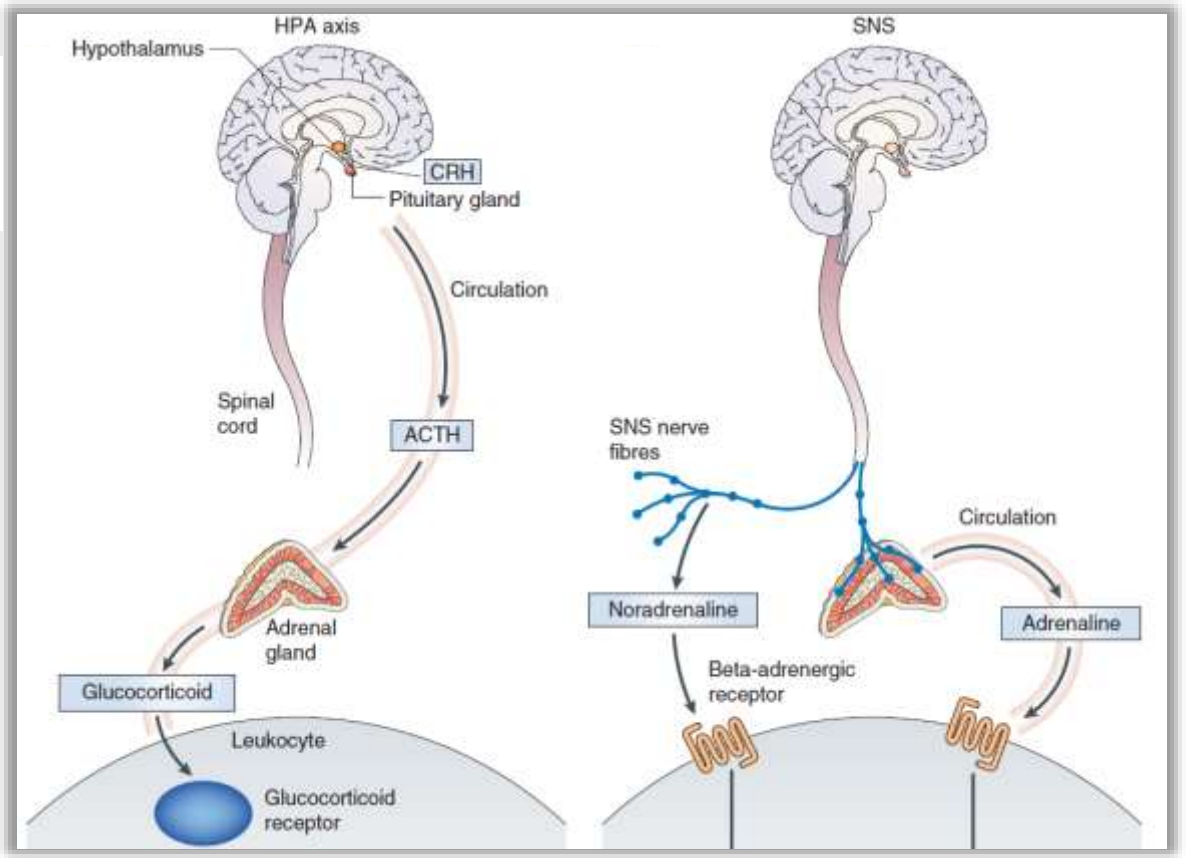
Aguilar-Raab & Ditzen, *Neurobiological Factors Underlying Attachment and Trust in the Believing Process.* In: H-F Angel et al. (2017). *Processes of Believing.* Berlin: Springer

Biologische Stressantwort

Hypothalamus:
Corticotrophin Releasing Hormon

Hypophyse:
Adrenocortico-tropes Hormon

Neben-nierenrinde:
Cortisol



ZNS:
Noradrenalin

Neben-nierenmark:
Adrenalin
Noradrenalin

Blutdruck

Herzrate

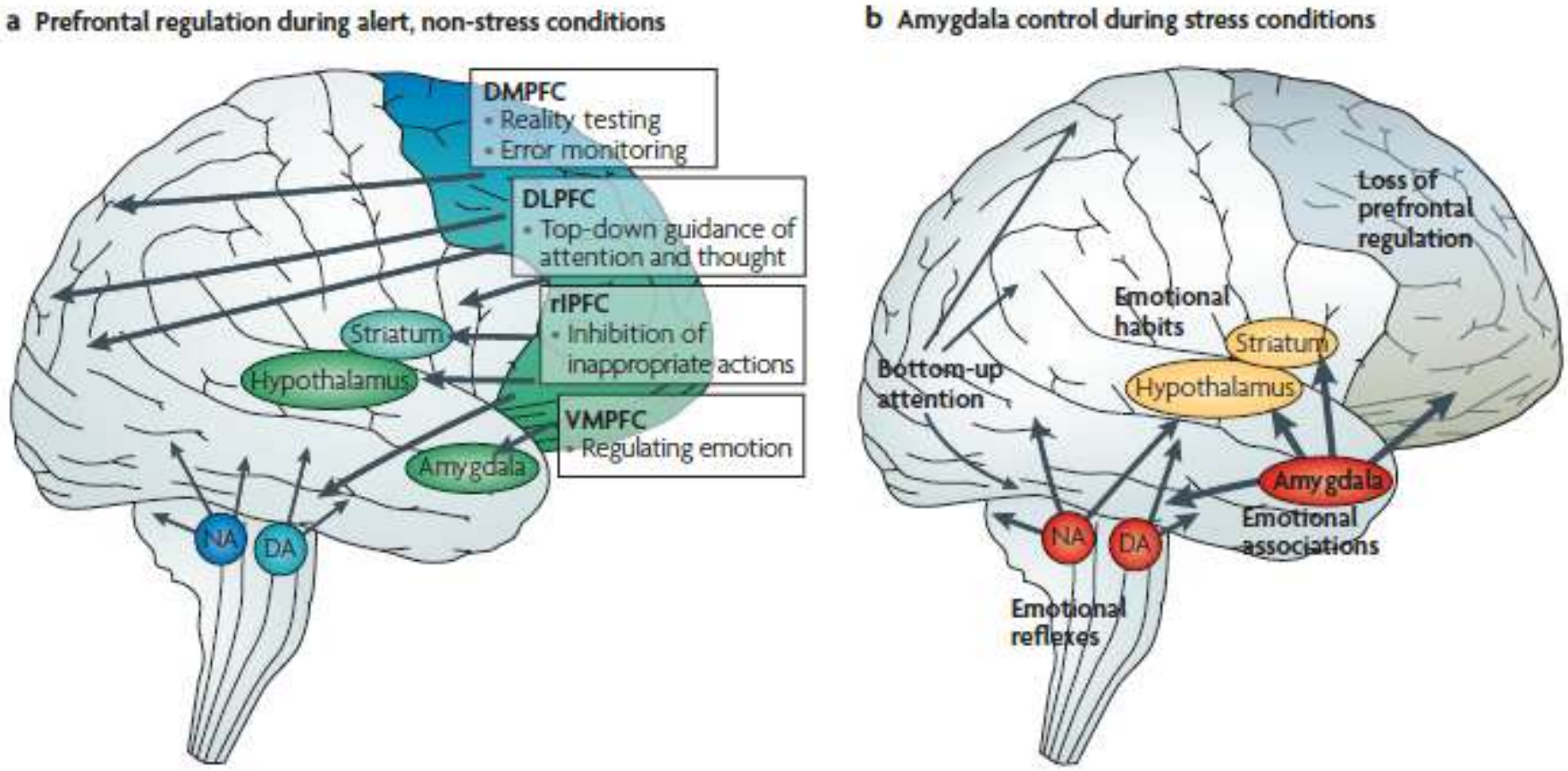
Herzraten-variabilität

Alpha Amylase

Eisenberger & Cole, *Nature Reviews Neurosci,* 2012

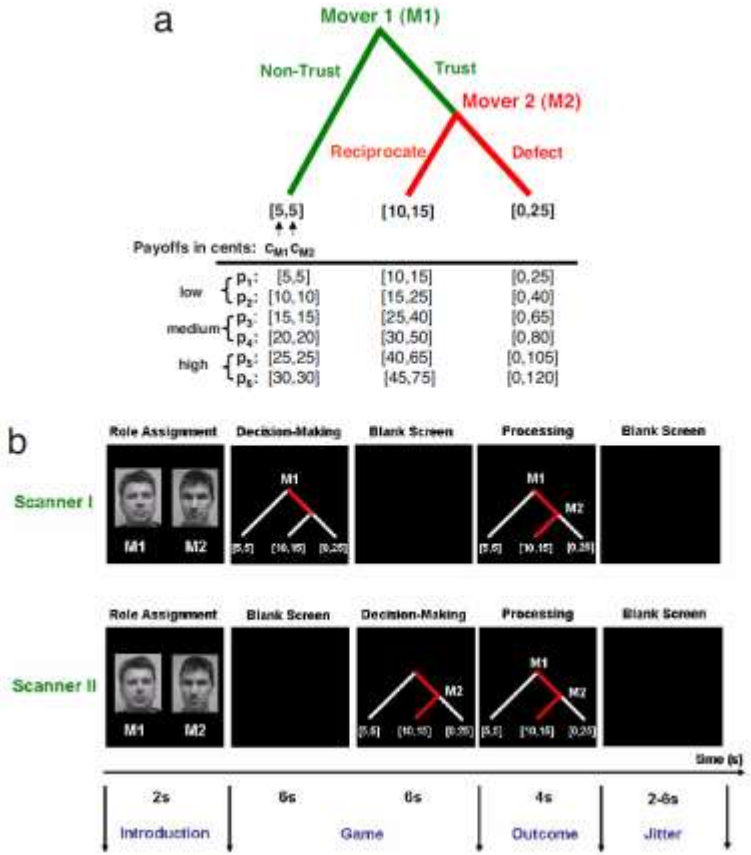
Neurobiologische Vermittler

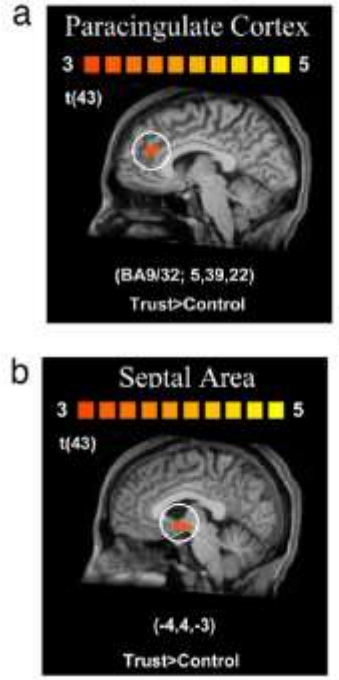
Stress, Informationsverarbeitung und Verhalten

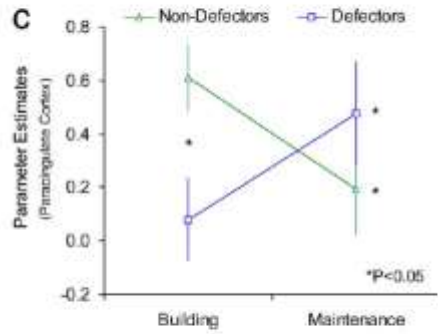


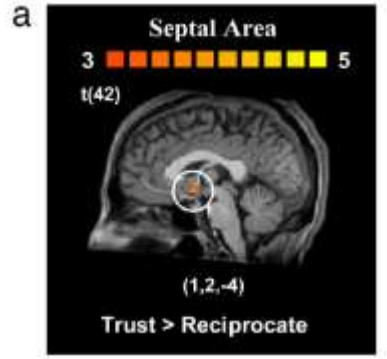
Arnsten, *Nature Reviews Neuroscience,* 2009 |

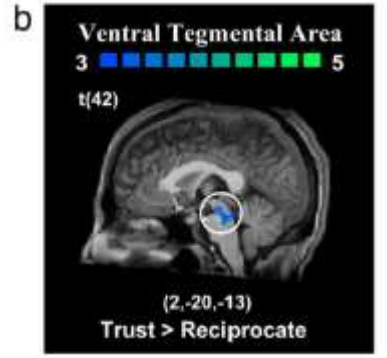
Neurobiologische Korrelate von Vertrauen

