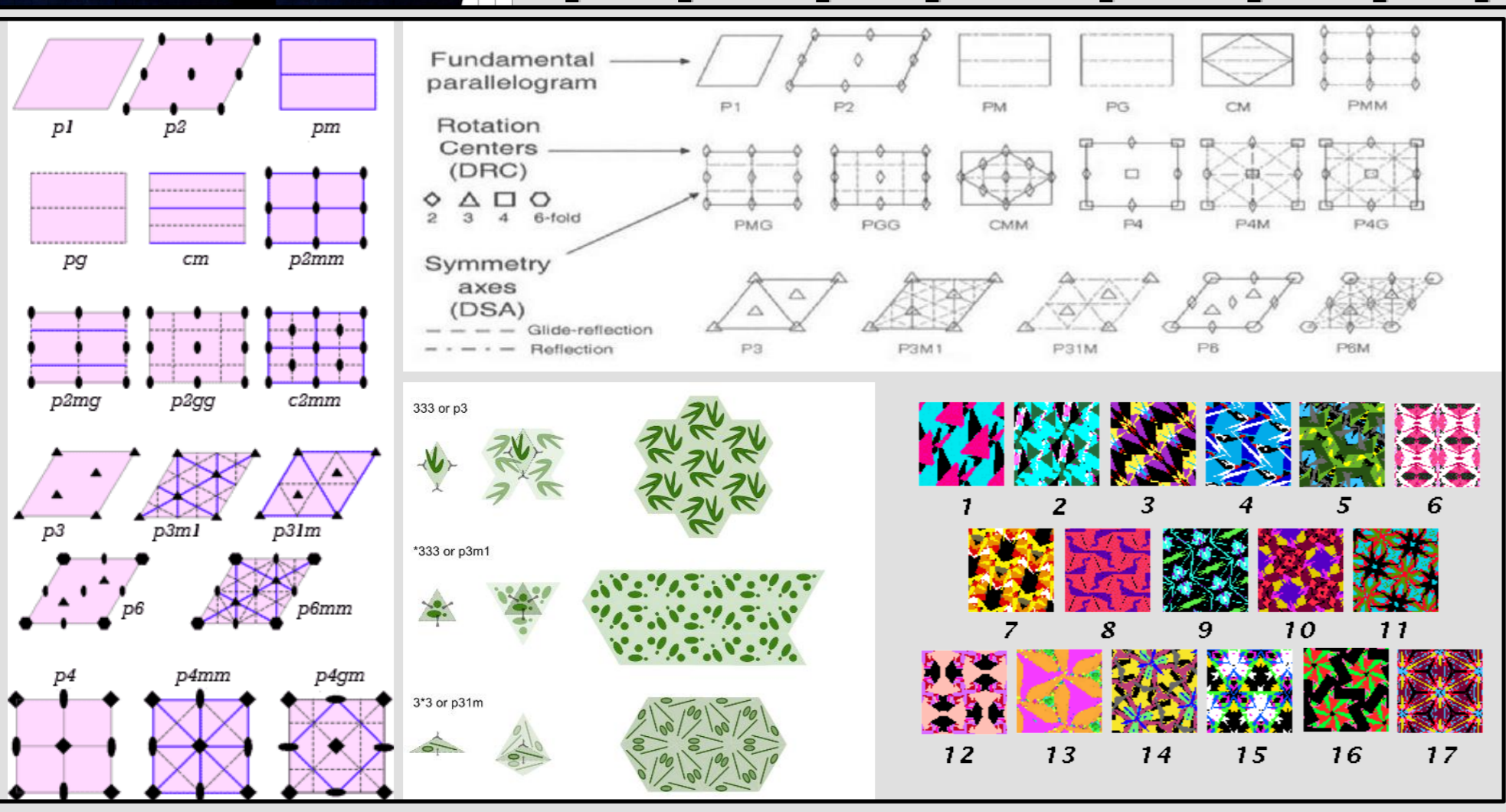


**AFFINE TRANSFORMATIONS MATRICES ≈ "TENSORS" LIE-GROUPS**

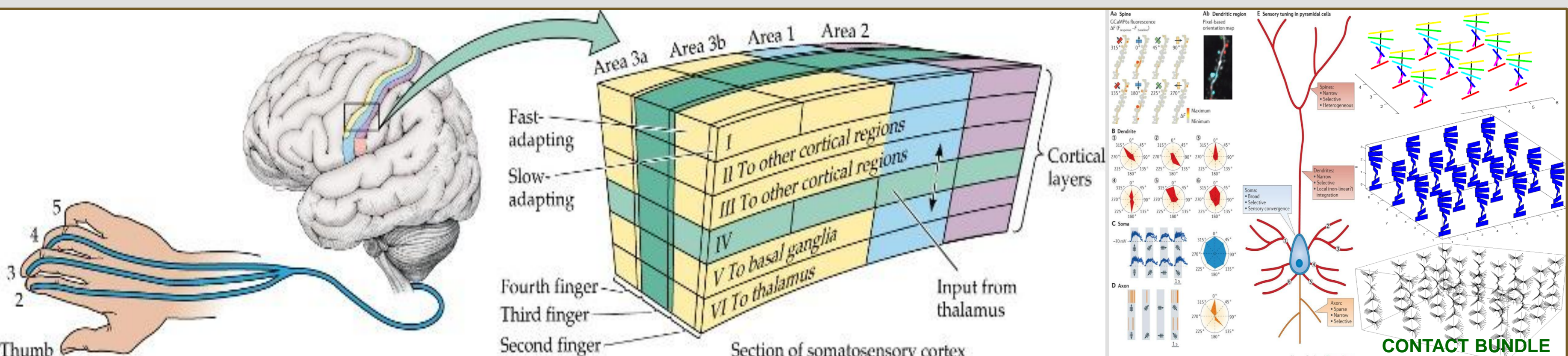
$$\begin{bmatrix} w_1 \\ w_2 \\ \dots \\ w_n \end{bmatrix} = \begin{bmatrix} A_{11} & A_{12} & \dots & A_{1n} \\ A_{21} & A_{22} & \dots & A_{2n} \\ \dots & \dots & \dots & \dots \\ A_{n1} & A_{n2} & \dots & A_{nn} \end{bmatrix} \begin{bmatrix} v_1 \\ v_2 \\ \dots \\ v_n \end{bmatrix}$$

