In today’s extremely competitive job market, career success for early-stage scientists both inside and outside of academia requires more than just research expertise. In addition to the research and technical competencies gained through mentored research in the laboratory, today’s scientists also need to develop proficiency with a wide array of non-bench professional skills. A recent report from the National Cancer Institute recommended a number of skills that would help graduate degree holders prepare for biomedical research careers. Among others, these skills included communication skills (writing, presenting, negotiating, and persuasion), leadership development (collaboration, mentoring, supervisory skills), and project management (planning, budgeting, organizational skills, problem solving; Mason et al., 2016). Similarly, a 2011 report by Monster.com identified the skills most important to recruiters and hiring managers: communication, problem solving, team work, self-motivation, initiative, logical thinking, ability to work under pressure, time management, work ethic, dependability, adaptability, leadership, organization, and self-confidence (Monster.com, 2011).

To provide our trainees opportunities to directly acquire these high-demand skills, the Postdoctoral and Career Development Office aims to create a career development program that will focus on communication, leadership and management, and professionalism skills. Together with the world-class discipline-specific research training programs at CU Denver/Anschutz, these programs will provide our trainees ample opportunities to become well-rounded, highly-qualified, candidates for a myriad of scientific professions. Although proficiency in these competencies is expected by the completion of a postdoctoral fellowship, it is appropriate to begin developing these competencies at the predoctoral level. As such, this program is designed to benefit both pre and postdoctoral trainees at CU Denver/Anschutz, and will prepare our trainees for successful transitions to both academic and non-academic careers. The specific goals of this program have been adapted from the National Postdoctoral Association’s Core Competencies for postdoctoral fellows*, and are outlined in detail below.

**GOAL 1: DISCIPLINE-SPECIFIC CONCEPTUAL KNOWLEDGE.**

This goal will be a primary focus of each discipline-specific program at CU Denver/Anschutz, and as such, proficiency will be accomplished primarily through research in the graduate or postdoctoral fellow mentor’s laboratory. During the pre or postdoctoral training period, trainees should become proficient with the following items:

- Analytical approach to defining scientific questions.
- Design of scientifically testable hypotheses.
- Broad based and cross-disciplinary knowledge acquisition.
- Detailed knowledge of specific research area.

*The original core competencies can be found at [http://www.nationalpostdoc.org/?SixCoreComps#iv](http://www.nationalpostdoc.org/?SixCoreComps#iv).
GOAL 2: RESEARCH SKILL DEVELOPMENT.
Similar to Goal 1, this goal also will be a primary focus of each discipline-specific program at CU Denver/Anschutz, and proficiency will be accomplished primarily through research in the graduate or postdoctoral fellow mentor’s laboratory. During the pre or postdoctoral training period, trainees should become proficient with the following items:

- Research techniques and laboratory safety.
- Experimental design.
- Data analysis and interpretation.
- Effective search strategies and critical evaluation of the literature.
- Grant application and scientific publishing processes.

GOAL 3: COMMUNICATION SKILLS.
The ability to effectively communicate is essential to be effective as a researcher; however, these skills are often not explicitly addressed through the research process. As such, the Postdoctoral and Career Development Office will provide multiple venues and formats for pre and postdoctoral trainees to acquire knowledge about effective communication, and ample opportunities to acquire practical experience with effective communication. During the pre or postdoctoral training period, trainees should become proficient with the following items:

- **Writing:** e.g., Scientific publications; Grants/applications; Curriculum vitae, resume, and cover letters; Research and teaching statements or portfolio; and Letters of recommendation or collaboration.
- **Speaking:** e.g., Presenting research to scientific and lay audiences; Conference and seminar presentations, including posters and PowerPoint; Job interviews and job talks.
- **Teaching and Mentoring:** e.g., Teaching methods and pedagogy; Learning styles.
- **Interpersonal Communication Skills:** e.g., Style, tone, and non-verbal cues; Negotiation (e.g., in difficult economic times, formal conversations with PIs/mentors about continued funding of the postdoc position); Performance reviews/feedback; Conflict resolution, including difficult conversations/minimizing conflict.
- **Special Situations:** e.g., Networking; Managing the news media.

