

KOGNARA LLC

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The Science & Research Behind KOGNARA

Every mission. Every stage. Grounded in peer-reviewed research.

KOGNARA LLC · Neural Mission Series · 2026

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Introduction

KOGNARA's Neural Mission Series is built on decades of peer-reviewed research in developmental neuroscience, cognitive psychology, and early childhood education. The six developmental stages and the activities within each were selected based on the following foundational research — the same science used by pediatricians, developmental psychologists, and early childhood educators worldwide. This document is organized in two parts: (1) the research that defines the six stages of brain development, and (2) the research that supports the specific activities used within each stage.

PART 1: RESEARCH BEHIND THE 6 STAGES

The six stages in KOGNARA's Neural Mission Series map directly onto the brain's biological development windows — not arbitrary age groupings. The following research established these windows.

1. Piaget's Stages of Cognitive Development

Authors: Jean Piaget

Source: StatPearls / National Institutes of Health (NIH)

Year: Originally 1952; NIH review 2023

URL: <https://www.ncbi.nlm.nih.gov/books/NBK448206/>

Identified four sequential developmental periods, including the sensorimotor stage (birth–24 months) and preoperational stage (2–7 years). KOGNARA's first four stages align directly with Piaget's substage framework.

2. Brain Myelination Trajectories in Early Childhood (Cortical Maturation Study)

Authors: Sean C.L. Deoni et al.

Source: NeuroImage / PubMed Central

Year: 2015

URL: <https://pmc.ncbi.nlm.nih.gov/articles/PMC4463864/>

Mapped myelination progression from ages 1–6 in 215 children. Motor/visual cortices myelinate by age 1; prefrontal cortex myelinates last. This biological timeline directly informs when specific activities become developmentally appropriate.

3. Early Nutrition, Myelination, and Cognitive Development

Authors: Sean C.L. Deoni et al.

Source: NeuroImage (ScienceDirect)

Year: 2018

URL: <https://www.sciencedirect.com/science/article/abs/pii/S1053811917310807>

Longitudinal study of 150 children (3 months–9 years) showing rapid myelination between 500–750 days of age. Confirms Stage 3–4 (6–24 months) as a critical window for brain connectivity.

4. Executive Function Development in the First 5 Years

Authors: Zelazo, P.D. et al.; Diamond, A.

Source: Early Childhood Research Quarterly / Cambridge Core

Year: 2022

URL: <https://pmc.ncbi.nlm.nih.gov/articles/PMC9390057/>

Inhibitory control and working memory emerge in the first year of life. Cognitive flexibility develops between ages 3–4, grounding KOGNARA's Stage 5 and 6 activities in the neuroscience of prefrontal cortex maturation.

5. Social Brain Development and Myelination

Authors: Deoni et al. (RESONANCE Consortium)

Source: PubMed

Year: 2022

URL: <https://pubmed.ncbi.nlm.nih.gov/34463347/>

MRI study of 129 children (0–36 months) showing steep myelination in social brain regions during the first 3 years, directly associated with social-emotional development scores. Validates the social wiring focus in Stage 3.

6. The Scientist in the Crib: What Early Learning Tells Us About the Mind

Authors: Alison Gopnik, Andrew Meltzoff, Patricia Kuhl

Source: Harper Collins / Internet Archive

Year: 1999

URL: <https://archive.org/details/scientistincribw00gopn>

Synthesizes research showing infants are active, hypothesis-forming learners from birth — not passive recipients. Foundational theoretical basis for KOGNARA's mission-based approach across all stages.

7. Transforming How We Think About Stress in Early Childhood

Authors: National Scientific Council on the Developing Child

Source: Harvard Center on the Developing Child

Year: 2026 (updated)

URL: <https://developingchild.harvard.edu/resources/working-paper/how-we-think-about-response-to-stress-early-childhood/>

Shows that stable, predictable caregiver interaction builds resilient stress-response systems. Underpins KOGNARA's emphasis on calm, parent-directed activities across all stages.

8. CDC Developmental Milestones (Learn the Signs. Act Early.)

Authors: Centers for Disease Control and Prevention

Source: CDC.gov

Year: 2022 (updated 2026)

URL: <https://www.cdc.gov/act-early/milestones/index.html>

Provides the standardized developmental milestone framework used by the American Academy of Pediatrics. KOGNARA activities are benchmarked against these clinically validated milestones.

PART 2: RESEARCH BEHIND THE ACTIVITIES

Each Neural Mission card is grounded in specific experimental and longitudinal research showing that certain caregiver interactions produce measurable cognitive outcomes. The research below is organized by developmental theme.

VISUAL TRACKING & FACE RECOGNITION (STAGES 1-2)

9. Visual Preferences in Newborns (The Looking Chamber)

Authors: Robert L. Fantz

Source: Science / NSUWorks

Year: 1961

URL: https://nsuworks.nova.edu/cps_facbooks/733/

Infants as young as 1 week prefer to look at faces over other stimuli and complex patterns over plain shapes. This landmark study validates KOGNARA's face-tracking activities in Stage 1 as the first form of visual cortex development.

10. Face Specialization in the First Months of Life

Authors: Johnson & Morton

Source: ScienceDirect

Year: 1991 / reviewed 2007

URL: <https://www.sciencedirect.com/science/article/abs/pii/S0079612307640096>

Proposes two systems for early face recognition — a subcortical system active at birth drawing infants toward moving faces, and a cortical system that develops by 3 months. Supports the sequencing from passive face-gazing in Stage 1 to active tracking in Stage 2.