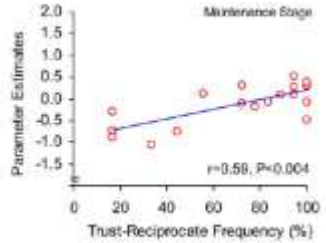


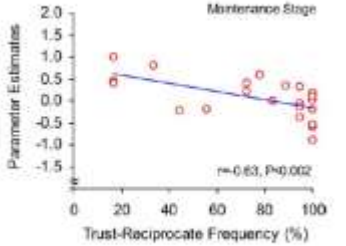












Krueger et al., *PNAS,* 2007

Limbisches System

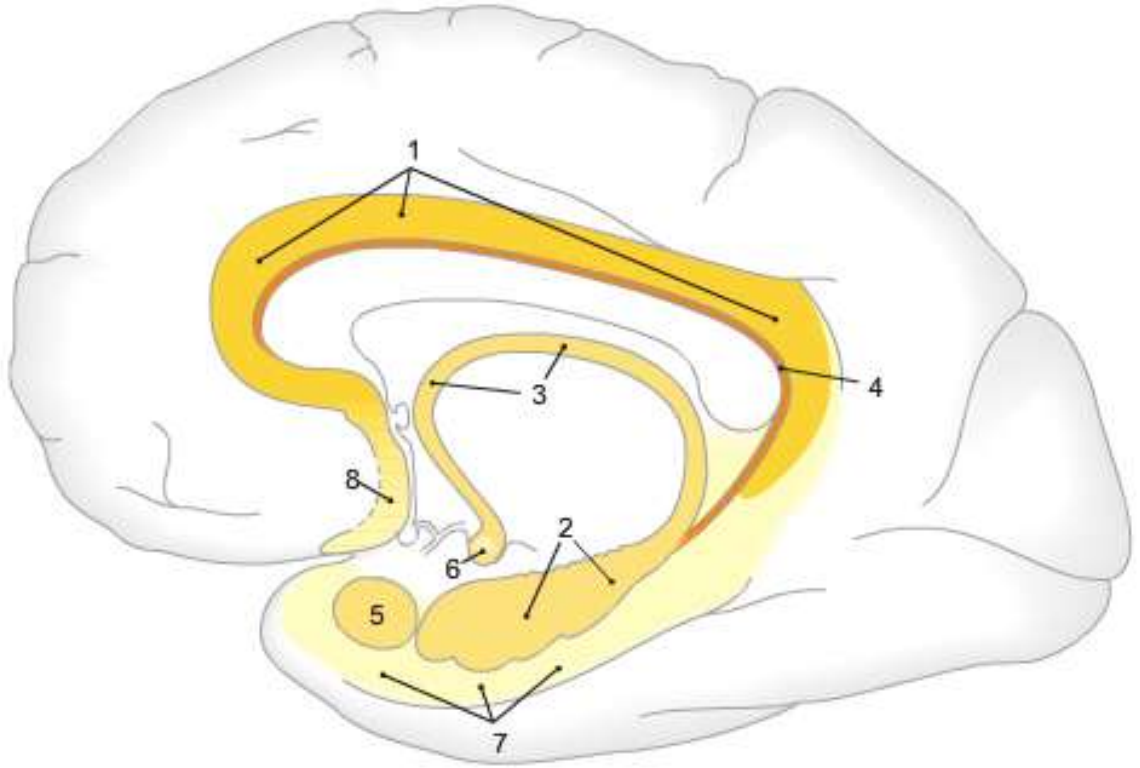
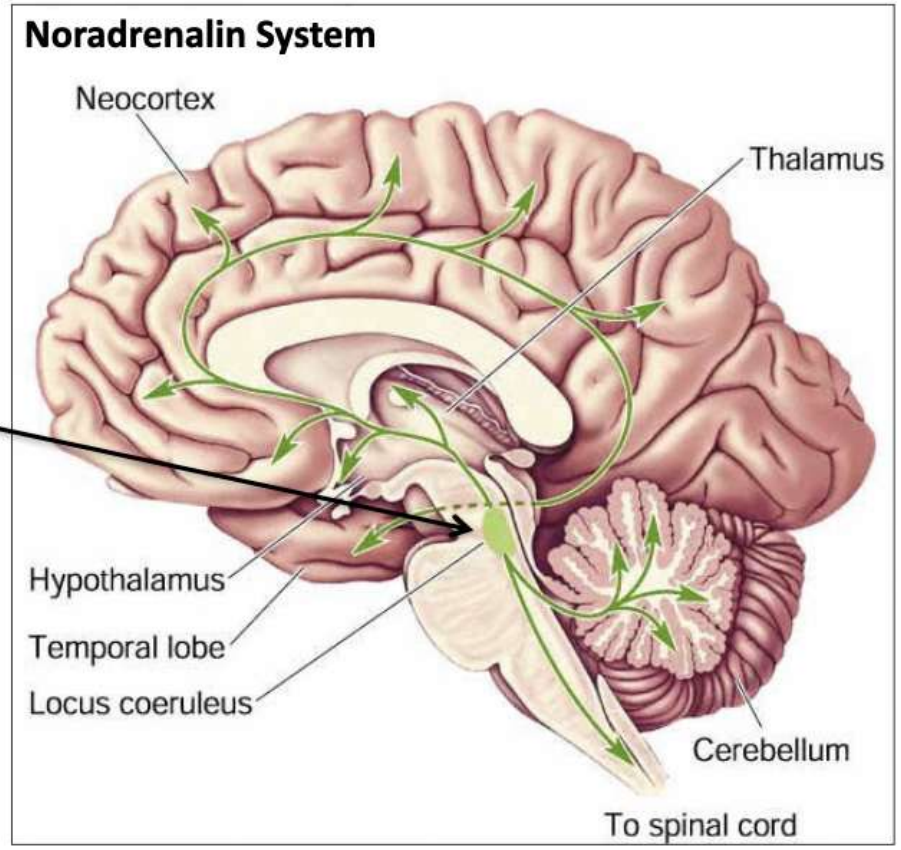


Abb. 9.15 Die wichtigsten Komponenten des limbischen Systems.
1 Gyrus cinguli, **2** Hippocampus mit Gyrus dentatus, der sich zum einen mit seinen efferenten Fasern unterhalb des Corpus callosum (Balken) als **3** Fornix und zum anderen als dünner Streifen grauer Substanz dorsal des Balkens als **4** Indusium griseum fortsetzt, **5** Corpus amygdaloideum, **6** Corpus mammillare, **7** Gyrus parahippocampalis, **8** Septumregion.

Trepel (2015). *Neuroanatomie.* München: Urban & Fischer |

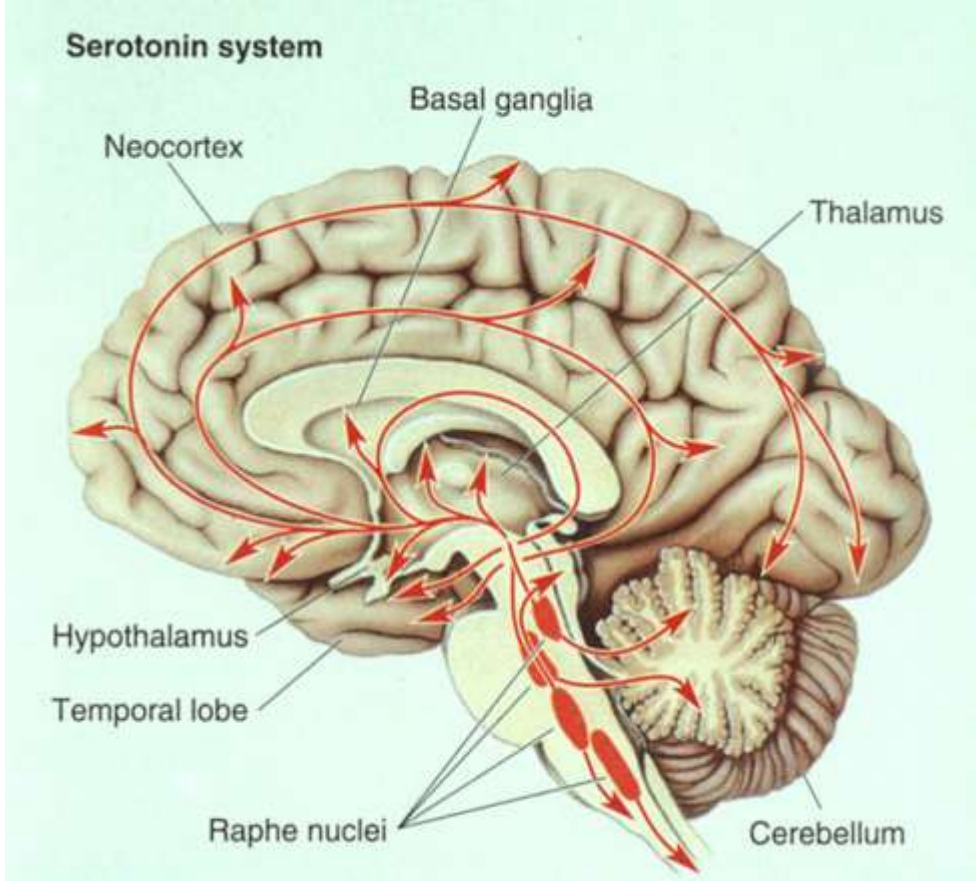
Noradrenalin

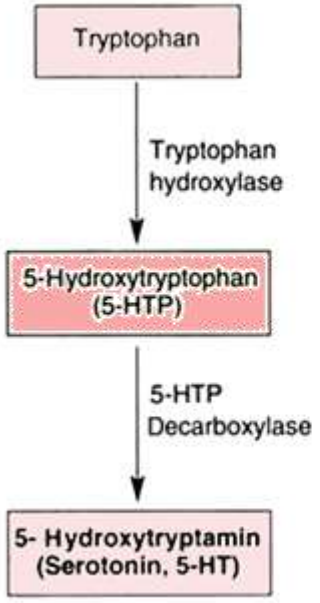
Unter Stress wird das zentralnervöse Noradrenalinsystem aktiviert (Kerngebiete im Locus Coeruleus), durch Projektionen von Amygdala, PFC, PVN des Hypothalamus, BNST und PAG.

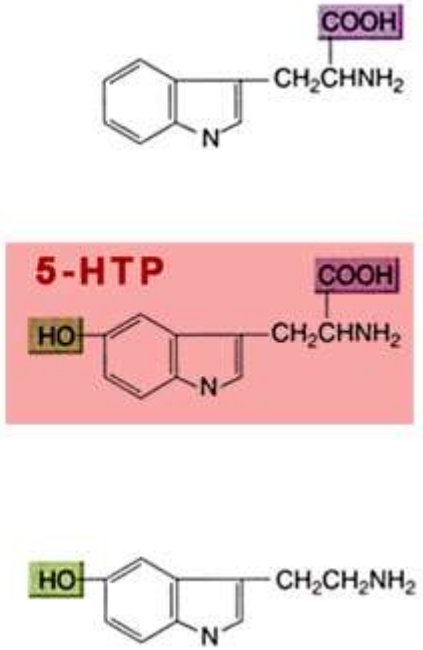


Domes & Kumsta (im Druck). *Biologische Psychologie,* Stuttgart: Kohlhammer

Serotonin


Serotonin system
Basal ganglia
Neocortex
Thalamus
Hypothalamus
Temporal lobe
Raphe nuclei
Cerebellum

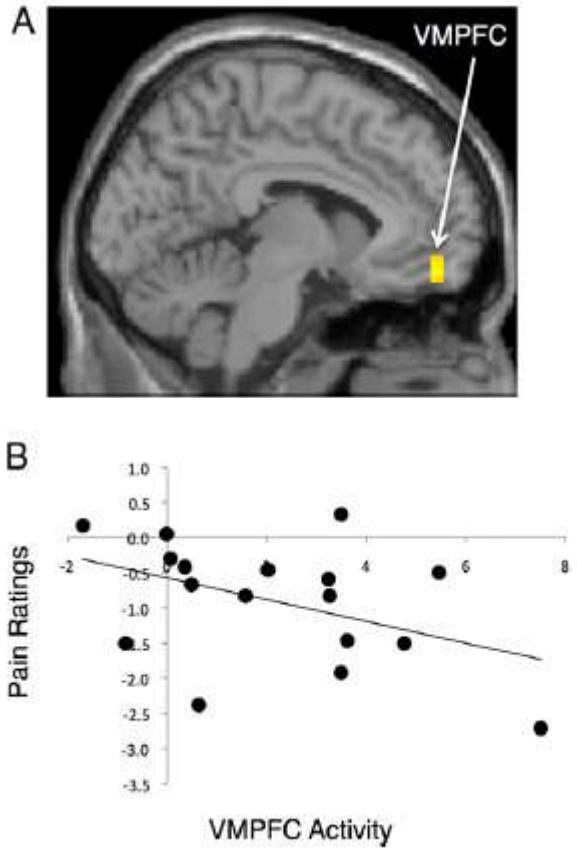

Tryptophan
Tryptophan hydroxylase
5-Hydroxytryptophan (5-HTP)
5-HTP Decarboxylase
5- Hydroxytryptamin (Serotonin, 5-HT)