VECTOR = [MATRIX = TENSOR] x VECTOR



A LIE-GROUP = MATHEMATICAL GROUP WHICH IS ALSO A DIFFERENTIABLE TOPOLOGICAL MANIFOLD. A MANIFOLD IS A TOPOLOGICAL SPACE THAT IS LOCALLY A VECTOR FIELD. A GROUP IS A SET OF ELEMENTS (MATRICES), WITH AN OPERATION (MULTIPLICATION) SATISFYING THE GROUP AXIOMS. A TENSOR IS A LINEAR MAP (DESCRIPTION OF CHANGES IN SHAPE) AND CAN BE PUT IN MATRIX FORM (VECTOR QUOTIENT NOT DEFINED). EXAMPLE IN 2 DIMENSIONS (PLANE): WALLPAPER GROUP: TILING

**MICROCOLUMNAR ORGANIZATION OF CORTEX = "TOPOLOGICAL POINT"**



AT EACH POINT OF THE CORTICAL TOPOLOGICAL MAP, DATA ARE GENERATED BY THE MICROCOLUMN → TANGENT VECTORS & TANGENT BUNDLE.

A CONTACT BUNDLE STRUCTURE WITH HORIZONTAL LIFTS HAS BEEN DESCRIBED (8-11) MICROCOLUMNAR ORGANIZATION IS PRESENT IN ENTIRE CEREBRAL CORTEX THE CORTEX HAS BEEN DESCRIBED AS A NONCOMMUTATIVE LIE-GROUP, EQUIPPED WITH A SUB-RIEMANNIAN METRIC (6, 7) TOPOLOGICAL MAPPING DESCRIBED FOR: SOMATOSENSORY INPUT ACCOUSTIC INPUT VESTIBULAR INPUT PROPRIORECEPTIVE INPUT (4) METRICITY (TIME & SPACE) OF ENVIRONMENT (ENTORRHINAL CORTEX) (5) VISUAL INPUT

**TONONI & BALDUZZI: INFORMATION INTEGRATION THEORY OF CONSCIOUSNESS:** COMPARISON OF "REPERTOIRES" IS THE BASIS OF CONSCIOUSNESS (1, 2). BY DEFINITION "REPERTOIRES" IS AVAILABLE DATA AND THUS A PART OF MEMORY. COMPARISON OF "REPERTOIRES" = MORPHISMS BETWEEN FIBERS IN THE BUNDLE OVER THE MANIFOLD = PERMUTATIONS, PERMUTATIONS = ENDOMORPHISMS IN LIE GROUP THEORY. MINIMISATION OF THE ACTION ALONG A TEMPORAL TRAJECTORY FOR INTEGRATION = MEMORY ACTION (A TIME-INVARIANT). NEURAL NETWORK THEORY: GRADIENT DESCENT MINIMIZATION OR SHANNON-ENTROPY IN NETWORK LEARNING (12).

**FIORI: MANIFOLD RETRACTION MODELS LIE-GROUP-TYPE NEURAL SYSTEM LEARNING:** THE ADJOINT REPRESENTATION: LIE-GROUP → LIE-ALGEBRA → ENDOMORPHISM GROUP. LIE-ALGEBRA = INFINITESIMAL GROUP ACTION (3).

**MEMORY:** INTEGRATION ALONG A PATH (TIME) IN BUNDLE STRUCTURE OVER A SYMPLECTIC TOPOLOGICAL MANIFOLD. AT TIME = 0, LIE-GROUP AND LIE-ALGEBRA ARE IDENTIFIED → MEMORY INITIATED BUT NOT YET FORMED. CONSCIOUSNESS IS THE FIRST, INFINITESIMALLY SHORT, STEP IN THIS PROCESS = LIE-ALGEBRA

**CONCLUSION: CONSCIOUSNESS IS THE INFINITESIMAL, INITIATING STEP OF MEMORY GENERATION BY THE CEREBRAL CORTEX, SEEN AS A MATHEMATICAL BUNDLE STRUCTURE ON A SYMPLECTIC TOPOLOGICAL MANIFOLD.**

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