GOAL 4: PROFESSIONALISM
Professionalism is an expectation of many careers, but often is not formally discussed. Professionalism encompasses many different contexts, including the laboratory, the University, the specific field of study, the societies that serve those disciplines, and in an online environment. In addition to the professionalism learned in the mentor’s laboratory, the Postdoctoral and Career Development Office will provide workshops and seminars designed to formally discuss professionalism. During the pre or postdoctoral training period, trainees should become proficient with the following items:

- Assess and uphold workplace etiquette, performance standards, and project goals.
- Comply with rules, regulations, and institutional norms.
- Respect, evaluate, and enhance the intellectual contributions of others.
Goal 4: Professionalism (continued)

- Advance and promote the discipline by participating in public and professional service activities, such as professional societies, editorial and advisory boards, peer review panels, and institutional committees.
- Advance and promote the discipline by participating in partnerships with government agencies, foundations, and/or nonprofit organizations, such as funding agency grant panels or other advocacy/advisory boards to contribute to the advancement and promotion of the discipline.
- Identify and manage apparent and actual conflicts of interest, ethical violations, and violations of expected professional behavior.
- Create and maintain a professional online presence.

GOAL 5: LEADERSHIP AND MANAGEMENT SKILLS

Leadership and management skills are critical for career success both inside and outside of academia. Indeed, leadership and the ability to effectively manage time, projects, budgets, and personnel is requisite to succeed as an academic independent investigator the same way it is to succeed in a myriad of non-academic careers (e.g., industry, government, business, etc.). As such, the Postdoctoral and Career Development Office will provide workshops and seminars designed to formally address leadership and management skills. During the pre or postdoctoral training period, trainees should become proficient with the following items:

- **Personnel Management**: e.g., Recruiting, hiring, and terminating personnel; Mentoring and retaining personnel; Conducting performance reviews and providing feedback; Working with individuals of diverse backgrounds; Managing conflict/having difficult conversations.
- **Project Management**: e.g., Establishing priorities; Short and long-term planning; Time management; Establishing/maintaining effective collaborations; Developing/managing budgets; Tracking use of and ordering supplies and equipment; Recordkeeping in print and electronic media; establishing data backup protocols; Running a meeting; Delegating responsibilities.
- **Leadership Skills**: e.g., Identifying and clarifying goals; Motivating/inspiring others; Understanding the long-term strategic vision and helping others to see where their work/roles fit in this picture; Understanding how to use appropriate leadership styles in any given situation; Serving as a role model.

GOAL 6: RESPONSIBLE CONDUCT OF RESEARCH

Responsible conduct of research (RCR) is critical to ensure that the scientific process is valid and impactful. As such, RCR will be a primary focus of each discipline-specific program at CU Denver/Anschutz, and proficiency will be accomplished primarily through research in the graduate or postdoctoral fellow mentor’s laboratory. During the pre or postdoctoral training period, trainees should become proficient with the following items:
Goal 6: Responsible Conduct of Research (continued)

- **Data ownership and sharing**: e.g., Sharing of data with collaborators, including industry-specific concerns as appropriate; Ownership and access to data, particularly once a postdoc’s appointment ends; Understanding and respect for intellectual property rights, patents, and copyrights; Understanding criteria for authorship and the elements of responsible publication

- **Research with human subjects (where applicable)**: e.g., Ethical principles for conducting human subjects research, including informed consent and subject confidentiality; Federal, state, and local regulations/guidelines for conducting human subjects research; Institutional Review Board (IRB) processes and procedures; Requirements for reporting clinical trials

- **Research involving animals (where applicable)**: e.g., Ethical principles for conducting research with animals; Federal, state, and local regulations/guidelines for use of animals in research; Understanding the Three Rs: Replace, reduce and refine animal use in research; Institutional Animal Care and Use Committee processes and procedures

- **Identifying and mitigating research misconduct**: e.g., Applicable definitions of misconduct (federal, ORI/PHS, NASA, NEH, NSF, etc.); Reporting procedures; The role and risks of being a whistleblower.