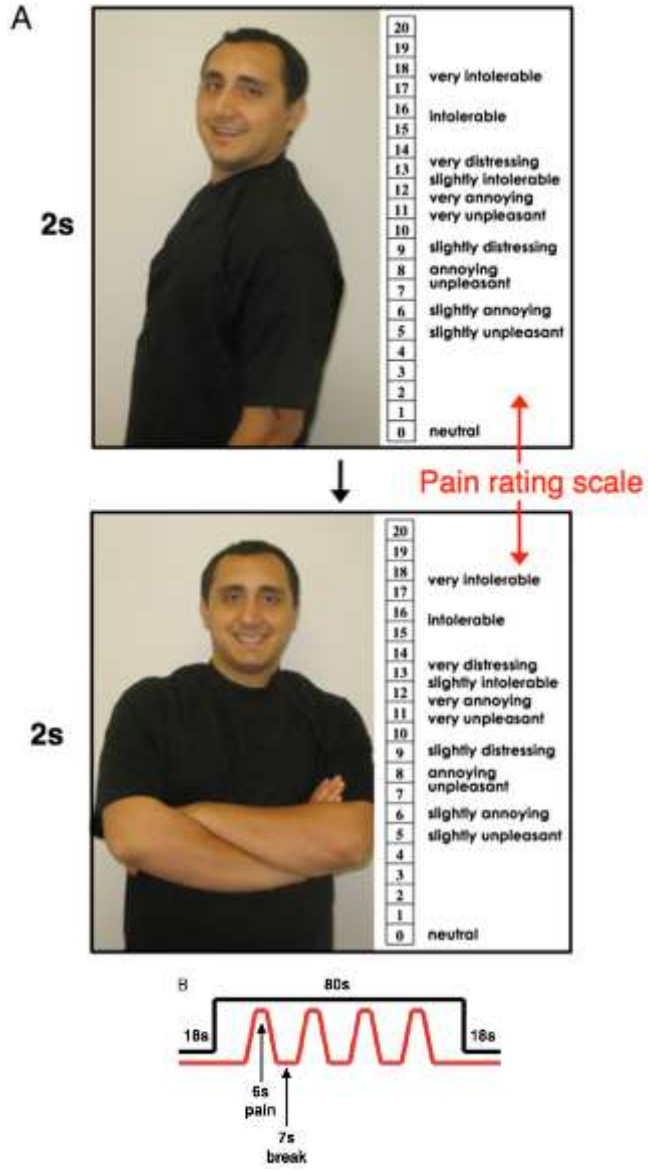

COOH
CH2CHNH2
N
5-HTP
COOH
HO
CH2CHNH2
N
HO
CH2CH2NH2
N

Serotonin und Einschätzung von Beziehungen

Bilderbeck et al., *Biol Psychiatry,* 2011

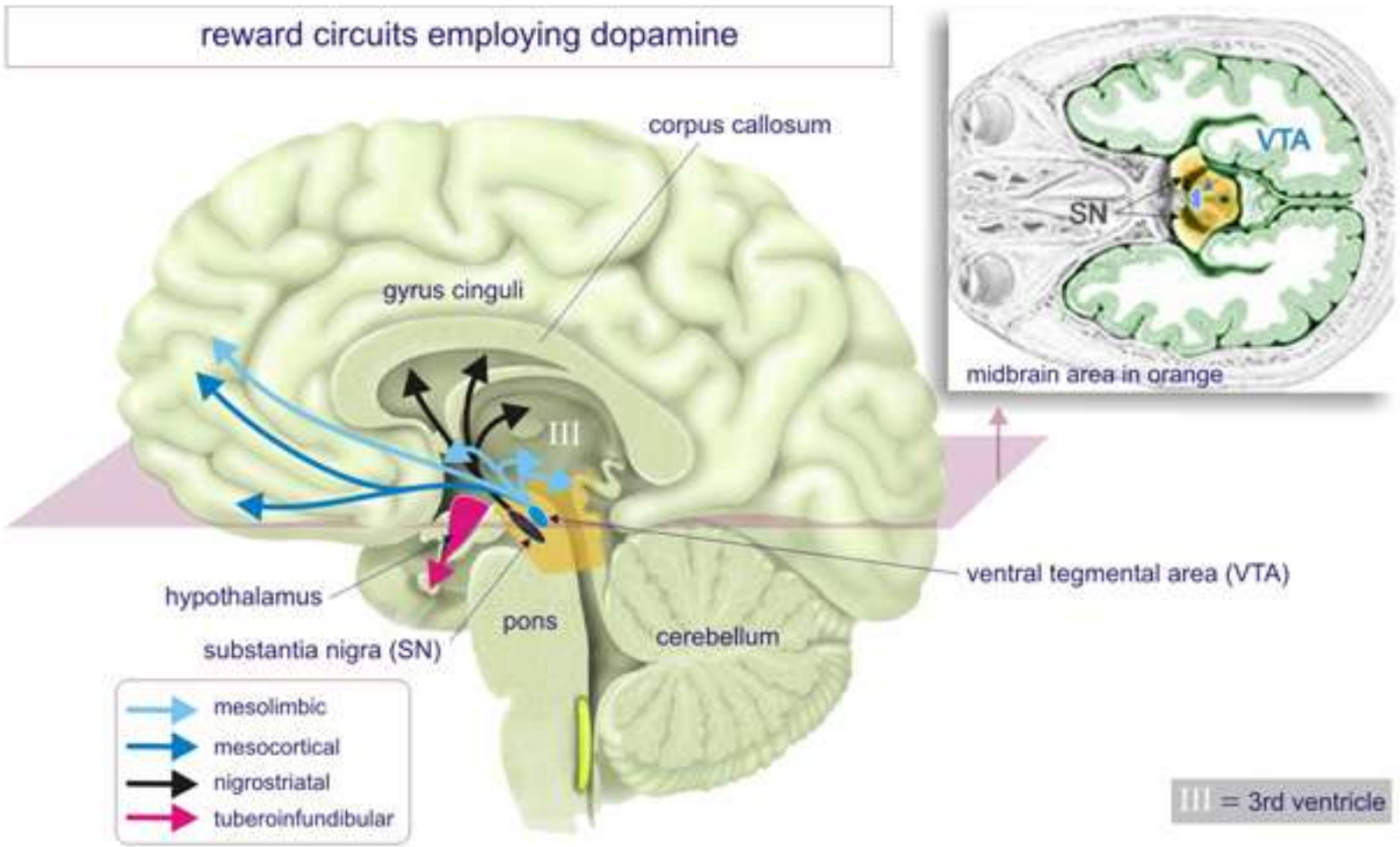
Opiate





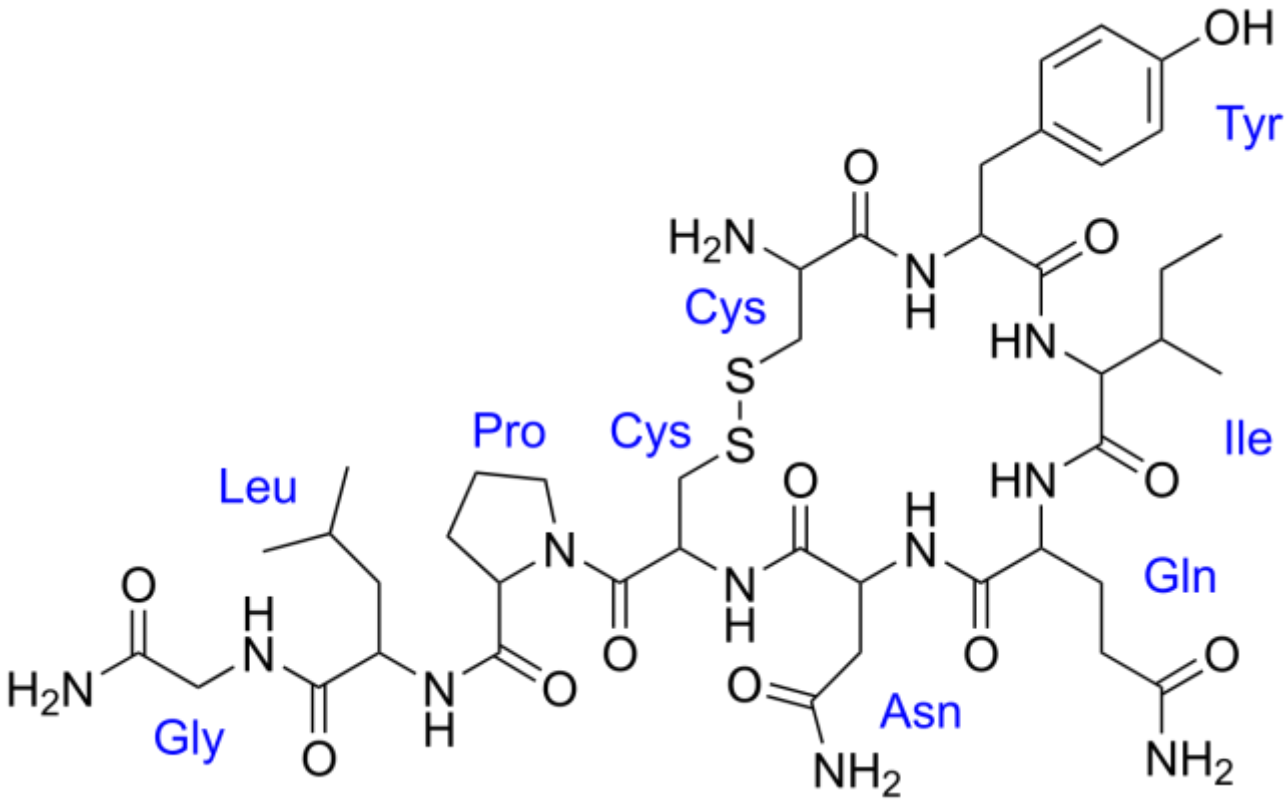
Eisenberger et al., *PNAS,* 2011

Dopamin

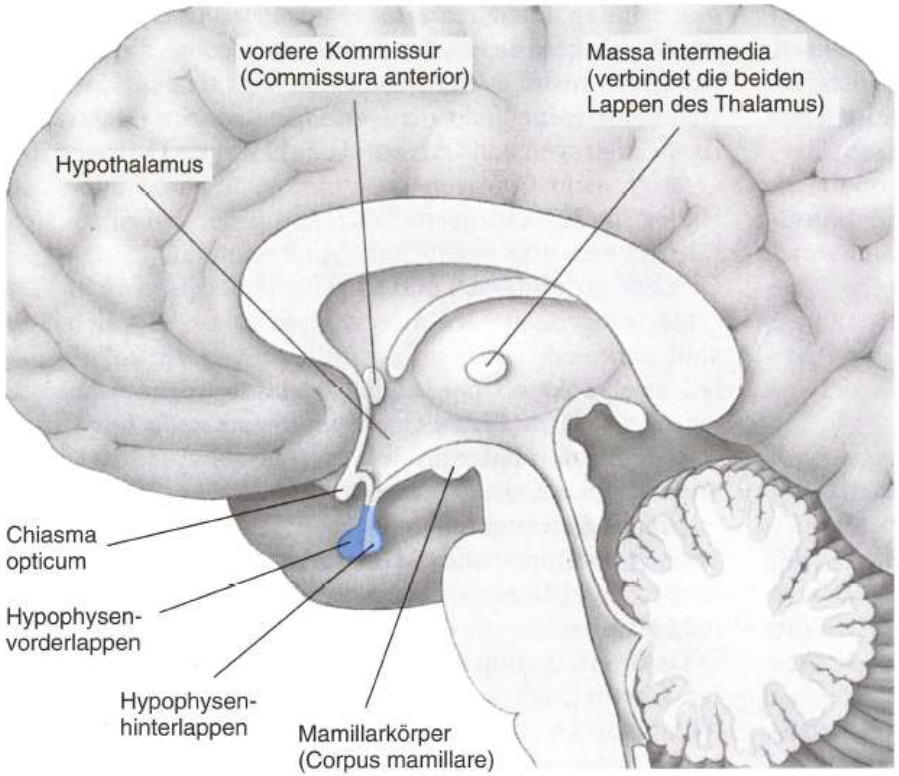


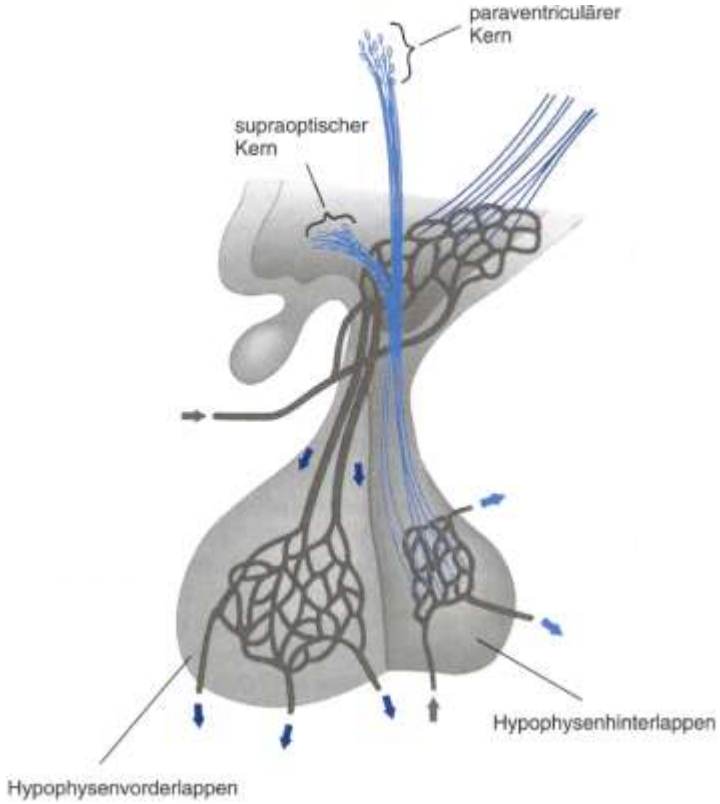
http://www.cellbiol.net/ste/alpobesity3.php |

Oxytocin



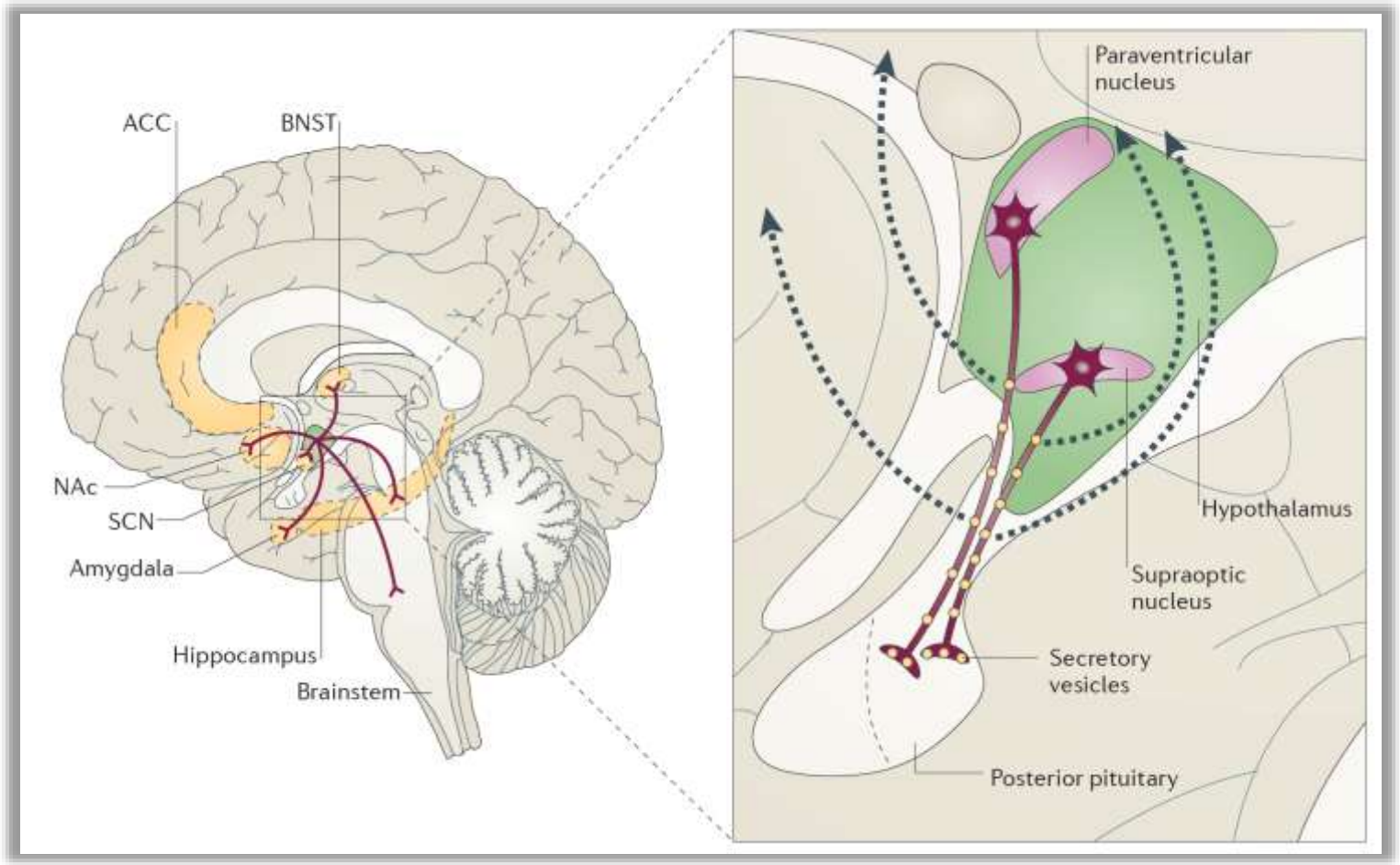
Oxytocin





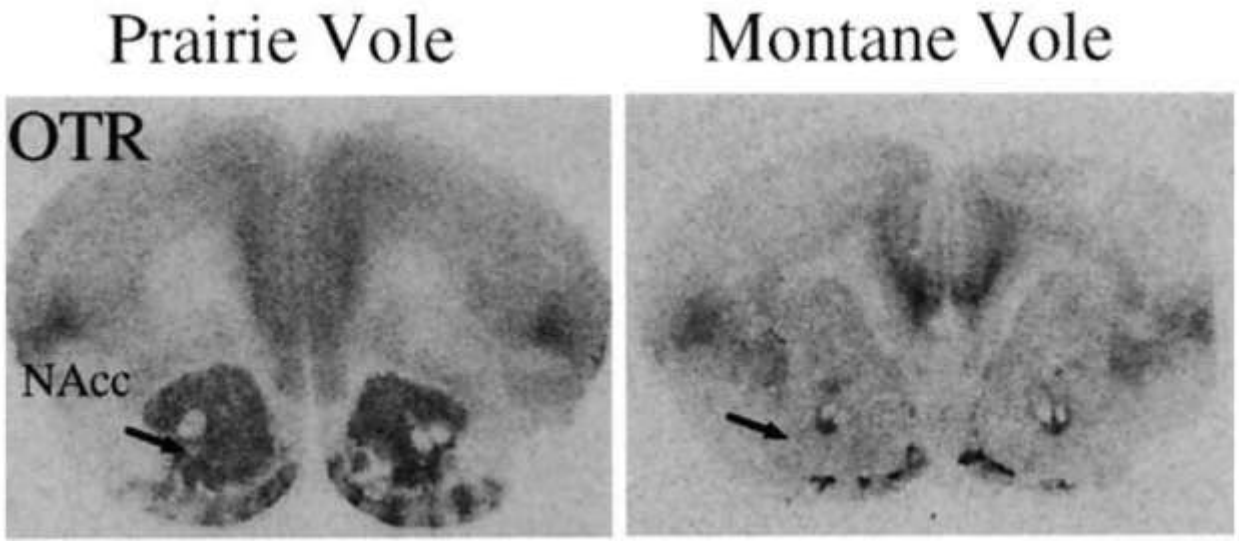
Pinel (1997) *Biopsychologie*. Heidelberg: Springer

Oxytocin



Meyer-Lindenberg et al., *Nature Rev Neurosci,* 2011

Oxytocin und Paarbindung

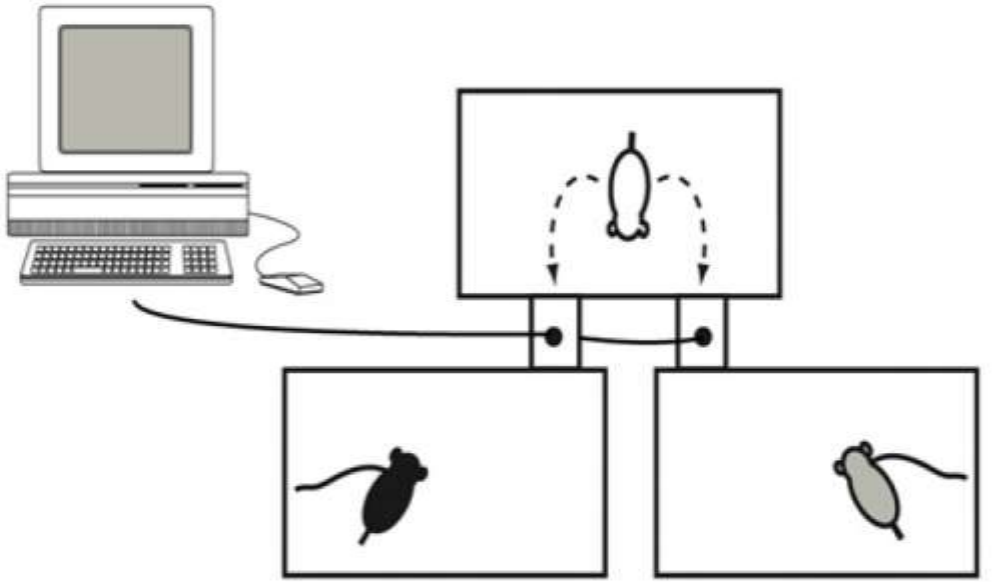


Nacc= Nucleus Accumbens

In vitro receptor autoradiography with the selective oxytocin receptor ligand [^{125}I]d(CH$_2$)$_5$[Tyr(Me)^2,Tyr-NH$^{9/2}$]OVT ([^{125}I]OTA)

Young, *Biol Psychiatry,* 2012 |

Oxytocin und Paarbindung



Young et al., *Front Neuroendocrinology,* 2011

Oxytocin und Paarbindung

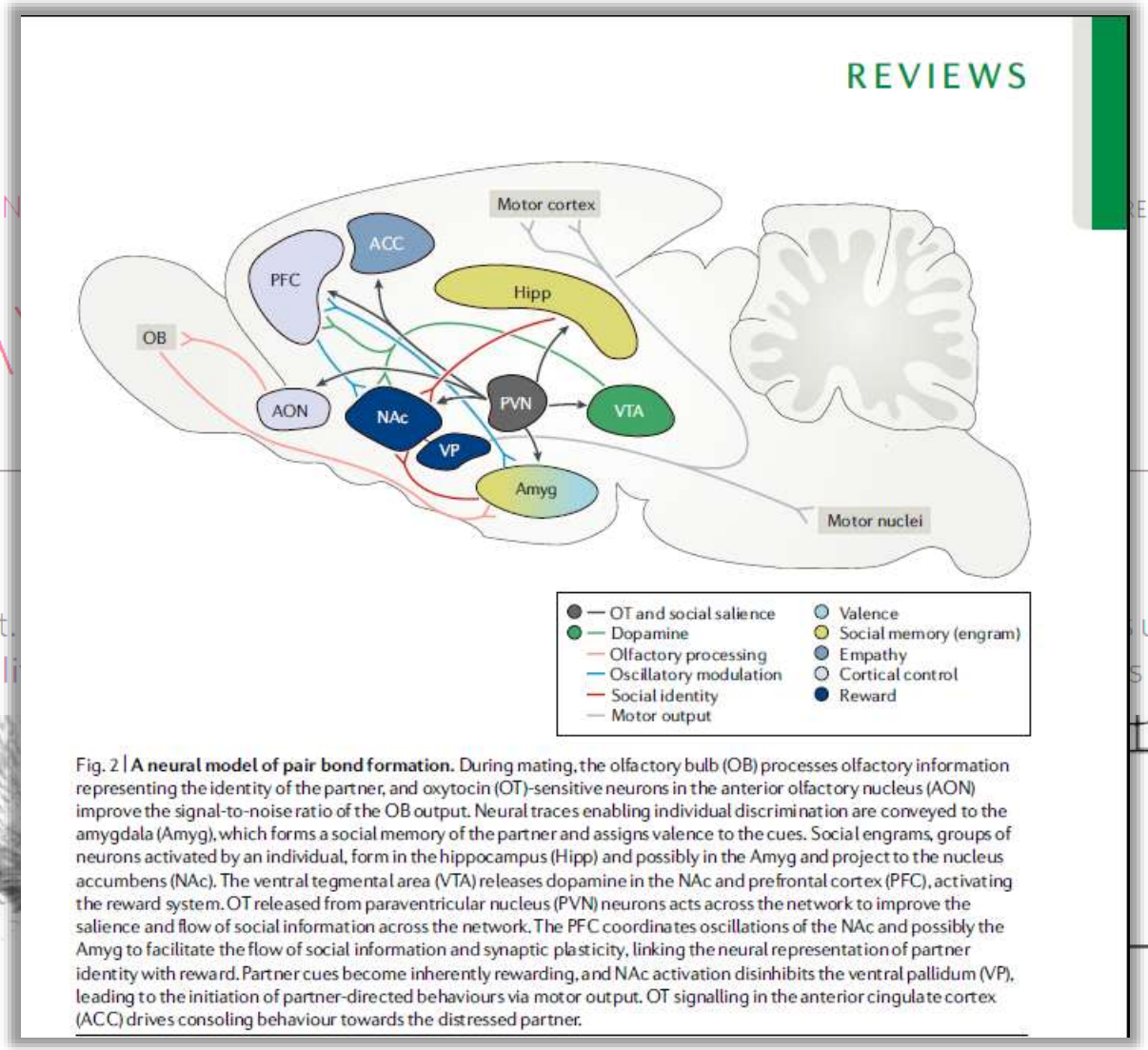


Fig. 2 | **A neural model of pair bond formation.** During mating, the olfactory bulb (OB) processes olfactory information representing the identity of the partner, and oxytocin (OT)-sensitive neurons in the anterior olfactory nucleus (AON) improve the signal-to-noise ratio of the OB output. Neural traces enabling individual discrimination are conveyed to the amygdala (Amyg), which forms a social memory of the partner and assigns valence to the cues. Social engrams, groups of neurons activated by an individual, form in the hippocampus (Hipp) and possibly in the Amyg and project to the nucleus accumbens (NAc). The ventral tegmental area (VTA) releases dopamine in the NAc and prefrontal cortex (PFC), activating the reward system. OT released from paraventricular nucleus (PVN) neurons acts across the network to improve the salience and flow of social information across the network. The PFC coordinates oscillations of the NAc and possibly the Amyg to facilitate the flow of social information and synaptic plasticity, linking the neural representation of partner identity with reward. Partner cues become inherently rewarding, and NAc activation disinhibits the ventral pallidum (VP), leading to the initiation of partner-directed behaviours via motor output. OT signalling in the anterior cingulate cortex (ACC) drives consoling behaviour towards the distressed partner.