EMOTIONAL ATTUNEMENT & SERVE-AND-RETURN (STAGES 2-3)

11. The Still Face Paradigm

Authors: Edward Tronick et al.

Source: Infant Behavior & Development / PubMed Central

Year: 1978 (original); 2020 (meta-analysis)

URL: <https://pmc.ncbi.nlm.nih.gov/articles/PMC7798358/>

When caregivers become emotionally unresponsive, 6-month-old infants immediately show reduced positive affect and elevated stress markers. Demonstrates that caregiver emotional engagement is not optional — it is neurologically necessary.

12. Serve-and-Return Interactions and Language Development

Authors: Tamis-LeMonda et al.; multiple authors

Source: Infant Behavior & Development / PMC

Year: 2024

URL: <https://pmc.ncbi.nlm.nih.gov/articles/PMC10873112/>

Prompt, meaningful caregiver responses to infant vocalizations at 9 months predicted significantly higher expressive language at 18 months. Validates the interaction scripts used in KOGNARA's Stage 2–3 activities.

OBJECT PERMANENCE & WORKING MEMORY (STAGES 3–4)

13. Object Permanence in Infancy

Authors: Renée Baillargeon

Source: Multiple peer-reviewed publications (cognitive science)

Year: 1987–2004

Showed that infants as young as 3.5 months have implicit object permanence — far earlier than Piaget proposed — and that active search games (like Peek-a-Boo and hidden object tasks) train the hippocampal and prefrontal circuits for memory and reasoning.

14. Executive Function: Inhibitory Control and Working Memory

Authors: Adele Diamond

Source: Annual Review of Psychology

Year: 2013 (foundational); 2022 (updated)

URL: <https://pmc.ncbi.nlm.nih.gov/articles/PMC9390057/>

Working memory is trainable through repeated, incrementally harder challenges. Diamond's research shows that play-based working memory tasks (like cup-hiding games) in toddlerhood predict academic success years later.

CAUSE & EFFECT / PROPRIOCEPTION (STAGE 2)

15. Infant Motor Learning and Cause-and-Effect Discovery

Authors: Carolyn Rovee-Collier

Source: Developmental Psychology (multiple publications)

Year: 1980–1999

The mobile conjugate reinforcement paradigm showed infants as young as 2 months can learn that their kicking causes movement, retaining this memory for days. KOGNARA's "Kick the Mobile" activity is a direct application of this research.

SYMBOLIC PLAY & REPRESENTATIONAL THOUGHT (STAGES 4-5)

16. Pretend Play, Language, and Cognitive Development

Authors: Sandra Berk, Vygotsky (theoretical basis)

Source: Child Development / multiple reviews

Year: 1994–2005

Symbolic and pretend play is the primary vehicle through which 12–24 month toddlers develop representational thought — the ability to let one object stand for another. KOGNARA's Stage 4–5 activities use naming, sorting, and play routines to activate this system.

EXECUTIVE FUNCTION & SELF-REGULATION (STAGES 5-6)

17. Executive Function in Preschoolers

Authors: Garon, N., Bryson, S.E., & Smith, I.M.

Source: Psychological Bulletin / Scribd / PubMed

Year: 2008

URL: <https://www.scribd.com/document/490202106/Garon2008PsychBullEFinprechoolers>

Comprehensive review showing the first 5 years are the critical window for executive function development, with the frontal cortex operative as early as year 1. Supports KOGNARA's escalating self-regulation activities in Stages 5–6.

18. Play-Based Executive Function Interventions in Preschoolers

Authors: Coelho et al.

Source: Frontiers in Psychology

Year: 2022

URL: <https://pmc.ncbi.nlm.nih.gov/articles/PMC8754087/>

Children in structured play programs showed significant improvement in working memory, inhibitory control, communication, and problem-solving. Validates KOGNARA's play-format delivery across Stages 5 and 6.

PHONOLOGICAL AWARENESS & READING READINESS (STAGE 6)

19. Phonological Awareness as a Predictor of Reading

Authors: Wagner, R.K., Torgesen, J.K., & Rashotte, C.A.

Source: Language, Speech, and Hearing Services in Schools / PMC

Year: 1994 / reviewed 2010

URL: <https://pmc.ncbi.nlm.nih.gov/articles/PMC2848754/>

Phoneme awareness is the single strongest predictor of reading success in young children. Stage 6 sound-swapping and rhyming activities are directly designed to build this skill before formal reading instruction begins.

20. Phonemic Awareness Training Improves Reading

Authors: Blachman, B.A.

Source: Journal of Learning Disabilities / Sage Journals

Year: 1994

URL: <https://journals.sagepub.com/doi/10.1177/002221949402700504>

Training phonological awareness in kindergarteners produces measurable improvements in reading and spelling. Confirms that KOGNARA's Stage 6 phonics activities are not just preparation—they are intervention.

OUR COMMITMENT

KOGNARA is committed to ensuring every Neural Mission is grounded in peer-reviewed developmental science — not trends, not apps, not screens. We update our research foundation regularly and welcome questions from pediatricians, developmental specialists, and educators. For inquiries, visit kognara.com.