



# MODALITES DE PARTICIPATION POUR LES PARTENAIRES SOLLICITANT UNE AIDE DE L'ANR

## IMPORTANT :

1. Le présent document énonce les modalités de participation des partenaires sollicitant une aide de l'ANR dans le cadre de l'appel à projets **ANR - JST CREST** - édition 2023.
2. Les modalités de participation et recommandations importantes présentées dans ce document s'ajoutent aux dispositions figurant dans le texte de l'appel de l'édition 2023 du programme CREST (publication prévue le 11/04/2023, pour le descriptif thématique voir en annexe de ce document)
3. Il est nécessaire de lire attentivement le texte de l'appel à projets, l'ensemble du présent document ainsi que le règlement relatif aux modalités d'attribution des aides de l'ANR et valant conditions générales de ces aides (<https://anr.fr/RF>) avant de déposer une proposition de projet de recherche.

Date de clôture  
05/06/2023, 10 h 00 (CET)

## Points de contact à l'ANR

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## 1. CONTEXTE ET OBJECTIFS DE LA COLLABORATION

A travers les accords qu'elle met en place avec des organismes de financement étranger, l'ANR permet aux chercheurs français d'initier ou d'approfondir leurs collaborations et leur réseau de recherche international.

L'objectif est de financer des projets de recherche internationaux d'excellence, se démarquant clairement des projets nationaux en cours et démontrant une forte synergie entre les équipes de chaque pays, ainsi qu'une réelle intégration des travaux communs.

En soutenant la participation des équipes françaises<sup>1</sup> à ces projets, l'ANR entend ainsi contribuer à l'émergence d'équipes d'excellence européennes et internationales.

Le programme japonais CREST (Core Research for Evolutionary Science and Technology) a été créé afin de soutenir des objectifs de recherche prioritaires en prévision de besoins économiques et sociétaux futurs. Ce programme d'excellence est mis en œuvre par la JST (Japan Science and Technology Agency), l'agence Japonaise pour la Science et la Technologie. L'ANR a signé avec son homologue JST un accord relatif au programme CREST afin de s'associer dans cette démarche. Pour l'édition 2023, les équipes françaises sont invitées à déposer des projets de recherche en collaboration avec une ou des équipes japonaises dans trois thèmes de recherche :

- *[Exploring Unknown Materials] Exploring Innovative Materials in Unknown Search Space*
- *[Society 5.0 System Software] Creation of System Software for Society 5.0 by Integrating Fundamental Theories and System Platform Technologies*
- *[MultiSensing] Research on Multi-sensing Biosystems and Development of Adaptive Technologies*

Le descriptif des trois thèmes de recherche figure en annexe de ce document<sup>2</sup>. En ce qui concerne le thème MultiSensing **des considérations philosophiques devront compléter les approches empiriques.**

## 2. MODALITES DE DEPOT

Dans le cadre de cet appel, les projets seront déposés en une seule étape.

La même proposition détaillée de projet franco-japonais, rédigée en langue anglaise, est déposée successivement auprès de l'ANR par le coordinateur français ou par la coordinatrice française et auprès de la JST par le coordinateur japonais ou la coordinatrice japonaise, en respectant le format et les modalités demandés, disponibles sur le site :

<https://anr.fr/CREST-2023> .

La date limite de dépôt des propositions de projet est fixée au :

**ANR** : avant le **05 juin 2023** à 10h00 (CEST)

**JST** : avant le **06 juin 2023**. Des modifications sont possibles, veuillez consulter le site de la JST au moment de la publication du texte de l'appel à projets, le 11/04/2023.

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<sup>1</sup> Cf Règlement Financier, art. 2.2.

<sup>2</sup> Les déposants et les déposantes sont priés de vérifier des mises à jour des textes faites par la JST, le cas échéant

**Le titre, le partenariat, le programme de travail et le partage des tâches communiqués aux deux agences doivent être identiques.**

Les sites de dépôts ANR en fonction de la thématique sont :

- [Exploring Unknown Materials](#)
- [Society 5.0 System Software](#)
- [MultiSensing](#)

Le coordinateur français ou la coordinatrice française doit :

- déposer sur la plateforme le document scientifique du projet<sup>3</sup>
- renseigner les informations administratives et financières demandées.

### **3. ELIGIBILITE**

**Pour être éligibles, les propositions doivent respecter les critères décrits ci-après, qui sont cumulatifs.**

#### **3.1 CRITERES D'ELIGIBILITE COMMUNS :**

##### **- Thèmes de collaboration scientifique**

Une proposition de projet doit relever de l'un des trois thèmes de recherche tels que décrits dans le texte de l'édition 2023 du programme CREST, en l'occurrence :

- *Exploring Unknown Materials*
- *Society 5.0 System Software*
- *MultiSensing*

Pour plus d'information sur les thématiques, voir l'annexe de ce document et la version publiée sur le site de la JST.

##### **- Dépôt de propositions de projet**

Le document scientifique de la proposition doit être déposé sur les sites de dépôts respectifs avant la date et l'heure de clôture. Aucun document n'est admis après cette date. A l'ANR avant le **5 juin 2023**, 10h00 CEST, ainsi que sur le site JST-CREST (avant le **6 juin 2023**).

##### **- Composition du consortium**

Le consortium du projet doit impliquer au moins un partenaire éligible au financement de l'ANR (cf. 3.2 *Partenaire(s) bénéficiaire(s) de l'aide*) et au moins un partenaire japonais éligible au financement de la JST. Deux coordinateurs ou coordinatrices scientifiques doivent être clairement identifiés, l'un /l'une pour les équipes françaises, l'autre (réfèrent pays) pour les équipes japonaises.

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<sup>3</sup> Un site de dépôt par thématique

### 3.2 CRITERES D'ELIGIBILITE PROPRES A L'ANR :

#### - Modalités d'attribution des aides de l'ANR

Pour les partenaires sollicitant une aide de l'ANR, les critères et modalités d'attribution sont définis dans le Règlement financier de l'ANR, disponible à l'adresse <https://anr.fr/RF>. Il convient de lire ce règlement avec la plus grande attention.

*Partenaire(s) bénéficiaire(s) de l'aide* : l'appel est ouvert aux partenaires acteurs de la recherche (de droit public, de droit privé, société commerciale...). Le consortium français doit comprendre au moins un partenaire acteur public impliqué dans la recherche française<sup>4</sup>.

#### - Caractère complet

Pour être complète, outre les éléments communs exigés en 3.1, une proposition dont un ou des partenaires sollicitent une aide de l'ANR doit inclure les éléments suivants :

- le document scientifique ;
- les informations administratives et financières

#### - Caractère unique

Une proposition de projet ne peut être semblable en tout ou partie à une autre proposition déposée à un appel en cours d'évaluation à l'ANR (tout appel à projets confondu, toutes étapes d'évaluation confondues) ou ayant donné lieu à un financement par l'ANR. Le caractère semblable entre deux Projets est établi lorsque ces Projets (dans leur globalité ou en partie) décrivent des objectifs principaux identiques ou résultent d'une simple adaptation<sup>5</sup>. Toutes les propositions semblables sont inéligibles.

#### - Durée du projet

La durée des projets est de 5 ans. Sans prolongation possible.