- **Conflicts of interest**: e.g., Personal and intellectual conflicts; Conflicts of commitment; Financial conflicts; Confidentiality and bias in peer review; Conflicts and potential competition between mentor and trainee.

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**CU Denver/Anschutz career development offerings aligned to program goals:**

**Goal 3: Communication Skills**

**Communication Series Workshops (Examples)**

1) **CV/Resumes**: Trainees will receive brief instruction on the differences between a CV and a resume, and then will work individually, in pairs, and as a larger group to create their personal master resume or CV. This workshop also will feature instruction on using the CSO job site. This workshop will be offered three times a year.

2) **Cover letters**: Trainees will receive brief instruction on writing an effective cover letter. Then, using an actual position of interest, trainees will create a draft of their cover letter and will receive feedback from at least two peers. Another possibility is for participants to write cover letters prior to the workshop, and spend the workshop hour on feedback. This workshop will be offered three times a year.

3) **Elevator speeches**: Trainees will receive brief instruction on how to create an effective elevator speech, and then will create a speech about any of the following topics: grant submission, recent paper, research project, career interests, or career story. This workshop will be offered three times a year.
Goal 3: Communication Skills (continued)

4) **Networking:** Trainees will receive brief instruction on effective strategies to establish new connections, and then, will spend the rest of the workshop networking together. This workshop will be offered three times a year.

5) **Interviewing:** This workshop will cover basics of the behavioral interview. Attendees then will participate in mock behavioral interviews. Participants will answer questions in pairs, providing an opportunity to answer strategies from each other. Faculty and other professionals will be asked to serve as mock interviewers. This workshop will be offered two to three times a year.

Special Communication Workshops (Examples)

1) **BEST Program – Speaking and Presenting:** “Content knowledge is the first essential requirement for a successful presenter, but expertise alone is not enough to communicate confidence and credibility to an academic audience. This requires an understanding of the impact of non-verbal behaviors and the mastery of a set of foundational physical behaviors. Participants will observe and practice the four critical physical skills that ensure the messenger is as prepared as the messages. Instructor-guided coaching and practice exercises will help each participant experience significant improvements in his or her presentation skills.”

2) **BEST Program – Learning How to Teach:** “The workshop will discuss issues such as how people learn, classroom culture, ethics and equity, how to define and describe outcomes, how to design a course and the need for and design of assessment forms, including rubrics and more.”

3) **BEST Program – Scientific and Technical Writing:** “As a scientist, writing is a critical part of your job. You’ve published papers, written successful grant applications, and received good reviews. Yet, between the demands of the lab and your research, you don’t always have the time to make your writing as strong as it could be. You need an efficient and painless way to get those words down on paper and assess their effectiveness. The workshop is taught by a former managing editor of a technical journal and focuses on the critical nodes of a successful scientific document. Through interactive exercises, in-class writing, strategic tips and illustrative readings, you will refine your writing skills to become more effective and efficient at creating the documents you need to support and promote your scientific work inside or outside academia.”

4) **BEST Program – Communicating with a Lay Audience:** “Four trainees prepare a 10-minute PowerPoint Presentation (with no more than 10 slides) that is understandable by a lay audience with no or minor education in science. The audience includes four entrepreneurship students from the Denver Campus who also present on topics of their choice. The best peer-selected presenter of each team earns a gift certificate and is recognized in the annual Milestones of Success Celebration.”
5) **Office of Research Development and Education (ORDE) – Positioning Your Work and Yourself:** “Description: Certainly, your research career path and development makes sense to you. But how do you tell the story of your work to others, including grant reviewers. Join us for this seminar where you will hear from a panel of faculty members who have great experience in working with faculty to form their research story, as well as having done it themselves. We will also look at how you can best represent yourself in your biosketch when applying for grants.”

6) **ORDE – Scientific Writing Workshop (CCTSI, ORDE, Writing Center).** “Description: This half-day workshop will guide faculty, postdoctoral fellows, and graduate students through how to think about conveying their scientific expertise to others by engaging technical writing perspectives and techniques. Participants will hear from an accomplished researcher on her own work to develop her writing in grants and publications. Participants will then choose two workshops out of the following options: grant-writing, basic writing principles, and creating compelling writing to engage the layperson.”