Young et al., *Front Neuroendocrinology,* 2011; *Nature,* 2009; Walum and Young, *Nat Rev Neurosci,* 2018

Oxytocin und Sicherheitslernen

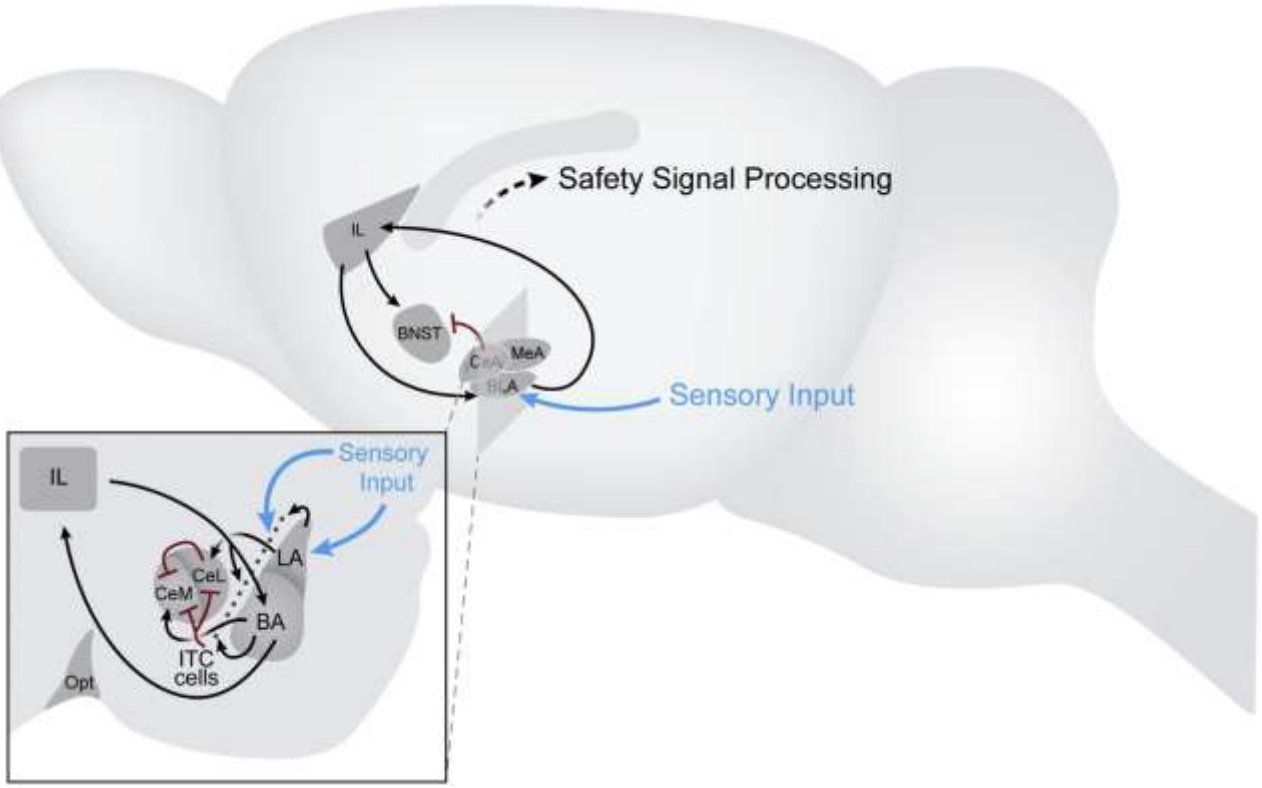
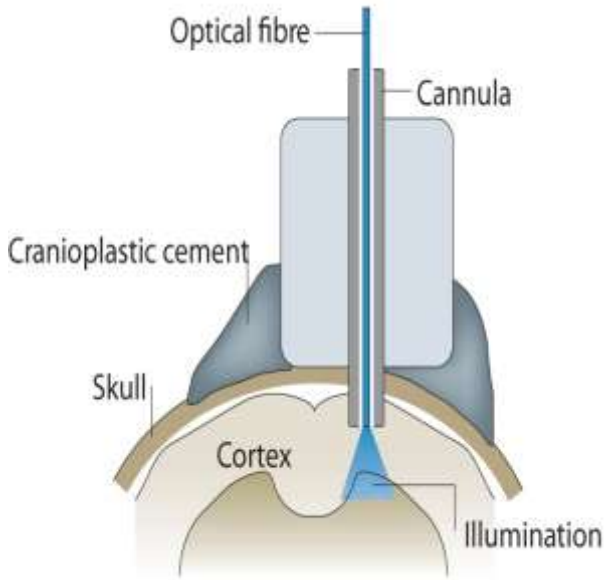


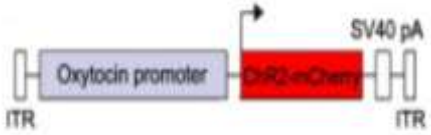
Fig. 3. The neural circuitries underlying safety learning in the rodent brain. As depicted, the BLA receives sensory input from the safety signals, then relays information to other nuclei of the amygdala as well as to the IL. In turn, the IL controls the activity of the BNST and amygdala in a top-down manner. Black and red arrows depict excitatory and inhibitory projections, respectively. The coherent activity of excitatory and inhibitory circuits leads to the reduction of fear expression mediated by the output from the CeM to the brainstem in the presence of safety signal. The inset shows the detailed connections between the nuclei of the amygdala and IL. Abbreviations: **BA**, basal nucleus of the amygdala; **BLA**, basolateral nucleus of the amygdala; **BNST**, bed nucleus of stria terminalis; **CeA**, central nucleus of the amygdala; **CeL**, lateral subdivision of CeA; **CeM**, medial subdivision of CeA; **IL**, infralimbic cortex; **ITC**, intercalated cells; **Opt**, optic tract.

Eckstein et al., *Int J Psychophysiol,* 2019 |

Grinevich-group: Stereotaxic Surgery



Viruses:



Grinevich and Stoop, *Neuron,* 2018

Oxytocin Nasenspray

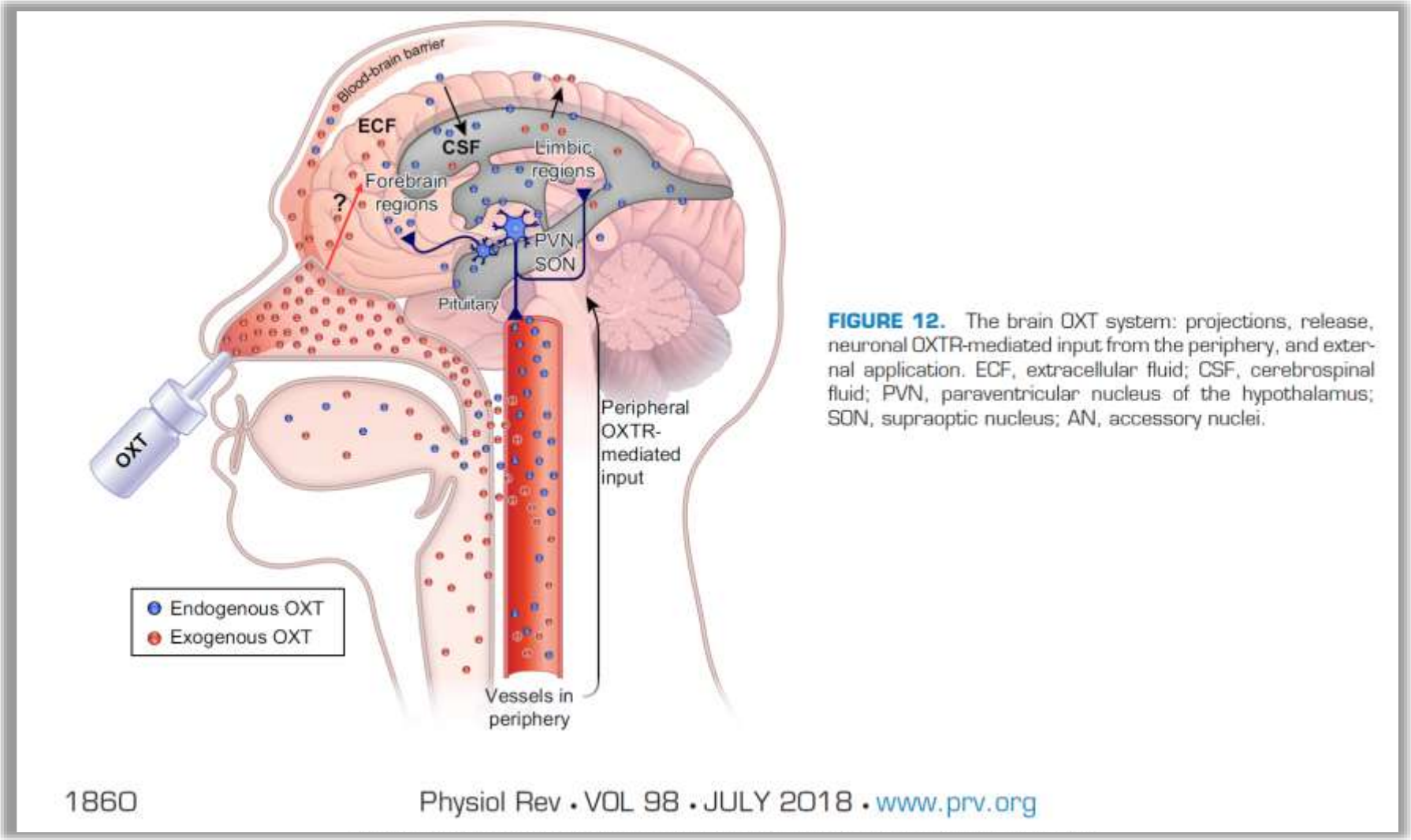


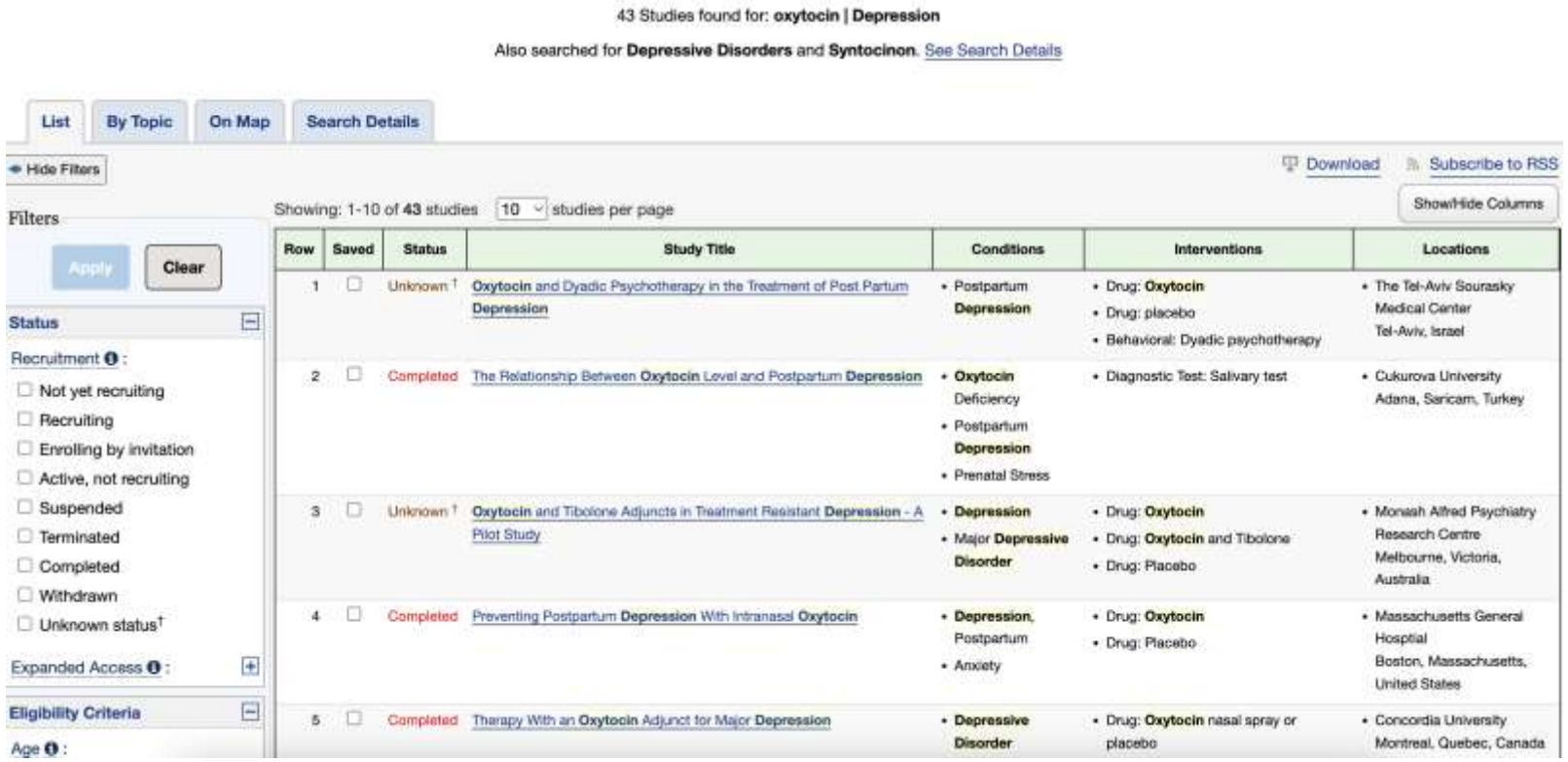
FIGURE 12. The brain OXT system: projections, release, neuronal OXTR-mediated input from the periphery, and external application. ECF, extracellular fluid; CSF, cerebrospinal fluid; PVN, paraventricular nucleus of the hypothalamus; SON, supraoptic nucleus; AN, accessory nuclei.

Jurek & Neumann, *Physiol Rev,* 2018 |

Clinical Trials mit Oxytocin als (Add-on zu) Psychotherapie

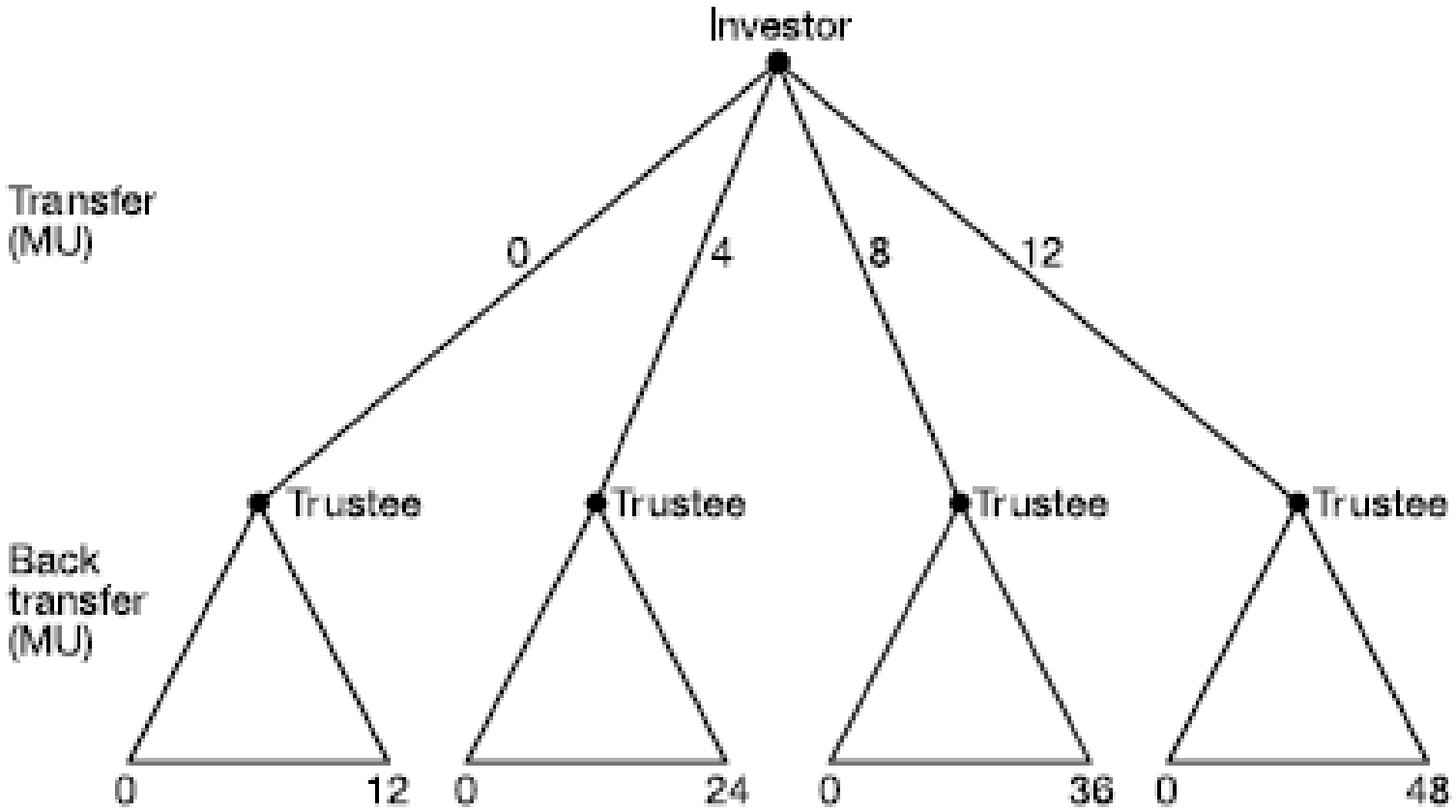
Bisher ca. 300 Studien zu den Effekten von Oxytocin Nasenspray bei psychischen Erkrankungen:

- 43 zu Depression
- 37 zu Angst
- 87 zu Schmerz
- 37 zu Schizophrenie
- 47 zu Autismus
- 11 zu Sucht
- 24 zu PTSD
- 13 zu Persönlichkeitsstörungen



Online-Suche: Clinicaltrials.gov am 26.01.2024 |

Oxytocin und Vertrauen



Kosfeld et al., *Nature,* 2005; Decklerck et al., *Nature Human Behavior,* 2020

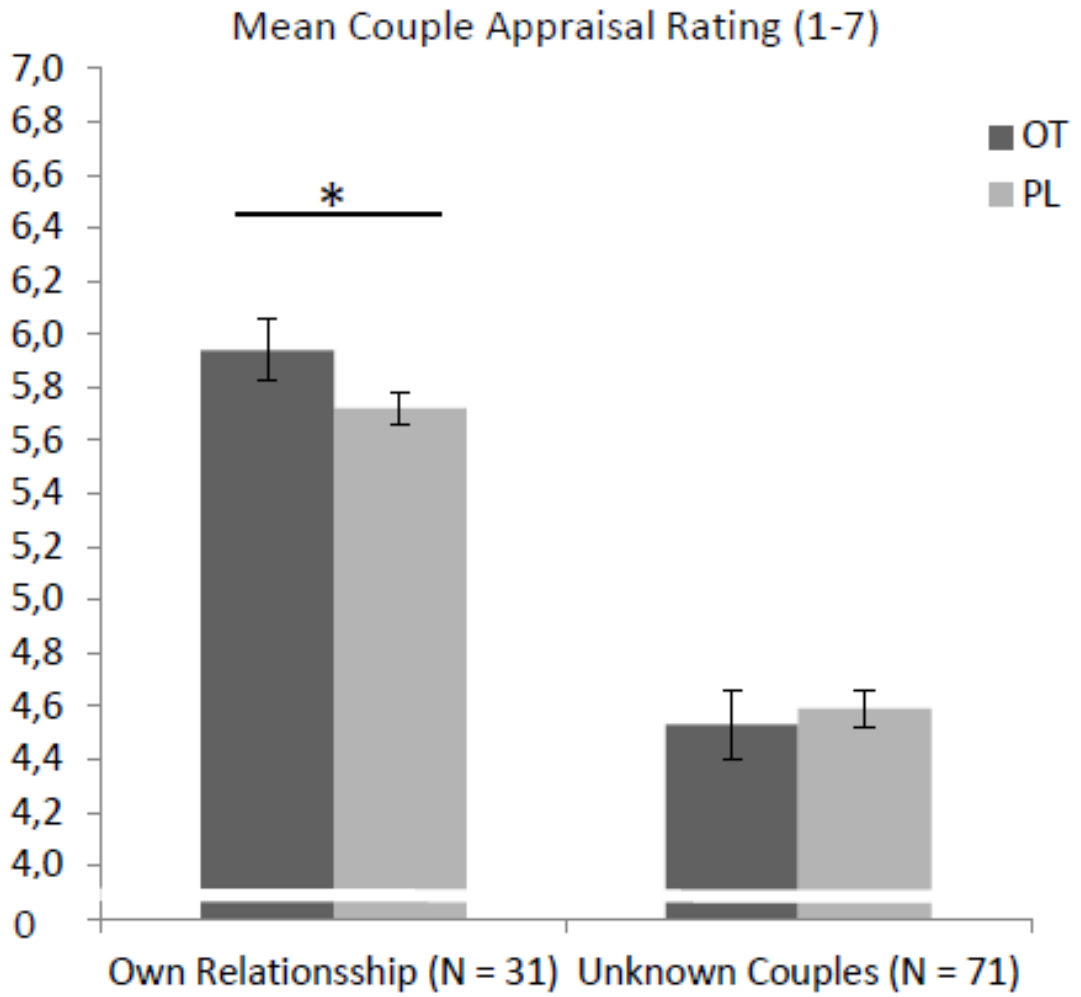
Oxytocin und Einschätzung von Beziehungen

repeated measures, 2 weeks apart

N = 77	40 men, 37 women, age: 21-50 years
Exclusion Criteria:	smoking, drugs, pregnancy, breast feeding, horm. contrac., med. o. psych. disorders;
Controlled for:	menstr. cycle phase, sports, eating, caffein und day time

Oxytocin und Einschätzung von Beziehungen


Corina Aguilar-Raab



Aguilar-Raab et al., *Frontiers Neurosci,* 2019

Oxytocin, Paarinteraktion und Wundheilung



Severin Läuchli Corinne Spörri Ekaterina Schneider





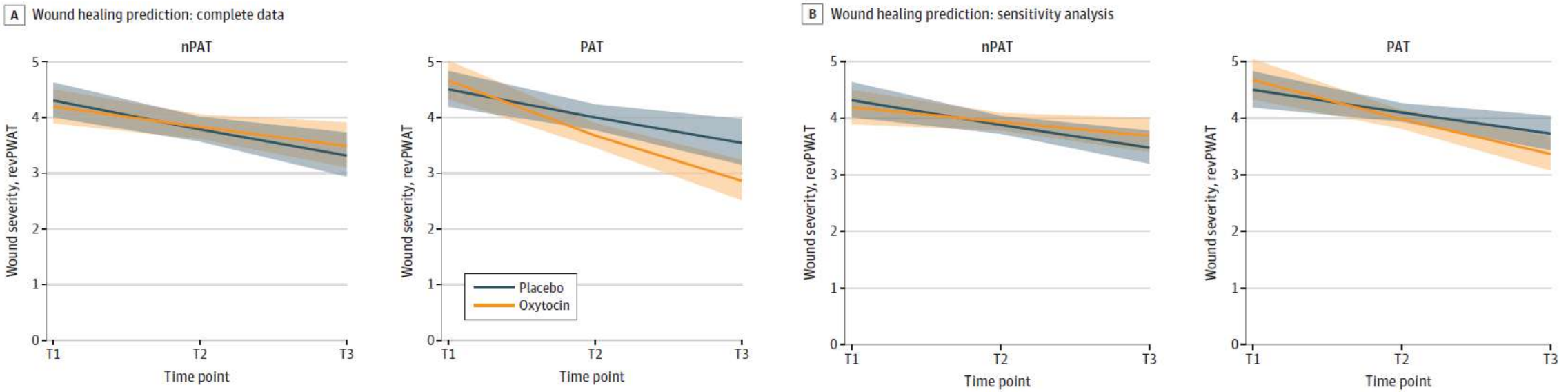
1 Woche

N = 160 (80 Paare) Alter: 21-50 Jahre
Einschlusskriterien: Heterosexuelle Partnerschaft seit mind. 1 Jahr
Ausschlusskriterien: Rauchen, chron. Erkrankung o. Medikamente, Schwangerschaft, Stillen
Kontrolliert für: Zyklusphase, Sport, Essen, Koffein, Tageszeit