### 3.3 CRITERES D'ELIGIBILITE PROPRES A LA JST :

Il est nécessaire de consulter le site de la JST dès la publication de l'appel à projets le 11/04/2023.

Un projet ne sera financé par l'ANR que s'il répond aux règles d'éligibilité de la JST et de l'ANR ainsi qu'aux modalités du règlement financier de l'ANR.

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<sup>4</sup> Comprend les entités de droit public de recherche et /ou de diffusion des connaissances et les entités de droit privé de recherche et/ou de diffusion de connaissances, ayant un établissement ou une succursale en France et n'étant pas une société commerciale.

<sup>5</sup> Une adaptation d'un projet par rapport à un autre consiste dans une reformulation de la description en utilisant les mêmes éléments de base (problématique et objectifs principaux similaires). La définition du caractère semblable est issue d'une analogie avec les critères de ressemblance d'ensemble (par opposition aux différences de détails) et de similarités dégagées par la jurisprudence nationale et européenne en matière de droits de la propriété intellectuelle. Pour l'établissement du caractère semblable, l'ANR vérifie notamment être en présence d'un des cas du 7.1 du règlement financier

## 4. EVALUATION

### 4.1 MODALITES ET CRITERES D’EVALUATION DES PROPOSITIONS

Les propositions seront évaluées successivement par l’ANR puis par la JST.

L’évaluation des propositions par l’ANR sera faite en une étape par un Comité d’évaluation scientifique **pour chacun des trois thèmes** de collaboration scientifique et le cas échéant, par des experts externes au comité éventuellement.

Dans le cadre de sa procédure d’évaluation, le comité JST sera amené à auditionner le coordinateur ou la coordinatrice japonais du projet.

Les critères d’évaluation sont communs aux deux agences et décrits ci-dessous :

1. **Pertinence et dimension stratégique du projet vis-à-vis des orientations de l’appel à projets :**  
Cohérence avec les thèmes de collaboration tels qu’identifiés dans la section 1 du présent document et décrits dans les sections 1, 2 et 3 des annexes : « *Exploring Unknown Materials* », « *Society 5.0 System Software* », « *MultiSensing* »<sup>6</sup>
2. **Qualité et objectifs scientifiques : recherche fondamentale singulière, reconnue internationalement et pour laquelle des résultats remarquables, qui contribueront grandement à l’innovation scientifique et technologique sont attendus :**
  - ✓ Clarté des objectifs de recherche et des hypothèses
  - ✓ Nouveauté, originalité, progression de l’état de l’art : la proposition de projet doit indiquer clairement et séparément :
    - le contexte de l’initiative de recherche (sa nécessité et son importance),
    - les activités de recherche des chercheurs participant au projet,
    - l’initiative de recherche et son programme.
  - ✓ La faisabilité, en particulier au regard des méthodes et de la gestion des risques scientifiques :
    - Résultats préliminaires obtenus pour poursuivre l’initiative de recherche
3. **Organisation du projet et moyens mis en œuvre :**
  - ✓ Compétences, expertise et implication du coordinateur / de la coordinatrice scientifique et des partenaires :
    - Capacité du coordinateur / de la coordinatrice à exercer un leadership fort et à porter la responsabilité pour toute l’équipe de recherche. Capacité à construire un cadre de collaboration suffisant pour permettre des contributions significatives et l’atteinte des objectifs de recherche.
    - Production des résultats de recherche a priori permettant d’accomplir les objectifs du projet.
  - ✓ Qualité et complémentarité du consortium, qualité de la collaboration, valeur ajoutée de la collaboration
  - ✓ Capacités de R&D et autres techniques des institutions de recherche des responsables scientifiques, dans le domaine du sujet de recherche.
  - ✓ Plan financier :

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<sup>6</sup> Consulter le texte publié par la JST contenant, le cas échéant des mises à jour éventuelles

- Adéquation des moyens demandés aux objectifs

#### 4. Impact du projet :

- ✓ Contribution à l'atteinte de l'objectif stratégique du thème de recherche (cf. texte en annexe)
- ✓ Impacts scientifique, économique, social ou culturel potentiels :
  - Actions de transfert technologique et d'innovation vis-à-vis du monde socio-économique (si pertinent)
  - Stratégie de dissémination et exploitation des résultats (si pertinent)

### 4.2 CLASSEMENT

Les propositions seront classées selon les résultats de l'évaluation. Chacun des trois comités mis en place par l'ANR se réunira pour donner un avis collégial et établir un classement des projets distinct pour chacun des thèmes. La sélection finale s'effectue sur la base de ce classement et des auditions des coordinateurs ou coordinatrices japonais (e) par la JST.

### 4.3 RESULTATS

L'ANR et la JST sélectionneront conjointement les projets à financer sur la base des deux classements et des auditions des coordinateurs/coordinatrices mentionnés au point 4.3 et à concurrence de la capacité budgétaire des agences.

**Un projet ne peut être sélectionné et financé que si les deux agences sont d'accord.**

## 5. DISPOSITIONS POUR LE FINANCEMENT

Seuls les coûts admissibles des Partenaires ayant sollicité une aide auprès de l'ANR seront financés. Les coûts admissibles et autres modalités d'attribution des aides de l'ANR sont précisés dans le « Règlement financier » disponible à l'adresse <https://anr.fr/RF> et dans la fiche sur les coûts admissibles n°3.

Pour connaître le taux de financement et le type de coûts applicables, remplir au besoin le formulaire « [Déclaration relative aux activités économiques des Partenaires d'un projet ANR](#) »<sup>7</sup>, accompagné de sa fiche explicative relative à la « [Catégorisation des Bénéficiaires](#) »<sup>8</sup>, puis retourner ce formulaire au contact suivant : [julie.ochrymczuk@agencerecherche.fr](mailto:julie.ochrymczuk@agencerecherche.fr) et/ou contacter cette personne pour de plus amples renseignements.

Les échéances applicables pour les comptes rendus intermédiaires et finaux sont celles déterminées dans le texte de l'appel et/ou dans l'acte attributif d'aide. Ces comptes rendus doivent être transmis au/à la chargé (e) de projets scientifiques.

Les projets ayant une durée de 5 ans (60 mois), aucune prolongation de projet ne sera acceptée.

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<sup>7</sup> <https://anr.fr/fileadmin/documents/2020/ANR-Formulaire-DECLARATION-RELATIVE-AUX-ACTIVITES-ECONOMIQUES-2020-3.pdf>

<sup>8</sup> [https://anr.fr/fileadmin/documents/2020/ANR-NOTICE-Formulaire\\_2020.pdf](https://anr.fr/fileadmin/documents/2020/ANR-NOTICE-Formulaire_2020.pdf)

### Nécessité de l'accord de consortium au sein du projet :

Il existe différents niveaux d'analyse des accords de consortium par l'ANR.

Les déposants doivent se référer au Règlement financier de l'ANR et à la fiche relative aux accords de consortium publiée sur le site de l'ANR (Fiche n°4 <https://anr.fr/RF>).

## 6. ENGAGEMENTS DES CHERCHEURS ET DES CHERCHEUSES QUI DEPOSENT UN PROJET ANR

### 6.1. PUBLICATIONS SCIENTIFIQUES ET DONNEES DE LA RECHERCHE

Dans le cadre de la contribution de l'ANR à la promotion et à la mise en œuvre de la science ouverte, et en lien avec le Plan National pour la Science Ouverte au niveau français et le Plan S au niveau international, les bénéficiaires de l'ANR s'engagent à garantir le libre accès immédiat aux publications scientifiques évaluées par les pairs et à adopter une démarche dite FAIR (Facile à trouver, Accessible, Interopérable, Réutilisable) conforme au principe « aussi ouvert que possible, aussi fermé que nécessaire ».

Ainsi, les publications scientifiques des bénéficiaires d'un financement de l'ANR dans le cadre du présent appel seront rendues disponibles en libre accès sous la licence Creative Commons CC-BY ou équivalente, en utilisant l'une des trois voies suivantes<sup>9</sup>:

- publication dans une revue nativement en libre accès,
- publication dans une revue par abonnement faisant partie d'un accord dit transformant ou journal transformatif<sup>10</sup>,
- publication dans une revue à abonnement. La version éditeur ou le manuscrit accepté pour publication sera déposé dans l'archive ouverte HAL par les auteurs sous une licence CC-BY en mettant en œuvre la Stratégie de Non-cession des Droits, selon les modalités communiquées dans les Conditions particulières.

De plus, le ou les Responsable(s) scientifique(s) du projet s'engagent à :

- ce que le texte intégral des publications scientifiques (version acceptée pour publication ou version éditeur) soit déposé dans l'archive ouverte nationale HAL, au plus tard au moment de la publication, et à mentionner la référence ANR du projet de recherche (ex : ANR-22-CE64-0001) dont elles sont issues.
- concevoir dès le démarrage du projet un plan de gestion des données (PGD) qui sera transmis à l'ANR et mis à jour jusqu'à la fin du projet.

Enfin, l'ANR encourage à déposer les pré-prints dans des plateformes ouvertes ou archives ouvertes et à privilégier l'utilisation d'identifiants pérennes ou uniques (DOI ou HAL Id, par exemple).

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<sup>9</sup> Pour vérifier si le journal ou la revue de leur choix est conforme au Plan S et quelle voie s'offre à eux, les auteurs pourront utiliser l'outil [Journal Checker Tool](#).

<sup>10</sup> Définition d'[accord dit transformant](#) ou [journal transformatif](#).



## 6.2. DEONTOLOGIE ET INTEGRITE SCIENTIFIQUE

Chaque Responsable scientifique sollicitant une subvention de l'ANR s'engage formellement sur le fait que sa hiérarchie (notamment les services administratifs et financiers compétents et les personnes habilitées à représenter juridiquement l'établissement gestionnaire de la subvention, ou ses représentants ou représentantes) a donné l'accord à sa démarche de dépôt en cours et que les informations relatives à la demande leur ont été communiquées. La liste des dépôts enregistrés par l'ANR pourra être envoyée par l'ANR aux directeurs ou directrices de laboratoire et aux responsables administratifs des établissements gestionnaires pour les projets les concernant.

Les projets de recherche bénéficiant d'un financement de l'ANR doivent respecter les principes de la [charte nationale de déontologie des métiers de la recherche](#)<sup>11</sup> ainsi que ceux de la [charte de déontologie et d'intégrité scientifique de l'ANR](#)<sup>12</sup>. Les Responsables scientifiques des Partenaires français (demandant ou non un financement) veillent au respect de l'ensemble de ces principes dans le cadre des activités de recherche menées sous leur responsabilité dans le cadre du projet.

## 6.3. ÉGALITE ENTRE LES GENRES

L'ANR, soucieuse de contribuer au déploiement d'une politique<sup>13</sup> ayant pour ambition de réduire les inégalités entre les femmes et les hommes dans l'ESR a intégré le principe d'égalité dans sa charte de déontologie et d'intégrité scientifique et déployé un plan d'action égalité. L'objectif poursuivi est notamment d'amener les communautés scientifiques à systématiquement considérer la dimension sexe et/ou genre dans leur recherche et ce, quel que soit le domaine, pour une production des connaissances de qualité, et de former les évaluateurs et évaluatrices à la question des biais potentiels de genre dans la sélection afin de garantir une équité de traitement entre les projets, qu'ils soient portés par des femmes ou des hommes.

En outre, afin de lutter contre une représentation trop souvent masculine de la science et afin d'encourager les jeunes femmes à investir des domaines dans lesquelles elles sont absentes ou minoritaires, l'ANR s'engage à valoriser les femmes de science ayant obtenu un financement ANR ou ayant pris part au travail des comités d'évaluation scientifique en tant que présidente ou membre de comité.

Dans ce contexte, l'ANR demande aux équipes françaises de prendre en considération la dimension sexe et/ou genre dans leur recherche et d'y sensibiliser leurs partenaires étrangers, et ce quel que soit le domaine scientifique afin d'écartier les biais de genre dans la production des savoirs et d'anticiper les conséquences potentielles de leurs applications.

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<sup>11</sup> [https://anr.fr/fileadmin/documents/2019/2015\\_Charte\\_fran%C3%A7aise\\_IS.pdf](https://anr.fr/fileadmin/documents/2019/2015_Charte_fran%C3%A7aise_IS.pdf)

<sup>12</sup> <https://anr.fr/fr/lanr-et-la-recherche/engagements-et-valeurs/lintegrite-scientifique/>

<sup>13</sup> Décret n°2020-256 du 13 mars 2020 en application de l'article 80 de la loi de transformation de la fonction publique.

#### 6.4. RESSOURCES GENETIQUES ET SAVOIRS TRADITIONNELS

Dans l'éventualité où des ressources génétiques seraient utilisées dans le projet déposé, les Responsables scientifiques s'engagent à ce que tous les participants au projet (demandant ou non un financement) respectent les obligations associées au protocole de Nagoya<sup>14</sup>. Dans le contexte de l'application du protocole de Nagoya, les bénéficiaires dont le projet relèverait de la « réglementation de l'accès et partage des avantages découlant de l'utilisation des ressources génétiques et des connaissances traditionnelles associées (APA) », devront fournir le récépissé de Déclaration de « Due Diligence » (DDD). Les DDD dans le cadre de travaux de recherche s'enregistrent directement en ligne via l'application dédiée sur le site du MESRI. Les accès peuvent être demandés au responsable de l'établissement d'accueil. Toutes les informations peuvent être consultées à l'adresse suivante : <http://www.enseignementsup-recherche.gouv.fr/pid37627/utilisation-ressources-genetiques-associees.html>

#### 6.5. CSTI (CULTURE SCIENTIFIQUE, TECHNIQUE ET INDUSTRIELLE)

L'ANR encourage les titulaires d'une subvention à mener et à participer à des activités de mobilisation des connaissances (transfert, partage, valorisation, mise en valeur et diffusion) auprès des milieux de pratique et du grand public, lorsque ces activités sont pertinentes. Les Responsables scientifiques s'engagent donc à promouvoir dans le cadre de leur projet, à chaque fois que cela est possible et pertinent, la culture scientifique, technique et industrielle.

## 7. RGPD

L'ANR dispose de traitements informatiques mis en œuvre dans le cadre de cet Appel. Des données à caractère personnel<sup>15</sup> sont collectées et traitées dans le cadre de ce/ces traitements.

Le détail des mesures de protection prises par l'ANR des données à caractère personnel qu'elle collecte et traite, est indiqué aux personnes concernées lors de la saisie de ces données dans les traitements informatiques correspondants. Vous pouvez contacter la Déléguée à la protection des données de l'ANR à l'adresse : [dpd@agencerecherche.fr](mailto:dpd@agencerecherche.fr)

Pour en savoir plus, consultez vos droits sur le site de la [CNIL](https://www.cnil.fr/) accessible à l'adresse suivante : <https://www.cnil.fr/>

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<sup>14</sup> A cet égard, les Bénéficiaires des aides de l'ANR dont le Projet relève de la « réglementation de l'Accès et partage des avantages découlant de l'utilisation des ressources génétiques et des connaissances traditionnelles associées (APA) », sont informés qu'ils devront justifier au plus tard à la date du dernier versement de l'Aide, du respect de leurs obligations.

<sup>15</sup> Nom, prénom des chercheurs, date de naissance, coordonnées professionnelles, titre(s), fonction (actuelle et antérieure), domaines d'activité, lieu de travail, organisme d'appartenance, adresse(s), curriculum vitae, numéro ORCID, nom et référence des projets, pré-propositions, propositions de projet (document scientifique, annexe administrative et financière)

## 8. PROTECTION DU POTENTIEL SCIENTIFIQUE ET TECHNIQUE (PPST)

Sur les recommandations du Service du haut fonctionnaire de défense et de sécurité (SHFDS) du MESRI, l'ANR met en œuvre la PPST pour les projets déposés comportant au sein de leurs consortiums, des partenaires domiciliés hors de l'Union européenne (UE). Les projets de coopérations internationales de nature scientifique ou technique identifiés par l'ANR seront soumis à l'avis du SHFDS/MESRI en tenant compte des orientations nationales établies par le SGDSN. Un avis négatif du SHFDS/MESRI ne permettra pas la sélection des projets. L'avis ne sera pas motivé par le SHFDS/MESRI auprès du déposant.

## 9. COMMUNICATION DES DOCUMENTS

L'ANR peut être amenée à transmettre certaines données et documents aux administrés, à d'autres organismes de financement français ou étrangers, à d'autres administrations (dont ses tutelles), aux organismes de contrôle, dans le cadre d'accords de collaboration, de l'ouverture des données publiques, l'accès aux documents administratifs<sup>16</sup>, l'échange entre administrations et la réutilisation des informations publiques<sup>17</sup>. Cette communication peut concerner notamment les données de caractérisation des projets, les expertises, le rapport de synthèse du comité d'évaluation, les pré-propositions/propositions de projet, documents contractuels, document scientifique, annexe administrative et financière.

La diffusion et la communication de ces données et documents administratifs s'effectuent dans le respect de la réglementation applicable et sous réserve de protection des données personnelles, de la propriété intellectuelle et du secret industriel et commercial. En effet, certains documents ou données collectés ne doivent pas être communiqués ou ne peuvent l'être que de façon restreinte. Dans le cas des collaborations avec d'autres organismes de financement ou co-financements en particulier, des contrats encadrent la communication des documents et la confidentialité. La communication des documents sera limitée à l'objet de la collaboration entre l'organisme de financement partenaire de l'ANR et celle-ci.

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<sup>16</sup> Loi 78-753 du 17 juillet 1978 sur la communication des documents administratifs, loi 79-587 du 11 juillet 1979 sur la motivation des actes administratifs, loi 2000-321 du 12 avril 2000 relative aux droits des citoyens dans leur relation avec les administrations

<sup>17</sup> Ordonnance n°2016-307 du 17 mars 2016 codifiant les dispositions relatives à la réutilisation des informations publiques dans le code des relations entre le public et l'administration, et son décret d'application n°2016-308 du 17 mars 2016

## ANNEXES

Les déposants sont invités à consulter le site de la JST pour avoir accès aux mises à jour éventuelles des textes ci-dessous, le cas échéant

1. *Exploring Unknown Materials: Exploring Innovative Materials in Unknown Search Space “Opening up of unexplored exploration space of materials with multi-element, composite, and metastable phases based on elements strategy”*

**Research Supervisor: Hiroshi Kitagawa (Professor, Graduate School of Science, Kyoto University)**

### Overview

This research area aims to create new materials with innovative functions by fully drawing out the latent potential of chemical elements through the synergy of multiple elements. More specifically, we are expanding materials search space into unknown areas, such as multi-component compounds, multi-element systems, and metastable phases, regardless of whether these materials are inorganic or organic. We are emphasizing strategic initiatives that will promote efficient materials searches. Regarding multi-component compounds, new molecules and solid materials made by undeveloped combination of elements, or nanosystems formed with heterogenous junctions or building units may realize innovative functions.

In terms of multi-element system, one may discover a variety of new phases (e.g., crystalline phases, amorphous phases, electron phases, and spin phases) and design materials exploiting effectively diverse types of defects. As for metastable phases, one may develop new materials through kinetic-control processes or nonequilibrium synthesis, realize desired crystalline phases and physical properties, enhance ion diffusion, battery capacity, and catalytic reaction, and control reversible phases.

Moreover, one may even discover simple and useful new materials like the allotropes of carbon (fullerene, diamond, ---). Other than the above, we welcome new concepts for designing materials, for example, informatics that adopt human insight, intuition, and sensitivity. We expect the goal of each research team to be the development of effective methods to create materials, including computational science/data science/high-throughput screening methods/nonequilibrium processes/in-situ measurements that are directly connected to informatics; proof of the development of novel functionalities or significant improvements in functionalities and durability.

The outcomes of this research area will be integrated to achieving the science of the advanced usage of elements and the foundation for creating new functional materials.

### **Research Supervisor’s Policy on Call for Application, Proposal Selection, and Management of the Research Area**

#### **1. Basic concept**

By using and applying the latent potential of elements to the utmost, this research area aims to create new materials that have innovative functions or enhanced performance that will contribute to solving increasingly serious social problems.

Although this has been carried out based on the “Element Strategy”, which mainly develops

alternatives to rare elements, we encourage researchers to expand materials search space into unknown areas, such as multi-component compounds, multi-element systems, and metastable phases, regardless of whether these materials are inorganic or organic, and to propose concepts and methodologies for the design of new materials. Therefore, in this research area we do not expect proposals for a simple extension or simple improvement of researches on conventional methods.

To develop new materials with novel functionalities and/or significant performance in an unknown area, it is essential to have ideas for the advanced usage of elements after setting the social issues to solve. Even if suggested an idea based on a variety of concepts (including multi-component compounds, multi-element systems, or metastable phases) and/or an original vision, please state how it is novel, and the theories/predictions behind it. With such ideas as a starting point, it is important to pioneer methodology to search in unknown materials space, to apply or to develop new techniques to synthesize and search for different materials, and to logically describe a research strategy demonstrating the proof of novel functions. Please clearly describe ideas and strategies on these issues in your proposal.

In FY2023, JST and ANR (Agence Nationale de la Recherche) invite Japanese-French joint research proposals in addition to regular (non-joint) ones. We welcome proposals that have effective strategy of leverage through the cooperation of Japanese and French researchers.

## 2. Assumed research fields

(1) Techniques to efficiently search for new materials in unexplored areas and (2) new processing techniques to synthesize the materials are the research points that we need to prove ideas related to the realization of innovative functions by applying elements in advanced ways.