**Communication Skills Experiential Opportunities (Examples)**

1) **PhD Post:** This is a pre and postdoctoral trainee organized newsletter. The PhD Post offers opportunities to broaden writing experience and practice communicating with diverse audiences.

2) **Postdoctoral Association (PDA):** The PDA has frequent advertising and marketing opportunities associated with their sponsored events. In addition, the PDA offers many venues to practice networking and interpersonal communication skills.

3) **Academia Industry Alliance (AIA):** Similar to the PDA, the AIA offers many opportunities to practice effective communication, including networking, cover letter and resume reviews by local bioscience companies, and elevator speech deliveries.

4) **Elevator Speech Competition:** This event will allow pre and postdoctoral trainees to compete for title of best elevator speech. This competition could also be held regionally, and trainees could compete with trainees from other CU system campuses.

5) **Mentored Teaching Program:** This program will allow postdoctoral trainees to receive instruction in undergraduate teaching (e.g., during summer workshops), and then gain practical experience by teaching a module (e.g., 3-weeks) of an undergraduate course. The postdoctoral trainee would be mentored throughout the program by a faculty member from the Denver Campus, and would teach their module in the faculty member’s course.

6) **Internships:** The Graduate School is working to establish internships with different on-campus offices and departments providing easily-accessible opportunities for trainees to gain experience with varying careers: e.g., University Communications.
Goal 4: Professionalism

Professionalism Series Workshops (Examples)

1) **Maintaining an online presence:** This workshop will briefly describe the importance of maintaining an online presence for success in today’s job market. Then, participants will create and/or revise their LinkedIn and/or ResearchGate profiles and receive feedback. This workshop will be offered three times a year.

2) **Emails and business cards:** This workshop will briefly describe the importance of professionalism when sending emails to individuals in varying positions (e.g., colleagues and superiors, potential employers) and discuss the importance of professional business cards. Participants will then practice sending mock emails with specific objectives, and will design potential business cards. This workshop will be offered three times a year.

3) **Diversity and inclusion in research:** This workshop will feature a brief presentation on the importance of diversity and inclusion in the scientific enterprise and other workplaces. Participants will then discuss case studies of various diversity and inclusion-related scenarios. This workshop will be offered three times a year.

Special Professionalism Workshops (Examples)

1) **Professional Attire:** This lunch and learn, hosted by the Postdoctoral and Career Development Office and the BEST program, discussed how trainees can determine what constitutes professional attire in different situations (e.g., interviews, conferences, etc.) and how they can decide which is most appropriate.

2) **Association of International Researchers (AIR):** AIR’s mission is to promote cultural diversity, inclusive excellence and networking thereby contributing to the University’s Strategic Priority five that states “Enhance diversity university-wide and foster a culture of inclusion.” AIR hosts cultural awareness events throughout the year, and offers opportunities to pre and postdoctoral trainees to increase their cultural competence.

3) **Academia Industry Alliance (AIA):** AIA’s events offer opportunities to learn about professionalism and etiquette in the bioscience/biotechnology sectors, and allows pre and postdoctoral trainees to practice interacting with business leaders in a professional manner.

4) **Internships:** The Graduate School is working to establish internships with different on-campus offices and departments providing easily-accessible opportunities for trainees to gain experience with varying careers: e.g., Administration (Graduate School; Dean’s Offices), Office of Diversity and Inclusion, Office of Regulatory Compliance, Office of Laboratory Animal Resources, Colorado Multiple Institutional Review Board, etc.
Goal 5: Leadership and Management Skills

Leadership and Management Series Workshops (Examples)

1) **Leadership styles**: This workshop will allow trainees to determine their personality styles and understand how personality affects our daily interactions. Trainees will learn how to leverage the strengths of their personality styles, and identify areas where their personality might create a weakness.

2) **Negotiating**: This workshop will teach trainees effective negotiating strategies. Trainees will then work through mock-negotiating sessions, in which each trainee will compete with each other to try to get the best deal.