Oxytocin, Paarinteraktion und Wundheilung

Severin Läuchli | Corinne Spörri | Ekaterina Schneider | Cristobal Hernandez

Instruierte positive Paarinteraktion (PAT) und Oxytocin interagierten in der Tendenz und verbesserten die Wundheilung

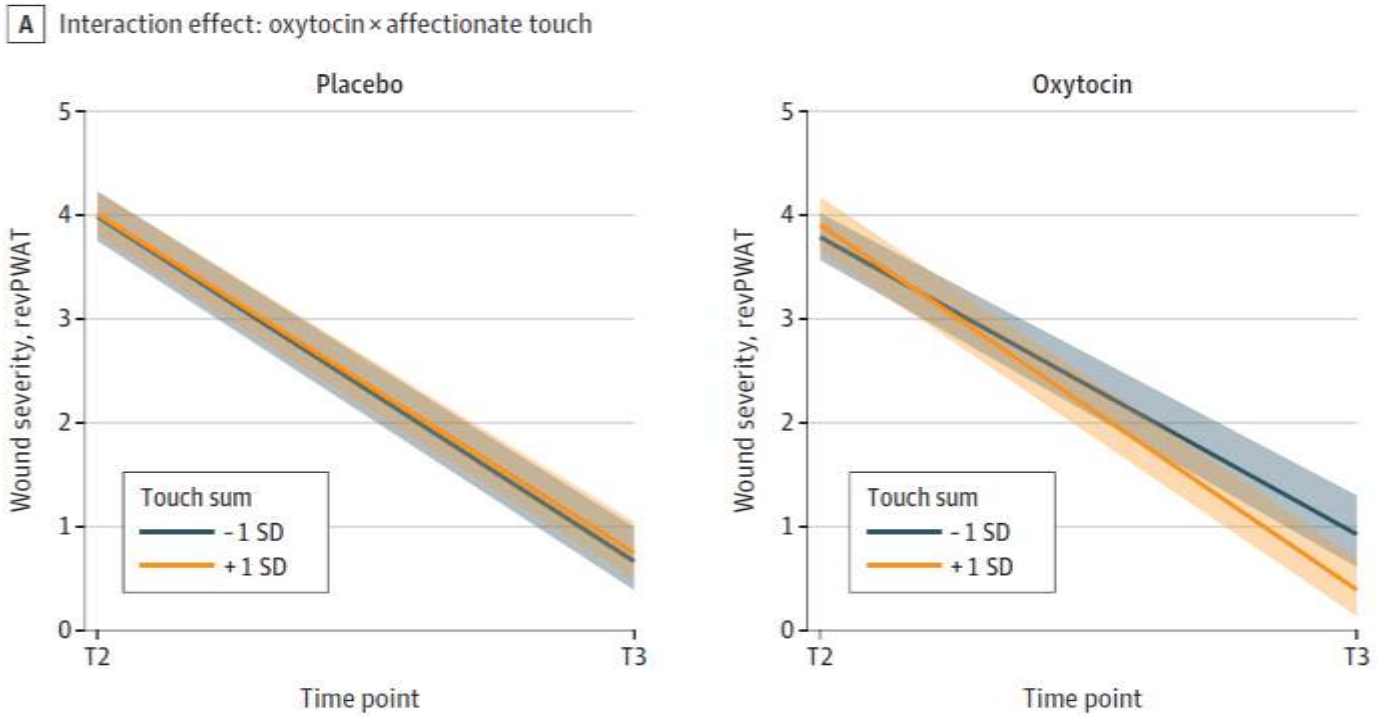


Schneider et al., *JAMA Psychiatry,* 2026

Oxytocin, Paarinteraktion und Wundheilung

Severin Läuchli Corinne Spörri Ekaterina Schneider Cristobal Hernandez

Berührung im Alltag und Oxytocin interagierten signifikant und verbesserten die Wundheilung

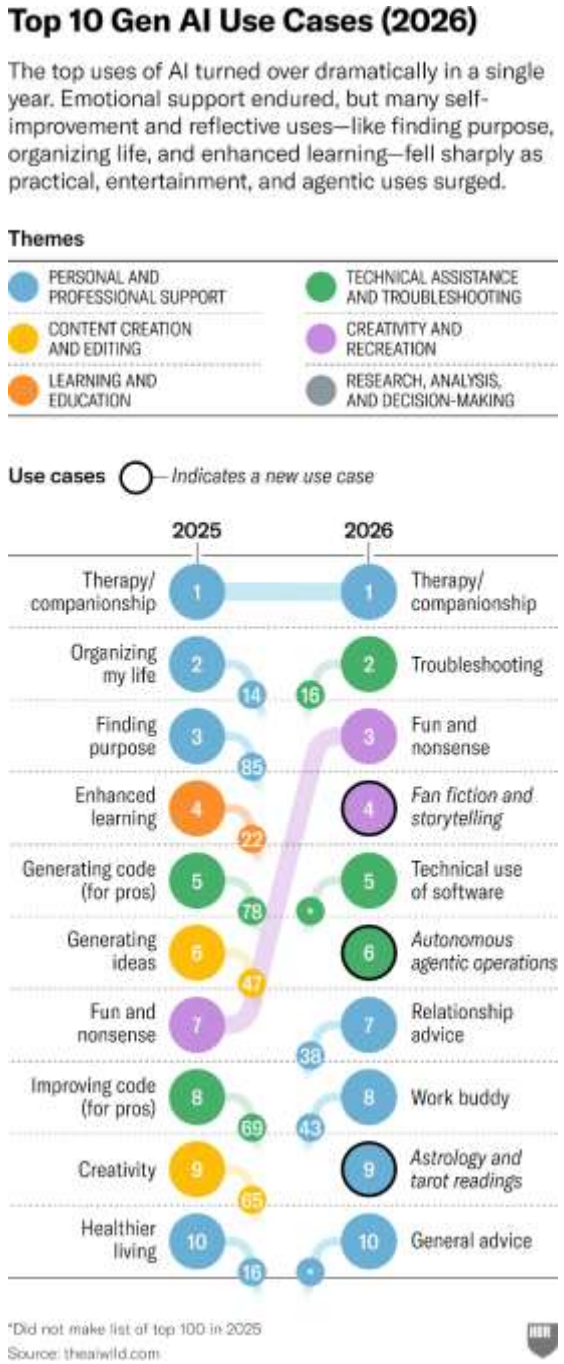


Schneider et al., *JAMA Psychiatry,* 2026

Offene Fragen und Implikationen: Beziehungen mit KI

Unterschiedliche Beziehungsformen mit KI (laut Umfrage berichten bereits 25% der Deutschen eine Form der emotionalen Beziehung mit KI)

Deutliche Verschiebung der KI-Nutzung hin zu Therapy/ Companionship



Koch (2025). *Hallo, wie fühlst Du Dich heute?* Zürich: Kein & Aber;
M. Zao-Sanders: https://theaiwild.com/; https://hbr.org/2026/06/how-people-are-really-using-ai-in-2026

Beziehung (mit KI) in der Medizin

Zunehmende Digitalisierung der Interaktionen in der Medizin mit

- Vorab-Information der Patient:innen
- Frei verfügbaren Diagnose-Tools
- KI-basierten Interventionen

image: Freepik.com

Stoumpos et al., *Int J Environ Res. Public Health,* 2023 |

Beziehung (mit KI) in der Medizin

1. Which digital formats do patients prefer depending on the context of the conversation?

2. What are the psychobiological responses of patients to varying levels of digitalisation and AI in real conversations?

1) Online Survey: Attitudes towards digitalisation and AI in medical consultations

Two of four scenarios with varying degrees of psychological involvement in symptoms, severity of the illness and shame presented:

Leukemia	→ benign vs. severe
Jaw pain	→ somatic vs. psychosomatic
Genetic diagnosis	→ stressful vs. relieving findings
Skin alterations	→ shameful vs. not shameful

N = 1009	Age: 18-78 years (*M*=38, *SD*=15), ♀ *n* = 543, ♂ *n* = 459, non-binary *n* = 9
Inclusion	of legal age
Exclusion	Refusal of participation or early termination
controlled by	Age

Mayer et al., *Computer in Human Behavior,* 2024

1) Online Survey


Julia Mahal


Carlotta Mayer


Johannes Ehrenthal


Daniela Geisel


Steffen Walter

Simulation of a **standardised medical consultations** with **varying degrees** of **digitalisation**


Face-to-face


Video Call with a physician


Correspondence via Chatbot


Video Call with an Avatar

Wizard of Oz-Design (simulated AI)

Effects of/on

- → Stress (subjective, HRV, EDA, cortisol and α-Amylase)
- → Memory performance
- → Physician-patient relationship
- → Technology affinity
- → Automated emotion recognition

Mayer et al., *Computer in Human Behavior,* 2024

2) Real-time Interaction

Face-to-face

- Spoken conversation
- Human as a physician
- In the same room

Video Call with a physician

- Spoken conversation
- Human as a physician
- Digital remote

Research team‘s view

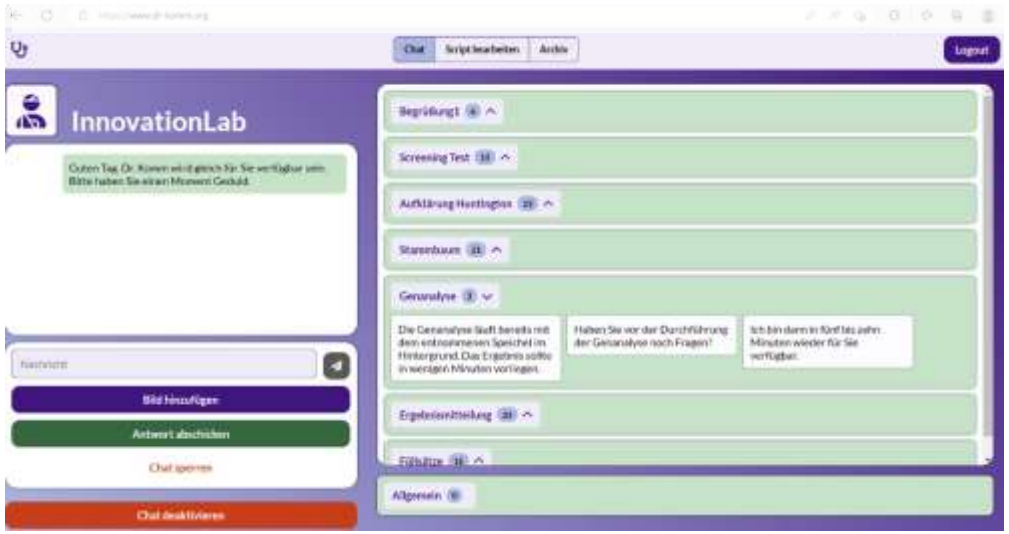
Patient‘s view

2) Real-time Interaction

Correspondence via Chatbot

- Text-based conversation
- AI as a physician
- All virtual

Research team‘s view



Patient‘s view

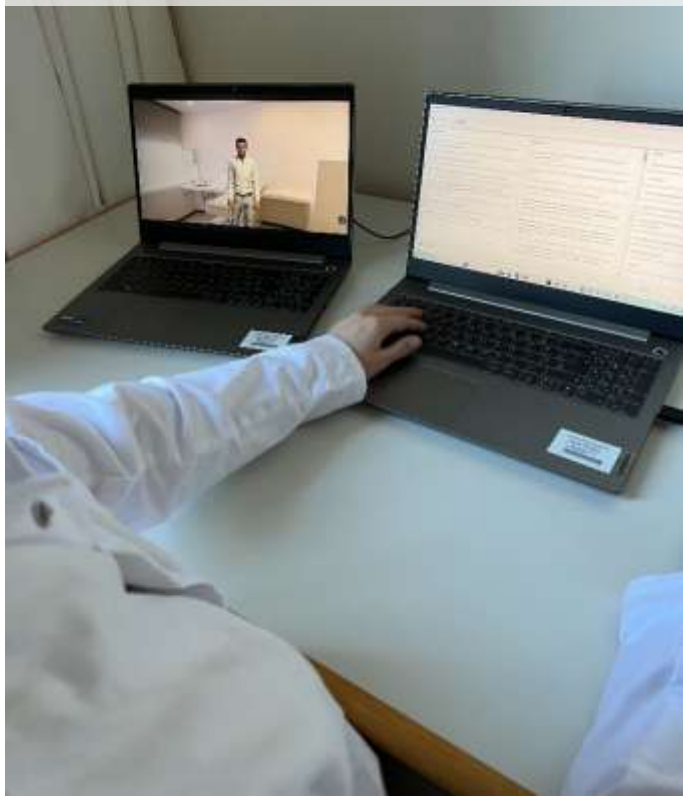
2) Real-time Interaction

Video Call with an Avatar

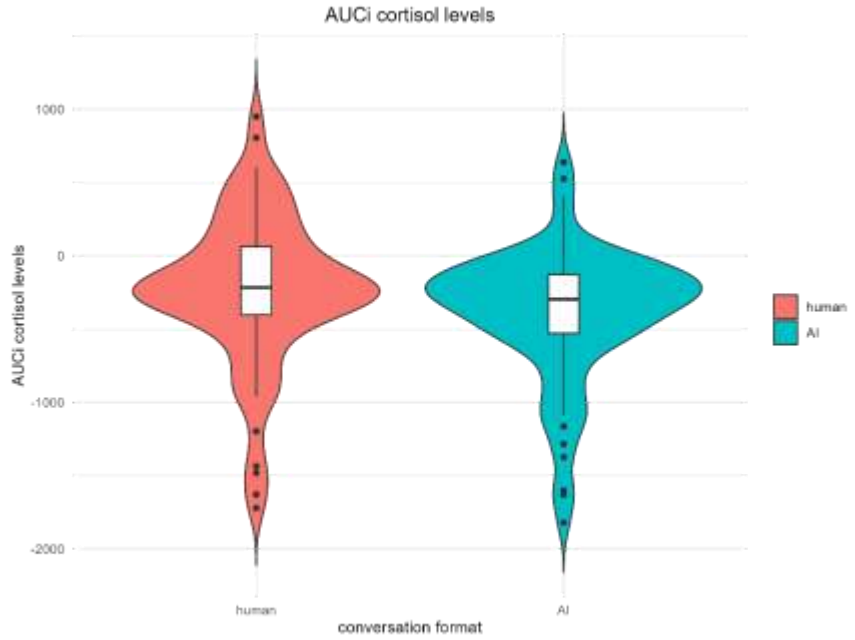
- Spoken conversation
- AI as a physician
- All virtual

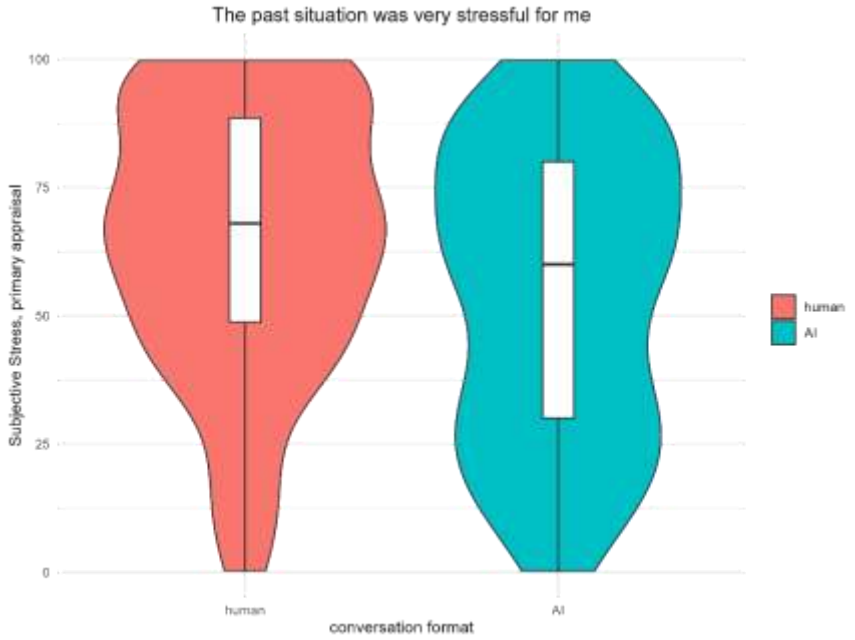
Patient‘s view

Research team‘s view



2) Real-time Interaction

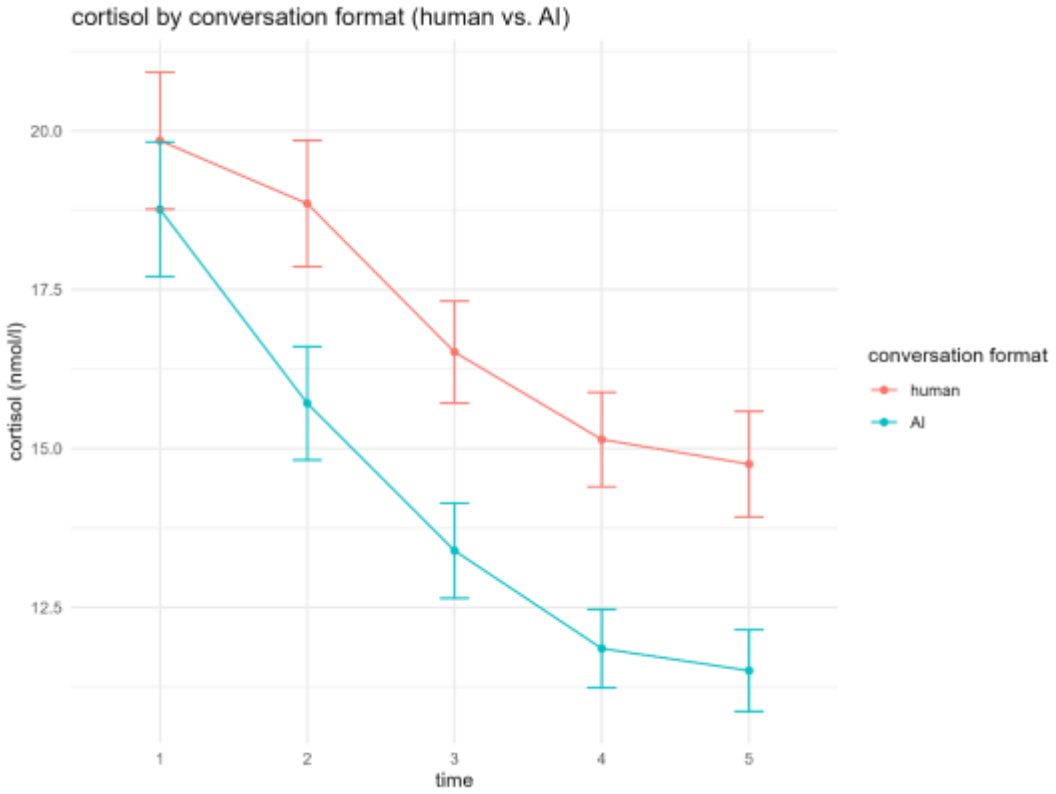




t(152.11) = 1.99, p >.05	human: *M* = -233.37, *SD* = 513.31 AI: *M* = -387.50, *SD* = 452.60	*t*(158.16) = 2.62, *p* >.01	human: *M* = 65.02, *SD* = 26.21 AI: *M* = 53.84, *SD* = 28.19

N = 149
Inclusion Age: 18-66 years (*M*=26, *SD*=9), ♀ *n* = 115, ♂ *n* = 34 of legal age and very good German language skills
Exclusion Smoking, drugs, pregnancy or breastfeeding, diseases, medication
Controlled for physical fitness, nutrition, caffeine intake

2) Real-time Interaction



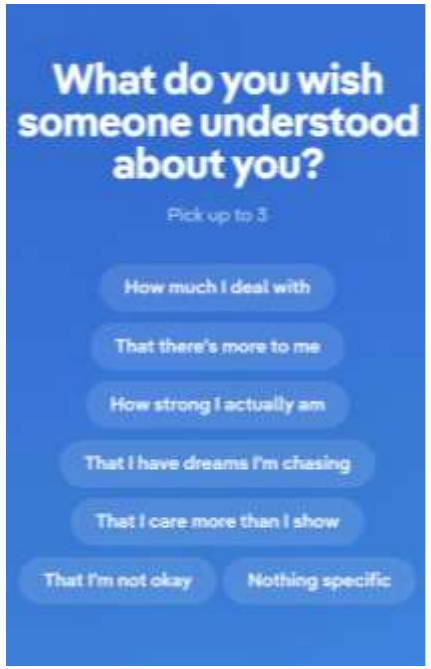
Time * conversation format:
$F(4, 628) = 2.53$, $p < .05$

Corrected with Greenhouse-Geisser:
$F(1.85, 290.03) = 2.53$, $p = .09$

N = 149	Age: 18-66 years (*M*=26, *SD*=9), ♀ *n* = 115, ♂ *n* = 34
Inclusion	of legal age and very good German language skills
Exclusion	Smoking, drugs, pregnancy or breastfeeding, diseases, medication
Controlled for	physical fitness, nutrition, caffeine intake

AI Companions und Love Bots

Freund:innen kreieren



https://create.replika.com/ |

Beziehungen mit KI

Charakteristika:

- KI spiegelt uns
- Bestätigend bis überbestätigend
- Immer verfügbar, wenn im Netz
- Benötigt (sehr viel) Energie
- Kostet Geld
- Schafft möglicherweise Abhängigkeit
- Bietet keine individuelle Beziehung

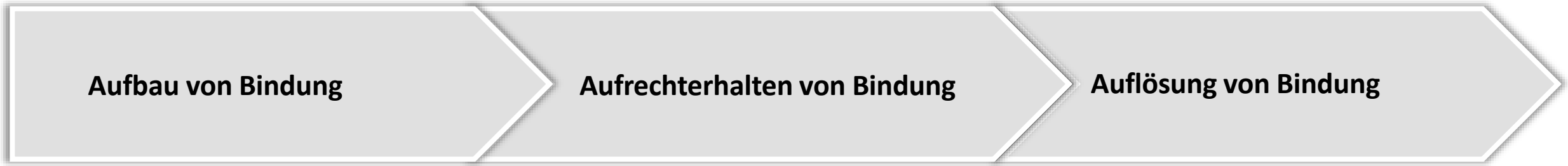
Film „Her“, 2013

Koch (2025). *Hallo, wie fühlst Du Dich heute?* Zürich: Kein & Aber

Vertrauen in Beziehungen mit KI

1) Individuelle Vorsicht bei Beziehungen mit KI notwendig:

   - Wie vertrauenswürdig ist die Information, die ich bekomme?
   - Was passiert mit meinen Daten?
   - Reale Beziehungen nicht vernachlässigen
   - Abhängigkeitspotential im Auge behalten
   - Wie mit Beziehungsabbrüchen und Liebeskummer umgehen?
   - Für Behandler:innen: KI-Beziehungen erfragen
   - Für Behandler:innen: Psychische Erkrankungen im Zusammenhang mit KI-Beziehungen berücksichtigen



Vertrauen in Beziehungen mit KI

1) Individuelle Vorsicht bei Beziehungen mit KI notwendig
2) Gesellschaftliche Vorsicht notwendig
    - Wie vertrauenswürdig ist die Information, die vermittelt wird?
    - Was passiert mit den Daten?
    - Altersgrenzen
    - Interaktionsdauer begrenzen
    - Standards zu Persönlichkeit, Interaktionsstil und ethischen Grundsätzen
    - „red flags“ in der Kommunikation mit links zu realen Kontaktstellen einbauen

Beziehungen mit KI

Ich-Gebrauch impliziert ein individuelles Gegenüber mit einer eigenen Identität.

Menschenähnlichkeit (anthropomorphism) ist mit größerem Vertrauen in einen Chatbot assoziiert.

If one company is selling a plain benign robot, competing with another company that sells a robot that tells jokes and smiles, that second company is going to win, said Lionel Robert, a professor of information and robotics at the University of Michigan. “Dependence is problematic,” Robert said. “On the other hand, it’s good for business.”

Oh et al., *Int J Human Comput Interact,* 2026; K. Hill, Why Do A.I. Chatbots Use ‘I’?, *The New York Times,* Dec. 19 2025; https://realtime.ai/

Danke

… an alle Teilnehmenden

… an alle Kooperationspartner:innen

… die Förderinstitutionen

… an die Teams in Heidelberg und Zürich

Danke für die Aufmerksamkeit

Danke für die Aufmerksamkeit und ich freue mich auf die Diskussion!