[Techniques to efficiently search for new materials in unknown areas]

- Computational science, data science, and high throughput screening methods to predict and discover substances that can specifically display high functionality in multi-element materials and nonequilibrium materials, as represented by diamond and metallic glass
- Design methods for new functional materials systems through the building units arrangement, layering, interface, etc. of heterogenous nanolevel structures
- Design methods for materials that simultaneously fulfill multiple functions, including electron/ion transport, optical, magnetic, dielectric properties, electrochemical energy storage, chemical reactivity and catalysis
- Techniques to efficiently create phase diagrams that incorporate factors controllable in engineering (other than temperature and pressure), and state diagrams at high temperatures
- Exploring informatics that adopt human insight, intuition, sensitivity, and more.

[New processing techniques to synthesize new materials]

- New processes that precisely control the time profile of pressure/temperature/atmosphere, use plasma, ions, electromagnetic waves, solutions, etc., and occur in nonequilibrium, at low temperatures, and/or under extreme conditions
- Techniques to control aggregation and local reactivity so that multiple nanolevel structures can be arranged adjacently
- The advancement of methods to control mechanical stress in thin films grown on special substrates
- Collaboration between data science techniques and operands/in-situ measurements that locally assess the structures and physical properties of the synthesis fronts, etc.

Moreover, in order to utilize the developed materials in the fields of energy, electronics and telecommunications equipment, chemistry, urban infrastructure, mobility, and healthcare, the followings must also be considered

- Life-span, increased durability, the stabilization of metastable phases, etc.

This research area accepts all materials fields, including inorganic, organic, and metal. It is also not limited by the shape of materials, such as crystal/non-crystal/solid solutions/flexible/soft materials. Although we have brought up multi-component compounds, multi-element system, and metastable phases as sample categories, other material categories in unknown areas are also considered eligible for research and development. However, simply improved research on existing materials via conventional methods, and proposals that are only extensions of past research are not eligible. Please submit proposals for research projects with breakthrough concepts that are not constrained by conventional Element Strategy or common sense, and clarify the novelty of your idea for the advanced application of elements, and your strategy to realize it.

### **3. The organization of research teams**

With the aim of creating new materials and novel functions, in this research area we are encouraging the multidisciplinary teams made up of groups that are responsible for computational science, data science, and cutting-edge measurements, in addition to material synthesis groups. Please endeavor to closely collaborate to create new materials research methods that are distinct from trial-and-error methods and simply improving conventional techniques. We envision the participation of groups specialized in high throughput experiments and operand measurements directly connected to data science within teams, however this is not necessary as an application requirement; if it becomes necessary when realizing your idea, you should consider collaborating within or outside of this research area. Regarding plans for research budgets, please set these out appropriately so that the research director bears responsibility for the results of the overall project, without allocating uniform fixed amounts to each group. Please note that proposals that focus mainly on the development of labor-saving through robotics that are not connected to nonconventional materials search techniques are not eligible.

### **4. Research budget and period**

The upper limit of the research budget is 300 million yen (direct costs) per project. However, if the proposal is wide-ranging across, for example, computational science/data science/high throughput assessments/non-equilibrium processes/in-situ measurement directly connected with data science, and the necessity is truly acknowledged, the upper limit may be raised to 400 million yen (direct costs) per project. The research term is within 5.5 years from FY2023 to FY 2028. Even for the JST-ANR joint proposals, the upper limit mentioned above is applied to the Japanese side team.

### **5. Principles of research-area management**

- A site visit will take place within about 6 months following project selection; the set-up of the research environment and research teams will be checked, and the research plan/images of concrete outcomes will be shared.

- Research area meetings will be held twice or thrice a year, to review research progress and, if necessary, to revise research plans/organization. Since other teams may even be interested in examples of failures from a different aim or perspective, please proactively report these in the

meetings.

- Three years after research begins, an interim evaluation of your project will take place; this will assess how the project has taken on the challenge of materials searches in unknown areas. Six months before that, we will conduct a site visit for advice as needed. Moreover, there will be discussions about measures to expand research outcomes in the second half of the project, to promote publications such as research papers, to acquire patents, and to enhance collaboration with industry. We will also hold symposiums, where those involved will report their results to external researchers, and discuss how to expand their outcomes.

- There will be an ex-post evaluation of projects in the final year of research, in which policies to further develop outcomes after the research period is finished will be discussed. Six months before that, we will conduct a site visit for advice as needed. There will also be symposiums, which should demonstrate the appeals of the outcomes of your CREST research.

- Collaboration should be considered with those within and outside of this research area, especially collaboration with the PRESTO research area “Creation of future materials by expanding materials exploration space,” which was established based on the same strategic objectives. Therefore, joint camp meetings with PRESTO will be also planned.

- Excellent operands/in-situ measurements techniques should be shared and adopted by other teams within this research area and the above PRESTO research area to accelerate the development of new process/synthesis technologies.



## 2. *Creation of System Software for Society 5.0 by Integrating Fundamental Theories and System Platform Technologies*

**Research supervisor: Yasuo Okabe (Professor, Academic Center for Computing and Media Studies, Kyoto University)**

### **Overview**

Society 5.0 proposed by Japan is a data-driven society in which people and things are connected, a variety of knowledge and information is shared, and new, never-before-seen value is produced. The spread of the novel coronavirus disease (COVID-19) will lead to further progress in the digital transformation of society. As a result, a variety of data that could potentially lead to violation of confidentiality and privacy will likely be stored in public cloud-based systems, which raises concerns of increased security and privacy risks.

The realization of a safe, secure, and reliable data-driven society requires the implementation of a framework that balances free information sharing and personal information protection. In the construction of increasingly ingenious and complex social systems, it is necessary to run system software based on "Security-by-Design" and "Privacy-by-Design" on various execution environments composed by hybrid hardware and operating systems. The new vulnerabilities in state-of-the-art hardware and OS reported in recent years are becoming more serious issues for Japan, which relies on overseas technologies. It has become difficult to solve fundamental issues with conventional individual responses. It is essential to view the entire social system from the perspective of "by-design", to research and develop innovative technologies with a view to integrating them with theories such as distributed cooperative parallel processing and AI, and to create open system software that is safe, secure, and reliable in principle, and that has no black box in it and does not rely on other countries.

This research area aims to produce innovative, foundational system software that is safe, secure, and trusted in the era of Society 5.0. This will be realized by promoting research and development that integrates and fuses fundamental theories and system platform technologies in a cross-cutting manner. Specifically, it aims to achieve the following three goals:

- (1) The creation of security technologies that make it possible to build secure services even in platform environments that include non-trusted hardware and operating systems.
- (2) The creation of advanced information sensing, sharing, and analysis technologies that ensure privacy even in open and malicious environments.
- (3) The creation of sophisticated architecture, design, and implementation technologies of system software that enables to deploy adaptive information sensing, sharing, and analysis in secure and privacy preserving manner.

This research area will be operated as part of the Ministry of Education, Culture, Sports, Science and Technology (MEXT)'s Artificial Intelligence/Big Data/IoT (Internet of Things)/Cybersecurity



Integration Project (AIP Project: Advanced Integrated Intelligence Platform Project).

## **Research Supervisor’s Policy for Application, Selection, and Management of the Research Area**

### **1. Background**

In the era of Society 5.0, it is likely that a wide variety of data obtained from various systems throughout society, such as traffic, energy, manufacturing, health, and education will be mutually connected, creating new social value. The spread of COVID-19 has also raised awareness of the need for social transformation with a view to the digitization of society and the post-COVID-19 era. However, realizing such a society requires addressing the various challenges likely to arise in these new ICT platforms and system software related to security and privacy.

These challenges require a variety of research to be promoted. For example, research to deal with cyber threats targeting vulnerabilities found out in ICT platform hardware and software, confidential information leakage and privacy violation of personal information, safe and secure information sharing and processing using “by-Design” concepts throughout the system.

Solving increasingly ingenious and complex security and privacy issues requires collaboration between researchers in the fields of architecture, operating systems, networking, software, databases, security, and privacy to promote fundamental research (theory) and applied research (system platform and system software). These actions are expected to deploy advanced system software technologies that support safety, security, and trust in the era of Society 5.0.

### **2. Principle of invitation project and selection**

Based on the background above, this research area promotes research and development that integrates and fuses fundamental theories and system platform technologies in a cross-cutting manner. It aims to essentially solve the critical issues of security and privacy across various social infrastructures. Specifically, the area will involve the following types of research. However, research is not necessarily limited to these topics, and we are hoping for more free and challenging proposals.

(1) The creation of disruptive security technologies that make it possible to build secure services even in platform environments that include non-trusted hardware and operating systems.

- Safe and secure computing architecture with hierarchical and decentralized authority
  - Distributed collaboration across multiple trusted spaces
  - Architecture level security verification, etc.
- Technologies to build trusted isolation execution environments
  - AI automated security policy operations with zero-trust architecture
  - Next-generation TEE (Trusted Execution Environment)
  - Formal secure software verification and data authenticity for safe execution, etc.
- Next-generation information sharing platform in heterogeneous environments
  - Automatic vulnerability assessment and real-time threat detection
  - Data protection and dynamic information flow tracking (DIFT)
  - Next-generation PKI, distributed identity, distributed/integrated access control, etc.

(2) The creation of advanced information sensing, sharing, and analysis technologies that ensure privacy even in open and malicious environments.

- Privacy protection technologies using cryptography with advanced functionality
  - High-performance privacy-preserving data mining with homomorphic encryption

- Privacy policy management taking GDPR and others into account
- Sophisticated differential privacy and local differential privacy

(3) The creation of sophisticated architecture, design, and implementation technologies of system software that enables to deploy adaptive information sensing, sharing, and analysis in secure and privacy preserving manner.

- Integrated technologies that challenges to tackle both (1) and (2) above
- High-performance computing algorithms for security and privacy treatment
- Data authenticity and provenance guarantee technologies
- Advanced operations in heterogeneous distributed data processing environments (i.e. various CPU, OS, VM combination)

This research area expects research members to advance future-thinking fundamental technologies while maintaining an attitude that is aware of the real world and specifically envisions how theoretical research can be implemented in society, along with establishing technologies that essentially solve real-world issues related to security and privacy. We are hoping for proposals that are not limited to fundamental theories or system platform technologies but that are integrated in a way that, through theory, can guarantee that systems as a whole completely satisfy security and privacy requirements.

We are also aiming to improve international competitiveness by envisioning use-cases for research results and self-assessing benchmarks against competing global technologies. Steering will be strengthened at the time of interim evaluation (e.g., appropriate budget control, verification of research signpost and final goals). Research results are expected to be made available as open-source software (OSS) and open APIs so that they can be widely disseminated in a variety of environments. Collaboration and cooperation with other teams in this research area and PRESTO (Precursory Research for Embryonic Science and Technology) researchers working under the same strategic objectives is expected, alongside mutual use of research products.

During research and development, research teams are recommended to consider using mdx (a platform designed to create a data-driven society) and SINET5. The mdx will be officially operational in FY2023 as a high-performance virtual environment.

### **3. Research period and funding**

The research period will be five years and six months (from October 2023 to the end of March 2029), and the total budget will be in the range of 150 million to 350 million yen (excluding indirect costs). We will promote research and development that integrates and fuses fundamental theories and system platform technologies in a cross-cutting manner, so the aim is to increase the size of the budget per project. We are also considering budgetary measures to support research acceleration, etc., as needed and promote collaboration through having multiple teams utilize each other's results.

### **4. Principle of research-area management**

This research area will be operated as CREST (Core Research for Evolutionary Science and Technology), a form of team-based research. We are particularly hoping for research and development proposals that go beyond elemental technologies and that integrate and fuse fundamental theories and system platform technologies in a cross-sectional manner. Team members and budget sizes may be increased as a result of transdisciplinary collaboration. It notes that it is recommended to consider incorporating not only security and privacy researchers but also statistical

mathematics and computer science researchers, system software/hardware researchers/engineers, and social science experts into your team. Although the research topics in this area are illustrated in Section 2, a principal investigator may have a team structure that aims to attain a single target or a team structure with goals that span multiple achievement targets. In addition, we believe that incorporating a human resource development perspective is vital in this area. Therefore, we expect junior researchers to develop further and also expect challenging research proposals from junior and young researchers.

When applying for this research area, please describe your envisaged goal outcomes in five years and six months and your milestone in three years as precisely as possible. In particular, be sure to include a promising use-case roadmap that indicates how you intend to apply your research results in the real world. For larger-budget proposals, it must include a detail explanation concerning on a proof of concept system development and its experiments execution plan.

This research area will be operated as one research area of MEXT's Artificial Intelligence/Big Data/IoT (Internet of Things)/Cybersecurity Integration Project (AIP Network Laboratory: Advanced Integrated Intelligence Platform Network Laboratory). It also contributes to the AIP project's integrated management by working on research projects in collaboration with the RIKEN Center for Integrative Research on Innovative Intelligence and other related research institutions.

### 3. *Research on Multi-sensing Biosystems and Development of Adaptive Technologies*

**Program Supervisor: Ryoza, Nagai President, Jichi Medical University**

**Research Supervisor: Atsushi Iriki, Team Leader, Center for Biosystems Dynamics Research, RIKEN**

#### **Overview**

This research area aims for an integrated understanding of “multi-sensing systems,” which encompass biological sensory systems and the peripheral nervous network, and the development of ways to visualize and control these.

Sensory functions and the autonomic nervous system play an important role as feedback systems that make sure the body is always fulfilling its functions. On the other hand, the decline and failure of sensory functions due to internal and external stresses such as increasing age, as well as impairment to the peripheral nervous system are major risk factors for health problems and the onset of chronic illness. Thus, by gaining an integrated understanding of the physiological mechanisms of “multi- sensing,” which encompasses biological sensory systems and the peripheral nervous network, we expect that it will become possible to develop new treatment methods that can target illnesses related to the organs across the body, to improve quality of life (QOL), and thus to extend healthy life expectancy. Moreover, the social implementation of innovative technologies via multi-sensing systems, such as sensory substitution and sensory sharing, could contribute to the realization of a richer, happier society. More specifically, we aim to clarify the operating mechanisms of multi-sensing systems, to explain pathological conditions, to develop technology that visualizes and quantifies states of activity, and, based on these, to develop treatment and prevention methods with few side effects and to create medicines, medical equipment, and minimally invasive devices that are suitable for individuals.

This program will create a novel research area of biological multi sensing systems synthesized across the sensory organs of multiple modalities and the peripheral nerves innervating them by crossing the boundaries of conventional life sciences (e.g., sensory physiology, molecular and cellular biology, and neuroscience) to interact with a broader spectrum of disciplines, including electronic and mechanical engineering, information and mathematical sciences, and cognitive psychology, resulting in the development of fundamental and applied technologies to be implemented in daily social environments. Currently, advancing measurement technologies have opened avenues to discover novel sensing functions and mechanisms and have revealed that sensory systems interact with the immune, metabolic, and endocrine systems to maintain homeostasis and at unconscious levels affect various perceptions or emotions that contribute to shaping our view of humanity and the world. Additionally, the application of advanced Information and Communication Technologies (ICTs; e.g., XRs, wearable devices) would allow the expansion of human internal and external sensing functions. This research area encourages research synthesizing a wide spectrum of sensory information, from internal and external environments to the biological functions of the body as a whole; however, reductionist approaches within conventional boundaries are discouraged. The development of technologies that realize biological sensor fusion by applying the principles of these multi sensing mechanisms is also encouraged, including, for example, the visualization, manipulation,

transmission, and representation of multiple sensory modalities. Furthermore, super-sensing mechanisms (by nonhuman animals or by engineering beyond ordinary human abilities) also fall within the scope of this research area in terms of incorporating them into human sensing systems through the development of their governing principles and the associated detection devices.

### **Research Supervisor’s Policy on Call for Application, Selection, and Management of the Research Area**

#### 1. Background and Overview

This program will create a novel research area of biological multi sensing systems synthesized across the sensory organs of multiple modalities and the peripheral nerves innervating them by crossing the boundaries of conventional life sciences (e.g., sensory physiology, molecular and cellular biology, and neuroscience) to interact with a broader spectrum of disciplines, including electronic and mechanical engineering, information and mathematical sciences, and cognitive psychology, resulting in the development of fundamental and applied technologies to be implemented in daily social environments.

This research area does not promote projects as straightforward extensions of existing paradigms limited by the boundaries of sensory organs and the peripheral nervous system but aims to make a leap through distributed and local interactions with other biological systems, such as the immune, metabolic, and endocrine systems. These breakthroughs will be expected to create novel rich and healthy human sensory environments (Umwelt), which will allow us to take the next step forward to extend the human society of the near future and engender innovation to realize such an advance. Japan has a long tradition of sensory research with significant previous achievements in a variety of species at multiple levels of biological hierarchies. This tradition comprises a great strength associated with an extensive body of knowledge and a diverse spectrum of technologies that have been accumulated to date. Additionally, recently advanced measurement technologies have started to open avenues to discover novel sensing functions and mechanisms or uncover sensory systems that interact with the immune, metabolic, and endocrine systems to maintain homeostasis and at unconscious levels affect various perceptions or emotions that contribute to shaping our view of humanity and the world.

Additionally, the application of advanced ICTs (e.g., XRs—VR, AR, SR, MR, wearable devices) would allow the expansion of human internal and external sensing functions.

This research area encourages research synthesizing a wide spectrum of sensory information, from internal and external environments to the biological functions of the body as a whole; however, reductionist approaches within conventional boundary conditions are discouraged. The development of technologies that realize biological sensor fusion by applying principles of these multi sensing mechanisms is also encouraged, including, for example, the visualization, manipulation, transmission, and representation of multiple sensory modalities. Furthermore, super-sensing mechanisms (by nonhuman animals or by engineering beyond ordinary human abilities) is also within the scope of this research area in terms of incorporating them into human sensing systems through the development of their governing principles and the associated detection devices.

As such, this research area will serve as a hub to liaise a wide range of research fields in Japan that have independently accomplished significant achievements to date and create a systematic platform for a synergistic effect among life sciences, electronic/mechanical engineering, information and

mathematical sciences, cognitive psychology, and philosophy, which have rarely interacted in the past. Through these incubation mechanisms, a novel biological multi sensing research area that has originated in Japan will be promoted to impact global research communities. Furthermore, to establish the next generation's novel academic field, training and support of the human resources of young leaders will be provided, and a novel value axis for research evaluation will be created. Through these activities, this research area will collectively pursue principles of multi sensing and development of technologies for the social implementation of multi sensing systems, which will lead to the creation of a new concept of humanities and its empirical verification that should eventually contribute to the development and enrichment of the human society of the near future.

In FY 2023, JST and ANR (Agence Nationale de la Recherche, France) invite Japanese-French joint research proposals in addition to regular (non-joint) ones. We welcome proposals that have effective strategy of leverage through the cooperation of Japanese and French researchers. If accepted, Japanese group will receive support from JST (CREST), whereas the French group from ANR. To apply, research representatives of Japan and France are required to prepare a joint research proposal (in English, CREST-ANR common format) and submit it to both JST and ANR. Also, please note that it is not possible to submit both a French-Japanese joint proposal and a regular CREST proposal to JST.

## 2. Project Goals and Selection Policies

This research area promotes integrated studies that interact across different research fields, and beyond the boundaries of conventional ones, to achieve the “priority strategies of science and technology” through, but not limited to, themes such as (1) to (4) below. With the spectrum of groups adopted through previous two years, we were able to complete portfolio that were initially aimed at when this research area was launched, whereby collectively able to be prepared to open a new multi-sensing research field. In this year, as the final year of three-year call, we expect proposals such that aim to create and develop further strategic areas through collaborations with this portfolio. Rather than extending or elaborating existing research paradigms, we expect proposals to, for example, develop a system that senses various environmental information that exceeds the detection capabilities of humans and other living organisms or the limits of conscious experiences, and present them in a virtual space that humans can perceive. We also strongly expect challenging proposals aiming at producing novel philosophical concepts of how the mode of a new multi-sensory perceptual world influences the development of culture and civilization in the near future together with falsifiable proof of concept experimentations. As reductionistic approaches being matured to the date and approaching a pragmatic turn of sciences into the phase of synthesis, we heartily look forward to such new groups that will join us under these perspectives. The selection criteria for the proposals include i ) the conceptual structure of the series of previous achievements, ii ) the state of past achievements within the conventional framework, and iii ) readiness for the next synthesizing stage of the proposed project. Although future plans will be central to the evaluation process, the association of the proposed project with past results will at least be considered.

(1) Signal transduction, processing, and operating mechanisms of multiple sensory modalities  
Studies should extend previous fundamental concepts (reduced to single molecules, receptors, and circuits) to the complexity of their dynamic states, e.g., intracellular multimolecular states and interactions across a wide range of different biological hierarchies, from the electronic states of atoms comprising functional molecules through conditions of environments (internal and external) in which information is acquired via mechanisms other than signal transduction at receptor cells. Such proposals, for example, might want to aim at the following:



- Mechanisms for detecting information at various sensors (including receptor cells) to feed, via peripheral nerve networks, the central nervous system for processing through structural and functional analyses using state-of-the-art imaging technologies.
- Operating mechanisms of biological sensory systems across atomic, molecular, and cellular levels.
- Mechanisms of sensing functions by organs other than conventional sensory receptors and interactions among them.
- Effects of the functions of sensing systems on the perceptions, emotions, and behaviors of individuals and social groups.

(2) Integration across multiple sensory systems and with other biological systems and organs

Studies should consider intermodal relationships and their integration principles across distant sensations (vision, audition), proximal sensations (taste, olfaction, haptics, pain, itch, etc.), and interoceptive, visceral, vestibular sensations and their distributed and local interactions with other biological systems, such as the immune, metabolic and endocrine systems, which would result in further interactions with hierarchical information processing in the central nervous system. Such proposals, for example, might want to aim at the following:

- Mechanisms of complementary interactions (i.e., biological sensor fusion) among sensory organs of different modalities.
- Structures and functions of circular networks across multiple internal organs, including the brain.
- Distributed local information processing at the level of sensory organs and/or innervating peripheral nerves and their interactions with other biological systems.

(3) Technologies for measuring and controlling multi sensing systems

Devices should be developed to measure and visualize the real-time spatiotemporal dynamics of (both known and unknown) sensory receptor system functions distributed throughout the whole body. Additionally, technologies (including XRs; VR, AR, SR, MR) should be developed to acquire, transmit, and represent proximal and interoceptive sensations that remain rather undeveloped compared with distant sensations (vision, audition), and the influences of such devices on social activities and mental functions should be theoretically assessed once they have been socially implemented. Such proposals, for example, might want to aim at the following:

- Wearable devices and basic technologies for high-speed and large-scale measurement and quantification of structures and functions of biological multi sensing systems.
- Technologies to analyze and process large-scale data from biological multi sensing systems.
- Exploration of previously unknown senses and principles to integrate them into existing human sensory systems to contribute to the extension and enhancement of human societies of the immediate future.
- Technologies to control, represent, and extend human sensing systems by integrating the biological mechanisms of sensory organs and ICT technology and/or engineering.

(4) Technologies to utilize the sensing abilities of nonhuman organisms and engineering devices

Technologies should be developed to utilize information from existing sensory modalities but beyond the human-detectable dynamic range, those from sensory systems of nonhuman organisms undetectable by humans, and from those detectable only via nonbiological devices, for contribution to the extension and enhancement of human societies of the immediate future.

Additionally, the influences of those technologies on social activities and mental functions should be

theoretically assessed once socially implemented. Such proposals, for example, might want to aim at the following:

- “Super sensing” functions of nonhuman organisms (including animals, microorganisms, plants) and engineering approaches and technologies for their application.
- Principles and conceptual framework for a novel human sensory environment (Umwelt) as a result of sensor fusion across multi- and super sensing mechanisms and novel technologies for their social implementations.
- Technologies to complement biological multisensing systems to substitute for and extend human sensing functions.

### 3. Project Duration and Funding Scale

The research period for each project should be no longer than five years and six months. The initial research budget should not exceed a total of 300 million yen (direct costs) per project. Substitutional support to accelerate research may be considered during the research period. In some cases, the research costs may be adjusted based on careful evaluation by the supervisor. In a joint proposal with ANR, the Japanese group should set the research budget within the above range, regardless of the size of the budget to be separately allocated by ANR.

### 4. Management Policies

#### (1) Research and development

This research area promotes projects to integrate otherwise unencountered research fields, but rather than being a straightforward extension of existing paradigms, it makes a leap to groundbreaking outcomes that could never be achieved through studies in single disciplines. To encourage risk-taking and challenging approaches to achieve this goal, judicious effort-based but not immediate results-based evaluation of research achievements will be respected. Specifically, when there is an early-stage lack of success, processes and details of the failure will be examined, and an internal advisory system will support the project to maximize the values of experiences accumulated through such failures for the benefit of making the next leap forward. Simultaneously, novel evaluation criteria and procedures will be sought to develop, establish this research field of novel concepts, independent of conventional frameworks, to eventually make them international standards. For this purpose, we will raise the international appeal of this field through contribution of newly joined international advisors. In addition, as the final phase of the three-year call for proposals, JST, together with ANR, will pursue stronger international links, especially allowing interdisciplinary integrations across humanities and natural sciences to lead to the creation of a novel conceptual advancement.

As such, project budgets will be reviewed on a yearly basis and thus may be adjusted according to the research progress. Additionally, the composition of the research team and budget may require reconsideration upon interim evaluation of the research progress and outcomes, including merging with other research projects or inviting additional external researchers to join in addition to mere reorganization within the project. For effective management as a network-based research institute, the research supervisors’ discretionary budget will be fully utilized to provide supplementary budgets for projects making outstanding progress and/or those making significant contributions to the research area. It will also be used, as depicted below, for internal programs for training young project participants to become leaders of the next generation who will drive this new research area and to promote internal and external collaboration.

#### (2) Human resources (training and support)



Training and support will be provided for young researchers to foster and create career paths for them to become leaders of the future interdisciplinary multi sensing research field. When aiming at integration with previously unrelated fields, initial understanding and mutual respect of each field's fundamental aspects is mandatory, including the basic terminology, ways of thinking, types of outcomes, and prioritized values. Conflicts in these areas may be unconscious but thus are critical barriers that need to be explicitly and intentionally overcome at the beginning. To accomplish such training, interdisciplinary lecture series (by volunteering project PIs and advisors) for young members across research projects will be organized using occasions of regular biannual research area meetings.

In addition, by utilizing ICTs, including social media, young researchers will be supported in creating an accessible environment for bold and ambitious discussions across different fields. The research supervisors' discretionary budget will be allocated to young researchers' internal mini collaboration projects, namely "Youngster's Challenge Project", upon a proposal-evaluation basis, that emerge from such discussions.

Through these activities, an atmosphere will develop that allows junior colleagues to discuss their projects with the PIs of other projects in different disciplines, and we hope that proposals for the next generation's important project will emerge from among the young researchers in this research area. Moreover, with the support of PIs in different disciplines, opportunities will be provided for young researchers to attend academic conferences and meetings in other fields, and environment will be constructed that lowers the psychological hurdles related to crossing disciplinary borders towards their future development.

### (3) Internal and external collaborations

CREST projects are collectively regarded as a network-based research institute and are managed collaboratively and comprehensively. Further links with PRESTO and with AMED-CREST and PRIME will be promoted under the leadership of the PS responsible for all four JST-AMED programs. Within CREST, proactive and open-minded interactions among members from different disciplines will be fostered through the establishment of a forum structure that will support joint and collaborative research. Corresponding to the core facilities of the physical research institute, our network institute will create a database platform in which member researchers can share a variety of data and resources to pursue the effectiveness, standardization and integrity of their research outcomes.

Throughout the four JST/AMED programs, a platform for regular exchanges of ideas will be established to seek potential constructive and innovative joint enterprises. External to the four programs, under the PS's leadership, joint proposals will be sought for symposiums/workshops in domestic and international academic conferences, conventions and meetings. To globalize these Japan originated new research areas, special issues under the themes of this research area will be organized in international journals, and international collaborations under such themes with overseas institutions and organizations will be supported.

## 5. Addendum

This research area emphasizes the research and development of biological multi sensing systems comprising the sensory organs and the peripheral neural network of humans and model organisms. Proof of concept empirical studies for novel philosophical speculations, or proposals utilizing

atypical species for the research on mechanisms of organisms' evolutionarily acquired super sensing functions are particularly encouraged. Original and challenging research proposals from midcareer researchers and female researchers are well appreciated.