3) **Conflict resolution**: This workshop will allow trainees to understanding their conflict resolution style using the Thomas-Kilmann Conflict Mode Instrument. Trainees will then discuss conflict resolution case studies in small and large groups.

4) **Mentoring**: This workshop will briefly present different mentoring styles and will discuss effective mentoring strategies. Trainees will then participate in case study discussions in small and large groups.

5) **Individual Career Plans (ICPs)**: This workshop will briefly present strategies for completing an ICP, and then will give trainees an opportunity to begin developing their plans. In addition, trainees will be offered an opportunity to complete the Strengths Finder© assessment, and will learn how to incorporate strengths into their ICP.

Special Leadership and Management Workshops (Examples).

1) **BEST Program – Team Building and Leadership Development**: “Participants learn how personal assessments can provide insight into their strengths and weaknesses with respect to their career aspirations; understand how different personality types can work effectively in teams; critique and redevelop their CV to emphasize their abilities and experiences; learn how to influence the outcome of situations and decisions they do not control; get insight into the underlying factors in conflicts and learn how to negotiate effectively; understand various forms of communication, including gender differences, and learn about effective networking.”

2) **BEST Program – Project Management for Biomedical Scientists**: “Trainees learn how to employ and apply tools and techniques in 10 Knowledge Areas: 1) Information Management (How do I plan, execute, monitor & control and close my project?) 2) Scope Management (What work must be done for the project?), 3) Time Management (How long will the completion of each component of this work take and in what order should it be executed?), 4) Cost Management (How much will each element of work cost and how do I budget and manage that?), 5) Quality Management (What standards are required, how will I assess, measure, and control quality?), 6) HR Management (Who do I need on my team, what does my team need, how do I manage effectively?), 7) Risk Management (Identify the project risks, assess the impact and probability, quantify, and mitigate) 8) Communications Management (What, with whom, how, when, why, where do I need to
BEST Program – Project Management for Biomedical Scientists (continued)

communicate?), 9) Procurement Management (Determine what to acquire and how?), 10) Stakeholder Management (Who are the stakeholders, how do I manage them effectively?)."

3) BEST Program – Life Science Development and Commercialization: “Workshop topics address how an idea is different from an invention or an innovation, the Life Science Innovation Roadmap and pathway to market, how to create a business model canvas, the organization of the FDA, the steps involved in getting FDA clearance, the basics of FDA administrative law, the basic types of intellectual property, how to obtain a patent, the implications of recent patent decisions that affect biomedicine and science, the identification of different funding mechanisms for seed stage ventures, how to create a venture pitch, recent changes in laws and regulations concerning raising private capital.”

4) BEST Program – Building Capital for Life Science Business: “This workshop focuses on the financial perspective of Life Science Development & Commercialization. The workshop familiarizes the participants with the activity of raising capital and walks them through an eight-step process for raising capital, using examples and exercises from businesses within the healthcare industry. The instructor is an expert in early stage capital development who has been raising capital for businesses, charities and community projects for 35 years. He is an experienced businessman and a licensed attorney.”

Leadership and Management Skills Experiential Opportunities (Examples)

1) Postdoctoral Association (PDA): The PDA offers opportunities to serve in a variety of leadership positions, both on the executive council and on special committees. For example, the PDA fields the Postdoc Research Day (PDRD) planning committee. Postdocs who serve on this committee gain substantial experience in leadership, teamwork, project management, time management, budget management, and running meetings.

2) Academia Industry Alliance (AIA): Similar to the PDA, the AIA organizes an annual symposium and offers various opportunities to serve in leadership positions.

3) Internships: The Graduate School is working to establish internships with the local bioscience community, which will provide trainees opportunities to gain experience with the kinds of management skills valued by the bioscience industry. In addition, internships will be established with different on-campus offices and departments providing easily-accessible opportunities for trainees to gain experience with varying careers: e.g., Administration (Graduate School; Dean’s Offices), Office of Grants & Contracts, Technology Transfer Office, Office of Research Development & Education, Office of Research Services, etc.
References:
